Journal of the Anatomical Society of India 65 (2016) 164–166

Contents lists available at ScienceDirect

Journal of the Anatomical Society of India

journal homepage: www.elsevier.com/locate/jasi

Original Article

Location and incidence of the zygomatico-facial foramen in dry human skulls: An anatomical study☆

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ARTICLE INFO

Article history:
Received 22 August 2016
Accepted 7 January 2017
Available online 16 January 2017

Keywords:
Zygomaticofacial (ZFF) foramen
Frontozygomatic (FZ) suture
Zygomaticomaxillary suture (ZMS)

ABSTRACT

Introduction: Zygomaticofacial foramen (ZFF) is present on the lateral surface of zygomatic bone. Zygomaticofacial nerve passes through it. The knowledge of incidence and location of ZFF has surgical importance.

Materials and methods: Seventy dry human skulls of indeterminate age and gender were studied for location, incidence and variations pertaining to zygomaticofacial foramen (ZFF). Region-wise incidence of ZFF was noted by dividing the lateral surface of zygoma into four (A, B, C & D) regions. The frequency of number of foramina was noted. The distance of ZFF from the orbital margin, frontozygomatic suture and zygomaticomaxillary suture were measured.

Results: Location wise the incidence of the ZFF was more in the 'C' region with frequency of 51.82% followed by 25.54% and 22.62% in 'A' & 'B' regions respectively with none in 'D' region. The number of foramina varied from absent to maximum of three. The single foramen was found in 67.14% of skulls. Frequency of absence of foramen was 18.57%. In 12.14% of skulls two foramina were observed whereas three foramina were seen in only 2.14% of skulls. The mean distances of the ZFF from frontozygomatic suture (FZ), zygomaticomaxillary suture (ZMS) and orbital margin in 'mm' is 27.4 & 27.29, 20.05 & 19.88 and 8.05 & 7.82 on the right and left side respectively.

Discussion: The study shows variability in the location and incidence of the ZFF which makes it a less reliable landmark for reference during surgical procedures in the region.

1. Introduction

The zygomatic bone forms the prominence of the cheek. Its lateral surface shows zygomaticofacial foramen. Often the foramen is double or it may be occasionally absent. It provides passage to the zygomaticofacial nerve and vessels. Zygomaticofacial nerve traverses the inferolateral angle of the orbit, pierces the orbicularis oculi muscle, exits through the zygomaticofacial foramen. Zygomaticofacial nerve supplies the skin on the prominence of the cheek, forms plexus with the zygomatic branches of facial nerve and palpebral branches of the maxillary nerve. Occasionally the nerve is absent.[1]

The nerve may be injured in periorbital surgeries.[2,3] Blind dissection may tear zygomaticofacial vessels resulting in postoperative hematoma.[4] Frequent variability in the incidence and location of zygomaticofacial foramen makes it an unreliable landmark for surgeries.[5] Zygomaticofacial foramen forms an important anatomical landmark during surgeries as suggested by others.[6] Incidence of the ZFF is used as an anthropological marker for differentiating between races and populations.[2,7]

This study was undertaken to know the incidence and location of zygomaticofacial foramen and measure the distance of ZFF from the nearby landmarks.

2. Methods

The study was conducted in a medical college located in Western Maharashtra. Seventy dry adult human skulls of indeterminate age and gender were studied. In each skull, the surface of zygomatic bone was divided into four regions by drawing two lines. The first line drawn running tangential to the

☆ This study was presented as a paper in the 58th NATCON, conducted in Pune, Maharashtra.

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http://dx.doi.org/10.1016/j.jasi.2017.01.001
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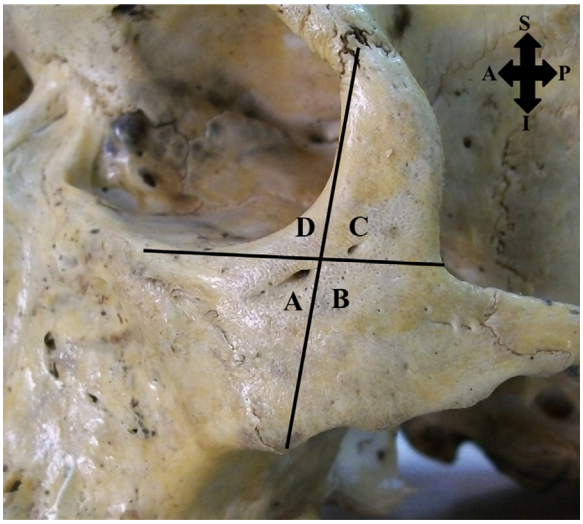

Fig. 1. Zygomatic bone was divided into four regions: A, B, C, and D.

