ISSN (Print): 2476-8316
ISSN (Online): 2635-3490
Dutse Journal of Pure and Applied Sciences (DUJOPAS), *Vol. 5 No. 1a June 2019*

Location of the Infraorbital Foramen in Patients Attending Aminu Kano Teaching Hospital in Nigeria: A Three-Dimensional Computed Tomographic Study Review

A. Gudaji*[1], S. Ali[1], A. H. Dambatta[2]
[t] Department of Anatomy,
Faculty of Basic Medical Sciences,
Bayero University, Kano
agudaji.ana@buk.edu.ng,
gudajikzr@yahoo.com

[2] Department of Radiology,
Aminu Kano Teaching Hospital,
Kano State, Nigeria

Abstract
Accurately locating the infraorbital foramen is important for avoiding complications during anyinvasive medical procedures at maxillofacial region. This study aimed at determining the position of infraorbital foramen using three-dimension (3D)of the human skull. A total of 316 (female: 121 and male:195) three-dimensional computed tomographic images (3D-CT images) of adult's skull done from January 2017–September 2017 at the Radiology Department of Aminu Kano Teaching Hospital were reviewed retrospectively. The distance from centre of infraorbital foramen to rhinion, infraorbital margin, piriform aperture and anterior nasal spine respectively and orientation of the infraorbital foramen in relation to maxillary teeth were measured using vitrea version 6.6.3. There was a statistically significant gender difference (p< 0.05) in the location of infraorbital foramen with the mean value in males exceeding that of females. In males the infraorbital foramen was 36.99 ±2.83 mm, 8.95 ±1.79 mm, 20.10 ±2.47 mm and 35.58 ±2.89 mm andin females' infraorbital foramen was35.94 ± 2.98 mm, 8.47 ± 1.82 mm, 19.12 ± 2.01 mm and 34.14 ± 2.67 mm away from the rhinion, infraorbital margin, piriform aperture and anterior nasal spine respectively. Infraorbital foramen was mostly vertically inline with the maxillary 2nd premolar teeth irrespective of gender (male 47.4% and female 52.9%).
In conclusion, the present study provides gender specific data on the location of infraorbital foramen in Nigerian Population which indicates the need forproper evaluation of infraorbital foramen even within same population.

Keywords: Infraorbital foramen, Nigeria, 3D images, Location, Skull.

INTRODUCTION
Accurate knowledge of the positions of facial foramina becomes important for diagnostic and clinical procedures such as the administration of regional anaesthesia, orthognathic, and cleft surgeries, and other invasive procedures in the maxillofacial region(Chung *et al*., 1995; Malet *et al*., 1997; Singh, 2011). These facial foramina transmit neurovascular bundles between the cranium and facial region. The nerves that emerge from these foramina are blocked at their exits to induce local anesthesia during various maxillofacial and cosmetic surgical procedures (Cisneiros *et al*., 2016). Traumatic or iatrogenic injury to the neurovascular bundles at the point

*Author for Correspondence

of emergence through these foramina may result in bleeding and hypoesthesia or paraesthesia or even anaesthesia in the region of supply depending on the degree of the injury(Malet*et al*., 1997; Barker *et al*., 2013).

Infraorbital foramen is an opening on the maxilla bilaterally, about 1cm below the infraorbital rim (Williams *et al*., 1989; Gour *et al*., 2012). The infraorbitalforamen transmits the infraorbital vessels and nerve.The infraorbital nerve which is a maxillary division of trigeminal nervesupply's the conjunctiva, skin over the lower eyelid, ala of nose and upper lip (McMinn, 1990; Moore and Dalley,1999) it also supply'sthe mucosa of the maxillary sinus, the maxillary incisor, canine, premolar teeth, and adjacent upper gingivae (Chrcanovic *et al*., 2011).

The infraorbital foramen is situated on the maxillary bone 1 cm below the infraorbital margin (Gardner et al., 1988; Williams et al., 1989) and the infraorbital nerve and vessels pass through it. These structures supply the lower eyelids, superior lip, ala of the nose and the premolar teeth.

