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Original Research Article

Morphometric Variations In Infra Orbital Foramen of Dry Adult Human South Indian Skulls with Its Surgical and Anaesthetic Significance

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ABSTRACT

The infra orbital foramen is an opening present bilaterally in the maxillary bone of the skull. It transmits infraorbital vessels and nerve. Earlier studies have shown clear racial variations in the location and features of infra orbital foramen. The aim of this study was to assess the morphological features and the position of infra orbital foramen with respect to the surrounding anatomical bony landmarks. The study was conducted in the department of Anatomy, Yenepoya Medical College, Mangalore. 82 adult dry human skulls were studied which included 47 male skulls and 35 female skulls. The features assessed were transverse and vertical diameter of infraorbital foramen, distance from infraorbital foramen to maxillary midline, distance to infraorbital rim, zygomatico-maxillary suture, supra orbital foramen and distance to pyriform aperture. The mean and standard deviation was calculated from the observed values. The significance of the parameters were studied both gender wise and side wise using t-test. The study showed higher values in males compared to females. The position of infra orbital foramen was also assessed with respect to maxillary teeth and the margins of supra orbital foramen. 44.51% of the infra orbital foramen were located in line with 2nd upper premolar and 56.1% of the infra orbital foramen were seen lateral to the lateral margin of supra orbital foramen. One skull showed bilateral accessory infra orbital foraminae. The results and variations of this study would be useful to the surgeons, specially the maxillo-facial surgeons during any surgery involving the infra orbital area. It would be of great use to anaesthetists as well while giving regional block anaesthesia.

Key Words: Infra orbital foramen, supra orbital foramen, zygomatico-maxillary suture, regional block anaesthesia

INTRODUCTION

The infra orbital margin forms the inferior border of the orbital rim and is formed by the maxillary bone medially and the zygomatic bone laterally. The infra orbital foramen is an opening present bilaterally in the maxillary bone of the skull. It transmits the infra orbital vessels and nerve. [(1)] The infra orbital nerve is a sensory nerve, a branch of the maxillary division of the trigeminal nerve. It supplies the skin and conjunctiva of the lower eyelids, skin of the upper cheeks, mucosa of the maxillary sinuses, mucosa of upper lip and part of nasal vestibule. [(2)]

The infra orbital nerve block is an ideal technique which requires lesser amount of local anaesthetics and helps in anaesthetizing the area innervated by the nerve. Hence it is of specific importance in regional anaesthesia of the face. Regional nerve block provides an additional advantage by preventing any tissue distortion which is usually caused by local infiltration of anaesthetic drugs. [(3)] The infra orbital nerve block is considered as a prime candidate for regional nerve block since the nerve provides a considerably large area of sensory innervations. An infra orbital nerve block provides anaesthesia for the area between the lower eyelid and the upper lip. [(4)]

The infra orbital foramen location is an important landmark for anaesthetists while giving regional nerve block in oral and maxillo facial surgeries and other invasive procedures. [(5)] The knowledge of exact location of the infra orbital foramen invariably reduces the complications. Though anatomical variations have been observed in the infra orbital foramen of same race, the location and the morphometric features varies greatly among skulls of different races. The position of the foramen in relation to supra orbital foramen and the maxillary teeth has also shown racial variations. [(6)] Therefore this study was conducted to assess the location and variations in the features of the infra orbital foramen in cadavers of adult south Indian population.

MATERIALS AND METHODS

The present study was carried out in the department of Anatomy, Yenepoya Medical College, Mangalore. 82 adult dry human skulls were included in the study of which 47 were male and 35 were female skulls. The infra orbital foramen of both the sides were included in the study, a total of 164 sides. The male and female skulls were distinguished based on heaviness of the skull, marked muscular rides, prominent glabella, super ciliary arches and a large prominent mastoid process in males compared to females.

The measurements were studied using vernier calipers. The various morphometric measurements studied were

1) Maximum transverse diameter
2) Maximum vertical diameter
3) Distance from infra orbital foramen to maxillary midline
4) Distance from infra orbital foramen to infra orbital rim
5) Distance from infra orbital foramen to zygomatico-maxillary suture
6) Distance from infra orbital foramen to supra orbital foramen
7) Distance from infra orbital foramen to pyriform aperture (Figure-1).

The positions of infra orbital foramen were assessed in relationship to upper teeth and with supra orbital foramen.

Bones with any gross deformity and bones of pediatric size were excluded from the study. Each parameter was studied in both males and females and also on right side and left side. Mean and standard deviation were calculated and the results were statistically compared using t- test.