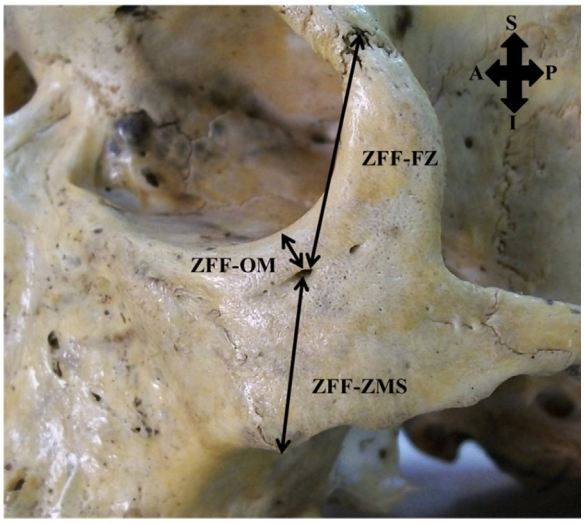

Fig. 3. The distances from the ZFF to the anatomical landmarks. ZFF-FZ, the distance from the ZFF to the frontozygomatic suture; ZFF-ZMS, the distance from the ZFF to the lowest point of the zygomaticomaxillary suture; ZFF-OM, the distance from the ZFF to the closest on the orbital margin.

lateral margin of the orbit and joining the lowest point on zygomaticomaxillary suture (ZMS) and frontozygomatic suture (FZS). The second line was drawn from the angle formed between the frontal process and the temporal process of zygomatic bone running tangential to the lowest point on the inferior margin of the orbit. The incidence of the zygomaticofacial foramen (ZFF) in each of the four regions i.e. A, B, C and D were noted (Fig. 1). The frequency of number of foramina was noted (Fig. 2). The distances of the ZFF to the lowest point of ZMS, to the nearest point on the FZS and to the closest point on the inferior margin of the orbit were noted (Fig. 3). These measurements were done bilaterally and mean and standard deviation were calculated.

3. Results

The region wise distribution of zygomaticofacial foramen was seen more in the region 'C' compared to other three regions (Table 1).

The incidence of zygomaticofacial foramen in the present study of seventy skulls varied from absent to maximum three in number (Fig. 2). The single foramen was found in 67.14% (forty-eight on the right side and forty-six on the left side) of skulls. Frequency of absence of foramen was 18.57% (twelve on right side and fourteen on left side). In 12.14% (nine on right side and eight on left side) of skulls two foramina were observed whereas three foramina were seen in only 2.14% (one on right side and two on left side) of skulls.

The distances measured from zygomaticofacial foramen to surrounding landmarks on the right and the left side are shown in Table 2.

4. Discussion

In the present study, the incidence of ZFF was seventy-one sides (51.82%) in the region 'C' followed by thirty-five sides (25.54%) in the region 'A' & thirty-one sides (22.62%) in the region 'B' with none