A nerve block is essential during surgical procedures around the infraorbital foramen. Therefore, the location of the infraorbital foramen assumes great importance. The analysis of important clinical, surgical and anesthetic aspect of the infraorbital foramen in relation to the infraorbital margin may be summarized as follows (Macedo et al., 2009).

The location of the infraorbital foramen determines the orientation of an acupuncture point used in trigeminal neuralgia treatment (Esper et al., 1998). The position of the infraorbital foramen helps to locate the infraorbital plexus region which we believe a risk zone during plastic surgery (Hwang et al.,2004). The location of this foramen determines morphometric variations from reference points to decrease the risk of orbital surgery (Karakaş et al., 2003). The morphometry of this foramen plays an important role during regional block anesthesia techniques of the infraorbital nerve (Chung et al., 1995; Radwan et al., 2001). The precise location of the foramen facilitates risk free zygoma fracture surgery (Du Tolt and Nortjé,2003). Thus knowledge of the infraorbital foramen location from reference points in this area provides important data for local anesthesia during rhinoplasty (Zide and Swift, 1998) and for the maxillofacial area during plastic surgery (Aziz et al., 2000).

Modern surgical procedures (Karakaş et al., 2003), anesthesia (Zide and Swift, 1998)and acupuncture require a more precise understanding of the surrounding anatomy (Esper et al., 1998).

The infraorbital foramen and infraorbital neurovascular bundles are important structures that need to be considered in surgical and anaestheticprocedures on the oral and maxillofacial areas: closure of posttraumatic facial wounds, biopsies, revisions of scars, cosmetic cutaneous procedures, endoscopic procedures, orbital procedures, and anaesthesia during rhinoplasty(Przygocka *et al*., 2012). Thus, for good surgical practice, it is fundamentally important to have knowledge of the topographical anatomy of the facial foramina, such as the infraorbital foramen (Cutright *et al*.,2003).

The existence of racial, age, gender and ethnic variation in the location of infraorbital foramen (Chung *et al*., 1995; Cutright *et al*.,2003) necessitated need for the documentation of anthropometry of infraorbital foramen in each population for a safe and successful invasive medical procedures at the maxillofacial region.

Even though several studies have pointed out the significance of the precise location of infraorbital foramen using different landmarks and study subject such as cadaver(Cutright *et al*., 2003; Muchlinski, 2008; Tungkeeratichai *et al*., 2013; Ercikti *et al*., 2016), macerated skulls (Kazkayasi *et al*., 2001; Elsheikh, *et al*., 2013; Ukoha *et al*., 2014; Orish *et al*., 2015) and recently using 3D-CT images(Lee, *et al*., 2012; Lim *et al*., 2016; Orhan *et al*., 2016). There was paucity of data on anthropometric of infraorbital foramen among Nigerian population and the few studies conducted on Nigerian population were on macerated skulls. Thepresent study was carried out to providegender specific information on the location of infraorbital foramen in patients attending Aminu Kano Teaching Hospitalin Nigeria, using 3D-CT scan Images retrospectively.

MATERIALS AND METHODS

A total of 316 (female: 121 and male: 195) 3D computed tomographic images of the adult skulls(age:20-90 years)free of any facial fracture and deformitiesdonefrom January 2017 – September 2017at the Radiology Department of Aminu Kano Teaching Hospital were reviewed retrospectively. The images were obtained at a slice thickness of 0.5 mm (160-Slice Toshiba Aquillion Prime CT-Scanner-Japan).

Each patient CT scan was loaded into a vitrea version 6.6.3 workstation and measurements were taken using the vitrea inbuilt ruler. The following measurements were taken under the guidance of a Consultant Radiologist:

I. FRHN: Distance from the center of infraorbital foramen to rhinion (Przygocka*et al*., 2012).
II. FIOM: Distance from the center of infraorbital foramen to infraorbital margin at the zygo-orbitale (Laís*et al.,* 2016)).
III. FPA: Distance from the center of infraorbital foramen to most lateral margin of piriform aperture (Orish*et al*., 2015).
IV. FANS: Distance from the center of infraorbital foramen to anterior nasal spine (Laís*et al.,* 2016).