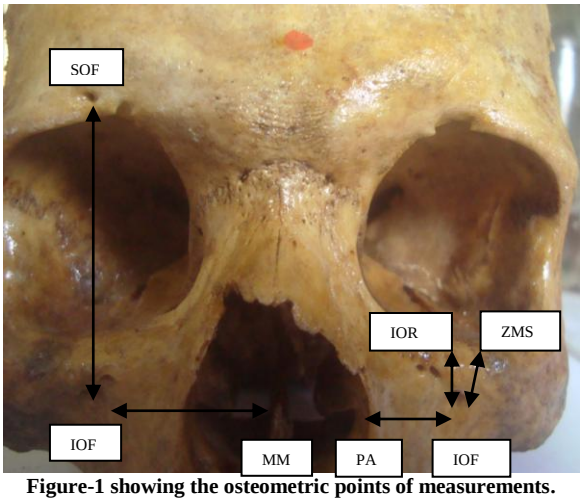

Figure-1 showing the osteometric points of measurements.

RESULTS

Table-1 Comparison of morphometric parameters of the infra orbital foramen in males and females.

Measurements	Males (Mean±SD) mm	Females (Mean±SD) mm	P-value
Maximum transverse diameter of IOF	3.76 ± 0.99	3.37 ± 1.25	0.0272*
Maximum vertical diameter of IOF	3.98 ± 1.12	3.43 ± 1.25	0.0035*
Distance from IOF to MM	25.77 ± 2.6	24.7 ± 2.4	0.0078*
Distance from IOF to IOR	6.6 ± 1.78	6.52 ±1.62	0.7678
Distance from IOF to ZMS	6.7 ± 2.12	6.44 ± 1.6	0.3913
Distance from IOF to SOF	42.57 ± 2.62	41.67 ± 2.64	0.0316*
Distance from IOF to PA	15.83 ± 2.25	15.55 ± 1.74	0.3879

Sig level- P value<0.05*

IOF - infraorbital foramen; MM - maxillary midline; IOR - infraorbital rim; ZMS - zygomatico maxillary suture; SOF – supra orbital foramen; PA- pyriform aperture.

Table-1 shows the comparison of morphometric data of IOF in males and females. All the parameters had higher values in males compared to females. The transverse diameter, vertical diameter, distance from IOF to maxillary midline and distance from IOF to SOF showed significant difference in males and females.

Table- 2 Comparison of the morphometric parameters of right sided and left sided infra orbital foramen

Measurements	Right (Mean±SD) mm	Left (Mean±SD) mm	P-value
Maximum transverse diameter of IOF	3.57 ± 1.17	3.68 ± 1.25	0.5615
Maximum vertical diameter of IOF	3.42 ± 1.12	3.64 ± 1.25	0.2370
Distance from IOF to MM	25.84 ± 2.6	24.9 ± 2.2	0.0134*
Distance from IOF to IOR	6.51 ± 1.78	6.61 ±1.64	0.7088
Distance from IOF to ZMS	6.62 ± 2.11	6.56 ± 1.7	0.8413
Distance from IOF to SOF	42.06 ± 2.7	41.79 ± 2.59	0.5144
Distance from IOF to PA	15.76 ± 2.08	15.67 ± 2.02	0.7790

Sig level- P value<0.05*

IOF - infraorbital foramen; MM - maxillary midline; IOR - infraorbital rim; ZMS - zygomatico maxillary suture; SOF – supra orbital foramen; PA- pyriform aperture.

Table-2 shows comparison of the morphometric data of right sided and left sided infra orbital foramen. Distance from infra orbital foramen to maxillary midline showed significant difference between the right side and left side.

Table- 3 Percentage variations in the position of infra orbital foramen in relation to upper teeth.

Position of Infra orbital foramen	Percentage
Between 1st PM and 2nd PM	25%
In line with 2nd PM	44.51%
Between 2nd PM and 1st Molar	21.34%
In line with 1st Molar	15%

PM- premolar; M- molar

Table-3 shows percentage variations in the position of infra orbital foramen in relation to the maxillary teeth. 44.51% of the infra orbital foramen were located in line with 2nd premolar followed by 25% which were located between 1st and 2nd premolar. 21.34% were found to be between 2nd premolar and 1st molar. Only 15% of the infra orbital foramen were seen in line with 1st molar.

Table-4 Percentage variations in the position of infra orbital foramen in relation to the margins of supra orbital foramen

Position of Infra orbital foramen	Percentage
Lateral to lateral margin of SOF	56.1%
Between medial and lateral margins of SOF	28.05%
Medial to medial margin of SOF	15.85%

Table-4 shows percentage variations in the position of infra orbital foramen in relation to the margins of supra orbital foramen. 56.1% of the infra orbital foramen were present lateral to the lateral margin of supra orbital foramen. 28.05% were present between medial and lateral margins of the supra orbital foramen and 15.85% were

present medial to the medial margin of supra orbital foramen.