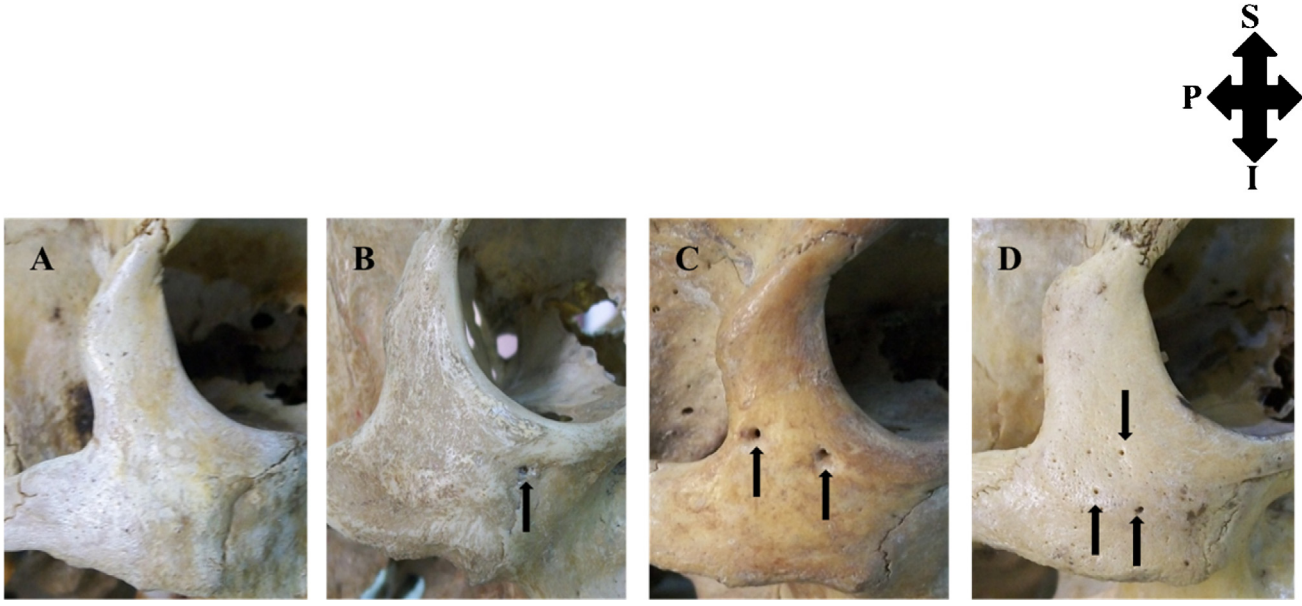

Fig. 2. The number of zygomaticofacial foramina (A: No foramen. B: One foramen. C: Two foramina. D: Three foramina).

Table 1
Distribution of the foramina according to regions.

Regions	Right	Left	Total
A	15	20	35 (25.54%)
B	19	12	31 (22.62%)
C	35	36	71 (**51.82%**)
D	0	0	0

The bold value is to highlight that occurrence of the Zygomaticofacial formen was highest in the 'C' region.

Table 2
Measurements of distances from zygomaticofacial foramen to surrounding landmarks.

Distance between	Side	Mean (mm) ± Std. deviation
ZFF-FZ	Right	27.4 ± 3.298
	Left	27.29 ± 2.839
ZFF-ZMS	Right	20.05 ± 3.086
	Left	19.88 ± 3.449
ZFF-OM	Right	8.05 ± 2.672
	Left	7.82 ± 2.233

ZFF, zygomaticofacial foramen; FZ, frontozygomatic suture; ZMS, zygomaticomaxillary suture; OM, orbital margin.

in the region 'D'. Whereas, the incidence reported by Aksu was one hundred seven sides (46.9%) in the region 'C', sixty-seven sides (29.4%) in the region 'A', fifty-one sides (22.4%) and the region 'B' and three sides (1.3%) in the region 'D'. So, exploring in the region 'D' during surgical procedures will be safer compared to other three regions.[5]

In the present study, ZFF was absent in twelve skulls on the right and fourteen skulls on the left side, similar absence of the foramen was reported by Senthil and Mangal in India and Aksu in Anatolian skulls study.[2,5,8] The single ZFF was seen in forty-eight and forty-six skulls on the right and the left side respectively in the present study. The incidence of single ZFF reported by Aksu was thirty-three and thirty-eight in 80 skulls, by Senthil was forty-six and fifty-one in 100 skulls and by Ongeti was forty-two and fifty-two in 104 skulls. The finding of skulls with two ZFF in this study was seen in nine skulls on the right side and eight skulls on the left side which was much lesser than reported by Aksu, Senthil and Ongeti. In the present study, the maximum number of foramina found was three. Senthil reported maximum four and Aksu reported five foramina.[5,8,9]