STATISTICAL ANALYSIS

Data was analyzed using SPSS version 21. Data were expressed in terms of mean and standard deviation (mean ± SD). Independent t-test and Chi-square test were used to test for sexual dimorphism and asymmetry. $p< 0.05$ was considered statistically significant.

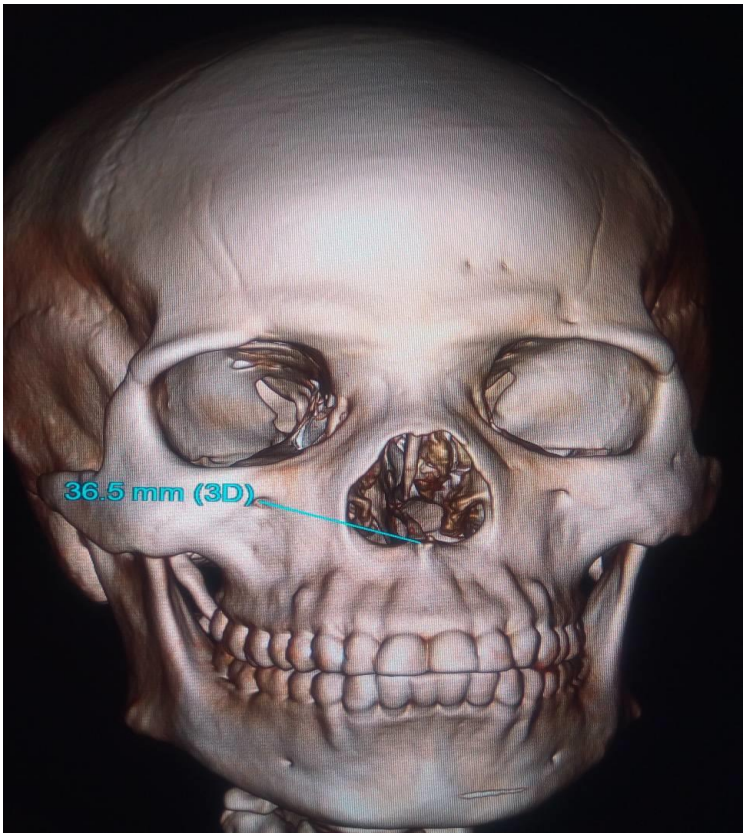

Plate I: Measurement of distance from the center of infraorbital foramen to anterior nasal spine.

RESULTS

Table 1: Descriptive statistic for age(years) and location of infraorbital foramen from reference landmarks (mm) in male and female Nigerians.

Sex	Variable	Mean ± SD	Range	Min-Max
Female	Age(years)	44.25 ± 17.45	70.00	20.0-90.0
(n=121)	FRHN	35.94 ±2.98	14.10	29.0-43.10
	FIOM	8.47 ±1.82	9.30	4.40-13.70
	FPA	19.12 ±2.01	12.00	13.80-25.80
	FANS	34.14 ±2.67	12.50	27.50-40.00
Male	Age(Years)	42.59 ± 17.96	67.00	20.0-87.00
(n=195)	FRHN	36.99 ± 2.83	16.40	29.10-45.50
	FIOM	8.95 ± 1.79	9.10	5.00-14.10
	FPA	20.10 ± 2.47	23.90	10.00-33.90
	FANS	35.58 ± 2.89	19.20	24.00-43.20

Key: FRHN: Distance from center of infraorbitalforamen to rhinion.
FIOM: Distance from center of infraorbital foramen to infraorbital margin.
FPA: Distance from center of infraorbital foramen to piriform aperture.
FANS: Distance from center of infraorbital foramen to anterior nasal spine.

Table 2:Sexual dimorphism in the location of infraorbital foramen among Nigerians.