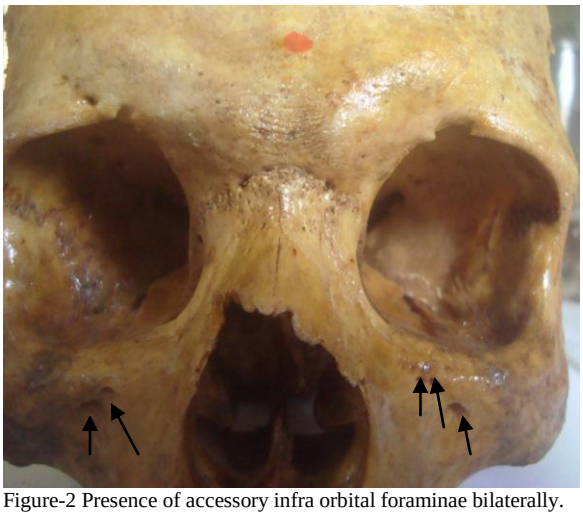

Figure-2 Presence of accessory infra orbital foraminae bilaterally.

Accessory foraminae were present bilaterally in one skull. Two were present on the right side and three on the left side.

DISCUSSION

The accurate position of the infra orbital foramen is very important for the anaesthetists while giving infra orbital nerve block. It is an important landmark for both diagnostic and clinical procedures. Any injury to the nerve bundle emerging from the foramen may result in complications. Therefore head and neck surgeons, maxillo facial surgeons and anaesthetists should have a good knowledge regarding the morphological parameters and the variations of infra orbital foramen.

Morphometric analysis of the infra orbital foramen was done in adult Srilankan skulls in 2010 by Isurani Ilayperuma. [(7)] Table-5 shows the difference in the morphological parameters between the study done in Srilankan skulls and the present study. Both the studies showed significant difference between males and females in transverse diameter, vertical diameter, distance from IOF to maxillary midline and in distance from IOF to SOF.

Table -5 Comparative Study Of Parameters Between Males And Females In Past Srilankan And Present South Indian Study

	PAST STUDY		PRESENT STUDY	
Measurements	Males(Mean ± SD) mm	Females (Mean ± SD) mm	Males(Mean ± SD) mm	Females (Mean ± SD) mm
Maximum transverse diameter of IOF	3.88 ± 0.89*	3.23 ± 1.06*	3.76 ± 0.99**	3.37 ± 1.25**
Maximum vertical diameter of IOF	3.75 ± 0.79*	3.05 ± 0.88*	3.98 ± 1.12**	3.43 ± 1.25**
Distance from IOF to MM	30.69 ± 3.43*	28.40 ± 2.82*	25.77 ± 2.6**	24.7 ± 2.4**
Distance from IOF to IOR	10.56 ± 1.74*	9.02 ± 1.58*	6.6 ± 1.78	6.52 ±1.62
Distance from IOF to ZMS	2.47 ± 1.56	1.76 ± 1.48	6.7 ± 2.12	6.44 ± 1.6
Distance from IOF to SOF	44.86 ± 3.35*	43.26 ± 3.63*	42.57 ± 2.62**	41.67 ± 2.64**

** - significant difference between males and females in the present study
* - significant difference between males and females in the past study

A study on anatomical variations of infra orbital foramen in Egyptian skulls was conducted in 2013 by Ezzeddin Elsheikh. [(8)] The parameters were compared between right side and left side. Table-6 shows the difference in the values between the study done in Egyptian skulls and the present study.

Table- 6 Comparative Study Of The Parameters Between Right And Left Side In Past Egyptian And Present South Indian Study

	PAST STUDY		PRESENT STUDY	
Measurements	Right(Mean ± SD) mm	Left(Mean ± SD) mm	Right(Mean ± SD) mm	Left(Mean ± SD) mm
Maximum transverse diameter of IOF	3.2±0.98	3.37±0.99	3.57 ± 1.17	3.68 ± 1.25
Maximum vertical diameter of IOF	3.38±0.76	3.4±0.75	3.42 ± 1.12	3.64 ± 1.25
Distance from IOF to IOR	6.2±1.4	6.5±1.3	6.51 ± 1.78	6.61 ±1.64

The above table shows the difference in the parameters between the different racial groups. In both the above past studies, the highest frequency of location of infra orbital foramen was seen in line with 2nd premolar. Similar findings were observed in the present study as well.

Highest frequency of infra orbital foramen was seen lateral to lateral margin of supra orbital foramen in the study done on Srilankan skulls as well as in the present study.

Hussain Saheb Shaik et al [(9)] conducted study in 2012 on 125 dry adult human south Indian skulls. The mean transverse diameter obtained in the study was 2.98±0.69mm and the mean vertical diameter was 2.89±0.71mm. In the present study, the mean transverse diameter was 3.57±1.12mm and the mean vertical diameter was 3.71±1.14. The present study value varies slightly from the past study.

CONCLUSION

Knowledge regarding the morphometric parameters of the infra orbital foramen and the presence of accessory foraminae would be of considerable help to the anaesthetists while giving regional block anaesthesia and thereby complications resulting from injuring the nerve bundles can be avoided. The results obtained in this study would as well help the maxillo facial surgeons particularly during reduction of fractures. The distance from the anatomic landmarks may assist the surgeons in avoiding complications during the invasive procedures.

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