The orbitozygomatic craniotomy which involves elevation of the lateral orbital rim and zygomatic arch requires a bone cut across of zygoma; ZFF in this surgery forms a reliable superficial landmark, when single, for extending this cut into the lateral edge of the inferior orbital fissure. The surgeons must be aware of the anatomic morphometry and variations in the region of ZFF while performing maxillofacial surgeries or during regional block anesthesia.[10,11]

During stabilization of zygomatic fractures and in endoscopic sub-periosteal facelift operations, the knowledge of location of ZFF is important. Gupta et al., 2009 suggested the ZFF as a landmark for orbitozygomatic craniotomy and also during lateral orbitotomy operations for access to intraorbital soft tissues. Mangal et al. (2004) suggested that the periorbita should be elevated carefully to avoid injury to zygomaticofacial nerve coming out of ZFF. The distances measured from ZFF to surrounding landmarks (Table 2) will help to locate the ZFF during surgical procedures.[2,12,13]

5. Conclusion

The variation in the incidence, location and distances from neighboring landmarks make it less reliable landmark for the surgeries in the region. The findings in this study will help surgeons understand the morphometry and variations in the region of ZFF and will provide a guide to the surgical procedures in the region.

Funding

None declared.

Conflicts of interest

The authors have none to declare.

Acknowledgements

We are grateful to the Dean of GSMC & KEMH, Parel, Mumbai for the support and permission to do this study.

References

1. Standring S, Berkovitz BKB, eds. In: *Face & Scalp in Gray's Anatomy: The Anatomical Basis of Clinical Practice* 39th Ed. Spain: Churchill Livingstone Elsevier; 1999. 510, 513 pp..
2. Mangal A, Choudhry R, Tuli A, Choudhry S, Choudhry R, Khera V. Incidence and morphological study of zygomaticofacial and zygomaticoorbital foramina in dry adult human skulls: The nonmetrical variants. *Surg Radiol Anat.* 2004;26:96–99.
3. Lei T, Gao JH, Xu DC, et al. The frontal-temporal nerve triangle: a new concept of locating the motor and sensory nerves in upper third of the face rhytidectomy. *Plast Reconstr Surg.* 2006;117:385–394.
4. Williams JV. Transblepharoblasty endoscopic subperiostal midface lift. *Plast Reconstr Surg.* 2002;110:1769–1775.
5. Aksu F, Ceri NG, Arman C, Zeybek FG, Tetik S. Location and incidence of the zygomaticofacial foramen: an anatomic study. *Clin Anat.* 2009;22(5):559–562.
6. Gonzalez LF, Crawford NR, Horgan M, Deshmukh P, Zammbranski JM, Spetzler RF. Working area and angle of attack in three cranial base approaches: pterional, orbitozygomatic and maxillary extension of the orbitozygomatic approach. *Neurosurgery.* 2002;96:144–149.
7. Jose RG, Dahinten S, Hernandez M. The settlement of patagonia: a matrix correlation study. *Hum Biol.* 2001;73:233–248.
8. Senthil Kumar S, Kesavi D. Incidence and location of zygomaticofacial foramen in adult human skulls. *Int J Med Res Health Sci.* 2014;3(1):80–83.
9. Ongeti K, Hassanali J, Ogeng'o J, Saidi H. Biometric features of facial foramina in adult Kenyan skulls. *Eur J Anat.* 2008;12(1):89–95.
10. Martins C, Li X, Rhoton Jr AL. Role of zygomaticofacial foramen in the orbitozygomatic craniotomy: anatomic report. *Neurosurgery.* 2003;53(July (1)):168–173.
11. Loukas M, Owens DG, Tubbs RS, Spentzouris G, Elochukwu A, Jordan R. Zygomaticofacial, zygomaticoorbital and zygomaticotemporal foramina: anatomical study. *Anat Sci Int.* 2008;83(June (2)):77–82.
12. Krishnamurty A, Roshni S, Murlimanju BV, et al. Foramina on the zygomatic bone: its clinical significance. *Clin Ter.* 2011;162(5):419–421.
13. Gupta T, Gupta SK. The ZMF: is it a reliable intraoperative guide for the IOF? *Clin Anat.* 2009;22(May (4)):451–455.