Side	Variable	Sex	N	Mean(mm)± SD	Min-Max(mm)	T	p-value
Right	FRHN	Female	121	36.012±2.715	30.0-43.0	-3.55	<0.001
		Male	195	37.124±2.703	30.0-45.5		
	FIOM	Female	121	8.553 ±1.706	4.4-12.9	-2.78	0.007
		Male	195	8.971 ±1.738	5.1-13.4		
	FPA	Female	121	19.335±2.073	13.8-25.8	-3.42	0.010
		Male	195	20.273±2.532	10.0-33.9		
	FANS	Female	121	34.231±2.769	27.7-40.0	-4.91	<0.001
		Male	195	35.634±3.139	24.0-43.2		
Left	FRHN	Female	121	35.865±3.241	29.0-43.1	-2.79	0.006
		Male	195	36.855±2.948	29.1-45.3		
	FIOM	Female	121	8.383 ±1.935	4.9-13.7	-2.80	0.005
		Male	195	8.930 ±1.838	5.0-14.1		
	FPA	Female	121	18.895±1.917	14.4-24.9	-4.04	<0.001
		Male	195	19.932±2.391	12.4-27.7		
	FANS	Female	121	34.046±2.572	27.5-40.0	-4.04	<0.001
		Male	195	35.526±2.627	28.4-41.9		

Key: FRHN: Distance from center of infraorbitalforamen to rhinion.
FIOM: Distance from center of infraorbital foramen to infraorbital margin.
FPA: Distance from center of infraorbital foramen to piriform aperture.
FANS: Distance from center of infraorbital foramen to anterior nasal spine.

Table 3: Asymmetry in location of infraorbital foramen in male and female Nigerians.

Sex	Variable	Side	n	Mean(mm)±SD	Min-Max(mm)	t	p-value
Female	FRHN	Right	121	36.012±2.715	30.0-43.0	0.383	0.702
		Left	121	35.865±3.241	29.0-43.1		
	FIOM	Right	121	8.553±1.706	4.4-12.9	0.726	0.469
		Left	121	8.383±1.935	4.9-13.7		
	FPA	Right	121	19.335±2.073	13.8-25.8	1.713	0.088
		Left	121	18.895±1.917	14.4-24.9		
	FANS	Right	121	34.231±2.769	27.7-40.0	0.539	0.591
		Left	121	34.046±2.572	27.5-40.0		
Male	FRHN	Right	195	37.124±2.703	30.0-45.5	0.940	0.348
		Left	195	36.855±2.948	29.1-45.3		
	FIOM	Right	195	8.971±1.738	5.1-13.4	0.226	0.821
		Left	195	8.930±1.838	5.0-14.1		
	FPA	Right	195	20.273±2.532	10.0-33.9	1.366	0.173
		Left	195	19.932±2.391	12.4-27.7		
	FANS	Right	195	35.634±3.139	24.0-43.2	0.369	0.712
		Left	195	35.526±2.627	28.4-41.9		

Key: FRHN: Distance from center of infraorbitalforamen to rhinion.
FIOM: Distance from center of infraorbital foramen to infraorbital margin.
FPA: Distance from center of infraorbital foramen to piriform aperture.
FANS: Distance from center of infraorbital foramen to anterior nasal spine.

