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### Original Article

## Anthropometric Measurements of Infra orbital Foramen in dried human skulls

K K Gour\*, S Nair\*, G N Trivedi\*, S D Gupta\*

\*Department of Anatomy, L. N. Medical College, Bhopal

#### ARTICLE INFO

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Infra orbital margin (IOM),  
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#### ABSTRACT

**Aim:** To determine the mean distance between Infraorbital foramen (IOF) and infraorbital margin (IOM) on both sides of dried human skulls, which is useful while performing surgical procedures in relation to infraorbital foramen and giving regional nerve blocks. **Materials and method:** 100 adult skulls of both sex (66 males and 34 females) irrespective of age were used for the study. The shape, orientation, location in relation with teeth and presence of accessory foramina were observed by direct inspection. The distance between infraorbital foramen and infraorbital margin was measured by using the digital vernier calipers. **Results:** The majority of IOF were oval shaped in male skulls (54.7%) and on left side (52.8%). The majority of IOF were directed inferomedially (65.8% in males; 67.8% in females). The majority of IOF were vertically oriented to 2nd premolar teeth (43% in both sexes and on both sides). The mean distance of infra orbital foramen from the infra orbital margin was  $7.39 \pm 1.63$ mm. Accessory foramen were noticed in 4% skulls. **Conclusion:** The results of our study may be helpful during surgical procedures in relation to infra orbital foramen and giving regional nerve block.

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#### 1.Introduction:

Infraorbital foramen is situated about 1cm below the Infraorbital margin [1],[2]. The Infraorbital nerve, a branch of maxillary division of trigeminal nerve, appears on the face through IOF and terminates by dividing into palpebral, nasal and labial branches to supply conjunctiva, skin over the lower eyelid, lateral aspect of external surface of nose and upper lip[3],[4]. The location of IOF has been determined in several studies. Kazkayasi in 2001 [5] studied the correct IOF anatomical relationship, course and location in 35 dry adult skulls. Some of them studied the location of IOF according to sex, and obtained different mean distances between men and women [6,7]. Some have shown the IOF relationship with other anatomical structures in studies with different purposes, which shows the importance of the IOF as a point reference for anatomical and surgical repair [8-12],studied the infraorbital foramen. The presence of supernumerary foramina also has been documented [13-14]. So, the knowledge of the morphology of IOF is useful while performing surgical procedures in relation to infra orbital foramen and giving regional nerve blocks.

#### 2.Material and methods:

One hundred dried skulls (66 males and 34 females) of unknown age were selected from the department of Anatomy and department of Forensic medicine, L. N. Medical College, Bhopal. Both sides of each skull were assessed by direct inspection. Foetal and child skulls, destroyed sides were excluded from the study. Total sides studied were 196. The following measurements and observations were recorded –

- 1) The shape of IOF as an oval or round opening.
- 2) The distance of IOF from the meeting point of IOM with zygomaticomaxillary suture. The measurement was made by using digital vernier calipers with least count of 0.01mm.
- 3) Vertical orientation of IOF with the upper teeth were recorded.
- 4) The direction of the IOF assessed by direct inspection as downward medially (DM), medially (M), anteriorly downward (DA) and vertically downward (VD).
- 5) The presence of accessory foramina.

\* Corresponding Author : K K Gour  
Department of Anatomy,  
L. N. Medical College, Bhopal  
E.mail: [drkkgour@gmail.com](mailto:drkkgour@gmail.com)

**Observation:**

Total skulls examined : 100 (196 sides)  
 Male skulls : 66 (66%)  
 Female skulls : 34 (34%)

No: of sides not able to examine due to destruction: male - 0; female - 4; right - 0; left - 4.

Total no. of sides examined = 196

Investigation of IOF in 100 skulls (196 sides) revealed that the shape of IOF was oval on right side in 66 (66%) foramina, on left side in 73 (76%) foramina, in 89 (67.42%) foramina.

from male skull and in 50 (52%) foramina from female skull; round on the right side in 34 (34%) foramina, on the left side in 23 (24%) foramina, in 43 (32.58%) foramina in male skulls and in 46 (48%) foramina from female skulls.

Regarding the location of IOF, the mean distance from the IOM was found to be  $7.70 \pm 1.81$ mm in males and  $6.73 \pm 0.87$ mm in females;  $7.43 \pm 1.68$ mm on the right side and  $7.37 \pm 1.59$ mm on the left side. The minimum distance recorded was 4.92mm and maximum was 13.63mm. The mean distance observed in most of the skulls (N - 196 sides) found to be 5.92mm.

The tooth most commonly found in the same vertical level with the IOF was upper 1st premolar on 70(35.71%) sides examined followed by 2nd premolar on 50 (25.51%) sides. No significant sex or side differences were observed.

The IOF was directed Downwards & medially in 157 (80.1%) sides examined, medially in 27 (13.78%) sides examined and vertically downwards in 12 (6.12%) sides examined.

In 4 skulls, accessory foramina were present. Single accessory foramen was found in 2 male (3.03%) and 1 female skulls (2.94%). Double accessory foramina were found in one male skull (1.51%). Most of the accessory foramina were present on the left side and were round in shape.

**3. Discussion:**

Since the Infraorbital nerve and vessels emerge through IOF, the knowledge of anatomical features of IOF is very important for the surgeons dealing with maxillary region, eg, in the surgeries for fracture of zygoma [15], intra or extra - oral anesthesia [16,17].

The distance between IOF & IOM had been reported to lie between 4 - 10mm [6],[11],[18]. The mean distance between IOF and IOM in our study was found in close range with [5]. Mean distance in our study was lower than that of [19],[6]. The knowledge of location of IOF is mandatory to avoid injuries of eye during nerve block and to identify danger zone of its location during dissection of the comminuted fracture of anterior maxillary wall or inferior orbital wall.