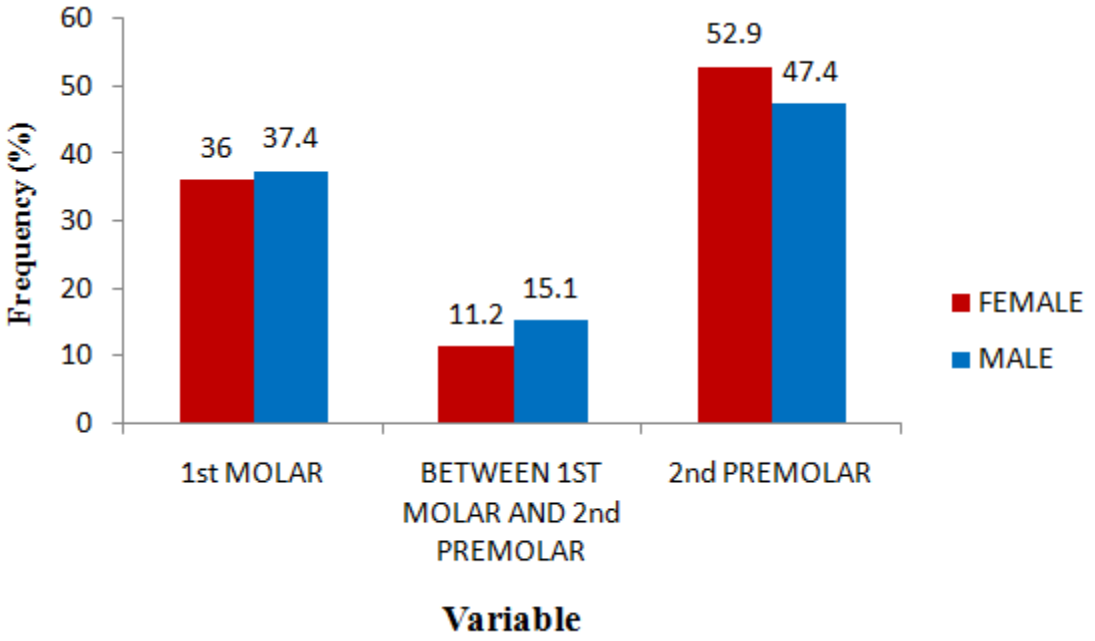

Figure 1: Frequency of vertical orientation of location of infraorbital foramen in relation to maxillary teeth in male and female Nigerians.

Table 4:Sexual dimorphism in the location of infraorbital foramen in relation to maxillary teeth among Nigerians.

Side	Variable	Female (n=242)	Male (n=390)	Total (%)	χ^2	p-value
		Frequency (%)	Frequency (%)			
Right	First molar	41(33.9)	73(37.4)	114(36.1)		
	In between first molar and 2nd premolar	14(11.6)	30(15.4)	44(13.9)	1.852	0.396
	Second premolar	66(54.5)	92(47.2)	158(50.0)		
Left	First molar	46(38.0)	73(37.4)	119(37.7)		
	In between first molar and premolar	13(10.7)	29(14.9)	42(13.3)	1.156	0.561
	Second premolar	62(51.2)	93(47.7)	155(49.1)		
Right& left	First molar	87(36.0)	146(37.4)	233(36.9)		
	In between first molar and premolar	27(11.2)	59(15.1)	86(13.6)	2.718	0.257
	Second premolar	128(52.9)	185(47.4)	313(49.5)		

Table 1: Shows the descriptive statistics for age, vertical and the distance from the infraorbital foramen to four landmarks (Rhinion, Infraorbital Margin, Piriform Aperture and Anterior Nasal Spine). The mean value for males exceeded that of females in all the variables with the exception of age where females were older

Table 2: There was a statistically significant ($p<0.05$) gender difference in the location of infraorbital foramen from rhinion (FRHN), infraorbital margin (FIOM), piriform aperture (FPA) and anterior nasal spine (FANS) respectively bilaterally with males having a higher mean value on the right:FRHN=37.12mm,FIOM=8.97mm,FPA=20.27mm,FANS=35.63mm, and Left:FRHN=36.86mm,FIOM=8.93mm,FPA=19.93mm,FANS=35.53mmfor the location of infraorbital foramen than the females on the right:

FRHN=36.01mm, FIOM=8.55mm,FPA=19.34mm,FANS=34.23mm and left: FRHN=35.87mm, FIOM=8.38mm, FPA=18.90mm, FANS=34.05mm.

Table 3: In both sexes the mean value for the location of infraorbital foramen from rhinion, infraorbital foramen, piriform aperture, anterior nasal spine respectively on the right exceeds that on the left but this asymmetry is statistically insignificant ($p> 0.05$) for both sex

Table 4 and Figure 1: The location of infraorbital foramen in relation to maxillary teeth along a vertical line was mostly in line with the maxillary second premolar in both sexes bilaterally (female 52.9% and male 47.4%) followed by the first molar (female: 36% and male: 37.4%) and lastly in-between the first molar and second premolar (female: 11.2% and male: 15.1%).There was a statistically insignificant gender difference ($p=0.26$) in the vertical orientation of infraorbital foramen in relation to maxillary teeth.