Different shapes of IOF were reported by many authors [20],[5],[21]. The results of our study were similar to those of Boopathi et al.

Most of the IOF were directed downwards & medially as revealed by Ellias and Apinhasmit. IOF in 13.78% of skulls were directed medially and vertically downwards in 6.12% skulls. It is essential to know the direction of IOF while passing needle to block the nerve and to direct the probe in radiofrequency neurotomy procedures.

Our study documented that the tooth most commonly noted in the same vertical line was upper 1st premolar in 35.71% sides.

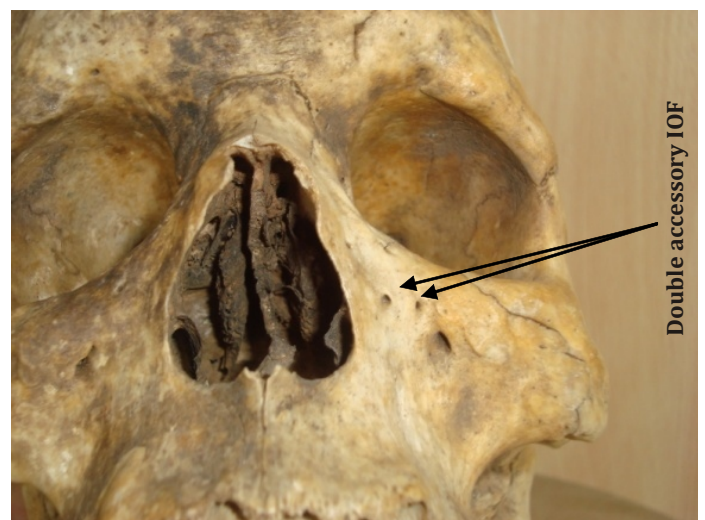
Gruber reported first the presence of accessory IOF and described 5 independent foramina. Kadanoff et al found it doubled in 9%, tripled in 0.5% and greater than 3 in 0.3% [22]. Bressan et al demonstrated accessory foramina in 5.4% males, 4.26% in females with high frequency on the left side in both males and females [23]. According to Hanihara and Ishida, accessory foramina were more commonly found in Northeast Asian skulls [24]. Boopathi et al reported accessory foramina in 16.25% of skulls in South Indians [20]. In present study, incidence of AF was lower when compared with that of Elias, Boopathi, but similar to Bressan. Regarding double AF, present study coincides with the findings of Kadnoff. The surgeons must remember this during nerve block since injury to any branch can result in sensory loss and incomplete nerve block.

**4. Conclusion:**

The knowledge obtained from anthropometric study conducted in Central Indians by present authors may provide guidance to the maxillofacial surgeons, anesthesiologists to localize infra orbital foramen and so may be considered for the better outcome of diagnostic or therapeutic procedures [25].

**Table I. Distance of IOF from IOM (mm)**

Gender	Mean	N	Standard deviation
Side			
Male	6.65	161	1.667
Female	6.20	83	1.859
Right	6.57	121	1.793
Left	6.42	123	1.699
Total	6.50	244	1.744

**Figure. Double accessory IOF**

**Table II. Orientation of IOF with the teeth**

Teeth	Gender		Total	Side		Total
	Male	Female		Right	Left	
1st MO	21 (15.9%)	5 (9.3%)	26(14%)	12(12.9%)	14(15.1%)	26(14%)
2ndPM/MO	40 (30.3%)	19 (35.2%)	59 (31.7%)	28 (30.1%)	31 (33.3%)	59 (31.7%)
1st/2ndPM	16 (12%)	4(7.4%)	20(10.8%)	14(15.1%)	6(6.5%)	20(10.8%)
2nd PM	55(41.7%)	25(1.9%)	80(43%)	38(40.9%)	42(45.2%)	80(43%)
2nd MO	0	1(1.9%)	1(0.5%)	1(1.1%)	0	1(0.5%)
Edentulous	29	29	58244	28	30	58
Total	161	83		121	123	244

1st MO = first molar; 2nd PM/ MO = between second premolar and first molar; 1st/2nd PM = between first and second premolar; 2nd PM = second premolar; 2nd MO = second molar tooth.

**Table III. Direction of IOF.**

Direction	Gender		Total	Side		Total
	Male	Female		Right	Left	
DM	106 (65.8%)	56(67.5%)	162 (66.4%)	83(68.6%)	79 (64.2%)	162 (66.4%)
VD	43 (26.7%)	16(19.3%)	59 (24.2%)	28(23.1%)	31(25.2%)	59 (24.2%)
AD	1(0.6%)	2(2.4%)	3 (1.2%)	10(.8%)	2(1.6%)	3 (1.2%)
M	11(6.8%)	9(10.8%)	20 (8.2%)	9 (7.4%)	11 (8.9%)	20 (8.2%)
Total	161	83	244	121	123	244

DM = downward medially; VD = vertically downwards; AD = anteriorly downwards; M = medially

**Table IV. Comparison of our study with previous studies**

Study	No: of samples	Mean±SD; distance of IOF from IOM (mm)	Shape (%)		Accessory foramen (%)
			Round	Oval	
Aziz et al	47	8.3±1.9			15
Cutright et al	80	6.4±0.3			
Kazkayasi et al	35	7.19±1.39	38	34.3	
Kazkayasi et al	10		40	30	5
Elias et al	210	6.71±1.70			15.23
Agthong et al	110	7.9±0.02			4
Apinhasmit et al	106	9.23±2.03	20.8	50	3.8
Gupta	79	7.0±1.6			
Boopathi et al	80	6.57±1.7	24.4	53	16.25
Our study	100	7.39±1.63	29.08	70.92	4

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