DISCUSSION

The present study shows the presence of infraorbital foramen bilaterally in both sexes which is in accordance with previous studies on Nigerian population (Ukoha *et al.,* 2014; Orish *et al*., 2015).

In this study, it can be deduced that there was a statistically significant ($p<0.05$) gender difference in the location of infraorbital foramen from rhinion, infraorbital margin, piriform aperture and anterior nasal spine respectively bilaterally with mean values in malesexceeding that of the females which could be attributed to male having broader face than female. The asymmetry in the bilateral location of the infraorbital foramen was not statistically significant ($p>0.05$) in both sexes.

Previous study on Nigerian population using dry skulls by Orish *et al*., (2015) reported a significant gender difference in the location of infraorbital foramen from infraorbital margin and lateral border of piriform aperture unilaterally on the left side with males also having a higher mean value than females. Laís *et al.,*(2016) also reported a significant gender difference for the location of infraorbital foramen from anterior nasal spine with males also having a higher mean value than females.

Location of infraorbital foramen from the rhinion (FRHN) was at a mean value of 37.12mm and 36.86mm for male and 36.01mm and 35.87mm for female on the right and left side respectively. This is consistent with studies by Przygocka *et al.,*(2012). Although Przygocka *et al.,*(2012) did not consider gender difference, they reported a mean value of 39.84mm and 38.88mm on the right and left side respectively.

Regarding the location of infraorbital foramen from Infraorbital margin (FIOM) and piriform aperture (FPA) the mean valuewas 8.97mm and 20.27mm on the right, 8.93mm and 19.93mm on the left for males and 8.55mm and 19.34mm on the right; 8.38mm and 18.90mm on the left for females respectively this agrees with studies by (Hussain*et al*., 2012; Varshney and Sharma, 2013;Ukoha*et al*.,2014;) but differ from studies by Karpagam and Thenmozhim (2016), whoreported a lower mean value of 3.70mm±1.02 for FIOM and 13.30 mm ±2.83 for FPA in southern Indian population while Lim *et al*.,(2016) reported a higher mean value of 13.4mm ±2.8 for FIOM in Korean population which could be attributed to racial difference in facial size.

In the present study, the location of infraorbital foramen from anterior nasal spine (FANS)was 35.63mm on the right, 35.53mm on the left for males and 34.23mm on the right ,34.05mm on the left for females. This is consistent with studies by (Singh*et al*., 2015; Laís *et al*.,2016) but higher than the mean value of 29.01mm ±3.59 for FANS irrespective of sex reported by Ukoha *et al*. (2014) for south-east and south-southNigerian population.They also reported a significant asymmetry in the location of infraorbital foramen from rhinion, piriform aperture and anterior nasal spine. However, in the present study, asymmetry wasnot statistically significant in the location of the infraorbital foramen. This could be attributed to difference in ethnicity and age which is also an indication of variation even within same population.

Infraorbital foramen was most commonly verticalin line with the maxillary second premolar teeth in both sexes bilaterally (female 52.9% and male 47.4%) followed by the first molar (female: 36% and male: 37.4%) and lastly in between the first molar and second premolar (female: 11.2% and male: 15.1%). There was no statistically significant(p=0.257) gender difference in the vertical orientation of infraorbital foramen in relation to maxillary teeth bilaterally. This agreed with previous studies (Elsheikh *et al*., 2013;Lim *et at*., 2016) although at different frequency level which also highlights racial variation. This result is slightly different from the findings of Varshney and Sharma (2013) as they also reported highest frequency value for second premolar but followed by the frequency value of between first molar and second premolar unlike in the present study where the position in line with the first molar was having the second highest frequency value. Ukoha *et al*. (2014) also reported the second premolar as most common (46%) vertical orientation of the infraorbital foramen for south-east and south-southNigerian population which is in accordance with the findings in the present study but they reported the position between first molar and second premolar to be the second most common vertical orientation of infraorbital foramen. This disagreed with the present study which is an indication of variations within same population.Such variations may be attributed to race, ethnic, age, dentition and dietary factors (Chung *et al*., 1995; Cutright *et al*., 2003; Ongeti *et al*., 2008).

CONCLUSION

Precisely locating the infraorbital foramen is crucial for avoiding complications during any invasive medical procedure at the maxillofacial region. The present study highlights gender specific variation and variation within same population in the location of infraorbital foramen which may help to facilitate invasive medical procedure at the maxillofacial region.

Conflict of interest: None declared

REFERENCES

Aziz, S.R., Marchena, J.M. and Puran, A. (2000). Anatomic characteristics of the infraorbital foramen: a cadaver study. *Journal of Oral Maxillofacial Surgery*, 58: 992–996.

Barker, L., Naveed, H., Adds, P.J. and Uddin, J. M. (2013). Supraorbital notch and foramen: positional variation and relevance to direct brow lift. *Ophthalmic Plastic Reconstructive Surgery*, 29:67–70.

Chrcanovic, B.R., Nogueira, M.H., Abreu, G. and Custodio, L.N. (2011). A Morphometric Analysis of Supraorbital and Infraorbital Foramina Relative to Surgical Landmarks. *Surgical and Radiologic Anatomy*, 33: 329–335.

Chung, M.S., Kim, H.J., Kang, H.S. and Chung, I.H. (1995).Locational Relationship of the Supraorbital Notch or Foramen and Infraorbital and Mental Foramina in Koreans.*ActaAnatomica,* 154:162–166.

Cisneiros de Oliveira, L.C., Silveira, M. P., de Almeida Júnior, E., Reis, F.P. and Aragão, J. A. (2016). Morphometric study on the infraorbital foramen in relation to sex and side of the cranium in northeastern Brazil. *Anatomy and Cell Biology*, 49:73–77.

Cutright, B., Quillopa, N. and Schubert, W. (2003).An Anthropometric Analysis of the key Foramina for Maxillofacial Surgery.*Journal of Oral Maxillofacial Surgery*, 61:354-357.

Du Tolt, D. F. and Nortjé, C. (2003). The maxillae: integrated and applied anatomy relevant to dentistry. SADJ. 58:325–330.

Elsheikh, E., Nasr, W.F. and Ibrahim, A.A. (2013).Anatomical variation of Infraorbital Foramen in Dry Human Adult Egyptian Skull, Anthropometric Measurement and Surgical Relevance. *International Journal of Otorhinolaryngology*, 5(3):125-129.

Ercikti, N., Apaydin, N. and Kirici, Y. (2016).Location of the Infraorbital Foramen with Reference to Soft Tissue Landmarks.*Surgical and Radiologic Anatomy*, 39(1):11-15.

Esper R.S., Yara, J., Yamamura, Y. and Cricenti, S.V. (1998). Relaçõesanatômicas do ponto de acupuntura E-2 (Sibai) localizado no forame infraorbital. *Reverend Paul Acupunture,* 4:19–21.

Gardner, E., Gray, D.J. andO'Hailly, R. (1988). Anatomia: estudo regional do corpohumano. 4th ed. Riode Janeiro: GuanabraKoogan.

Gour, K.K., Nair, S., Trivedi, G.N. and Gupta, S.D. (2012). Anthropometric Measurements of Infraorbital Foramen in Dried Human Skulls.*International Journal of Biological and Medical Research*, 3:2003–2006.

Hussain, S. S., Muralidhar, P.S., Desai, S.D., Thomas, S.T., Maavishettar, G.F. and Haseena, S. (2012). Morphometric Analysis of Infraorbital Foramen Position in South Indian Skulls. *Indian Journal of Innovations and Development*, 1:2277-5390.

Hwang,K., Han, J. Y., Battuvshin, D., Kim, D. J. and Chung, I. H. (2004). Communication of infraorbital nerve and facial nerve: anatomic and histologic study. *Journal of Craniofacial Surgery*, 15:88–91.

Karakaş, P., Bozkir, M. G. andOguz, O. (2003). Morphometric measurements from various reference points in the orbit of male Caucasians. *Surgery and Radiological Anatomy*, 24:358–362.

Karpagam, N.G. and Thenmozhim M.S. (2016).A Study of Morphometric Analysis of Infraorbital

Foramen in South Indian Dry Skulls. *Journal of Pharmaceutical Science and Research*, 8(11): 1318-1319.

Kazkayasi, M., Ergin, A., Ersoy, M., Bengi, O., Tekdemir, I. and Elhan, A. (2001). Certain Anatomical Relations and the Precise Morphometry of the Infraorbital Foramen-Canal and Groove: An Anatomical and Cephalometric Study. *Laryngoscope*, 111:609-614.

Laís, C. S.C.O., Maria, P.M.S., Erasmo, A.J., Francisco, P.R. and José, A.A. (2016). Morphometric Study on the Infraorbital Foramen in Relation to Sex and Side of the Cranium in

Northeastern Brazil. *ABC Journal of Anatomy and Cell Biology*, 49:73-77.

Lee, T., Lee, H. and Baek, S. (2012). A Three-Dimensional Computed Tomographic Measurement of the Location of Infraorbital Foramen in East Asians. *Journal of Craniofacial Surgery*, 23:1169–1173.

Lim, J.S., Min, K.H., Lee, J.H., Lee, H.K. and Hong, S.H. (2016). Anthropometric Analysis of Facial Foramina in Korean Population: A Three-Dimensional Computed Tomographic Study. *Archives of Craniofacial Surgery*, 17(1):9-13.

Macedo, V. C., Cabrini, R. R. and Faig-Leite, H. (2009). Infraorbital foramen location in dry human skulls. Brazilian Journal of Morphological Sciences, 26:35–38.

Malet, T., Braun, M., Fyad, J. P. and George, J. L. (1997). Anatomic study of the distal supraorbital nerve. *Surgical Radiological Anatomy*, 19:377–384.

McMinn R.M.H. (1990). Pterygopalatine fossa. In: Sinnatamby C.S.(ed).Last's Anatomy, Regional and Applied. London; *Churchill Livingstone,* 451-467.

Moore, K.L. andDalley, A.F. (1999). Nerves of the face. In: Moore K.L,Dalley A.F. (eds). Clinically Oriented Anatomy, 4th ed. Philadelphia:Lippincott Williams and Wilkins, 832-993.

Muchlinski, N.M.(2008). The Relationship Between the Infraorbital Foramen, Infraorbital Nerve, and Maxillary Mechano-reception: Implications for Interpreting the Paleoecology of Fossil Mammals Based on Infraorbital Foramen Size. *The Anatomical Record,* 291:1221–1226.

Ongeti, K., Hassanali, J., Ogeng'o, J. and Saidi, H. (2008). Biometric Features of Facial foramina in Adult Kenyan Skulls. *European Journal of Anatomy*, 12: 89-95.

Orhan, K., Misirli, M., Aksoy, S., Seki, U., Hincal, E.,Ormeci, T. and Arslan A. (2016). Morphometric Analysis of the Infraorbital Foramen, Canal and Groove Using Cone Beam CT: Considerations for Creating Artificial Organs. *International Journal of Artificial Organs*, 39(1)28-36.

Orish, C.N., Esomonu P.C., Osunwoke E. A. and Gwunireama, I. U.(2015). Anthropometric Study of Infraorbital Foramen in a Nigerian Population. *European Journal of General Medicine*, 12(4):298-301.

Przygocka, A., Podgórski, M., Jędrzejewski, K., Topol, M. and Polguj, M. (2012). The Location of the Infraorbital Foramen in Human Skulls, To Be Used as New Anthropometric Landmarks as a Useful Method for Maxillofacial Surgery. *Folia Morphologica*, 71(3):198–204.

Radwan, I.A., Saito, S. and Goto, F. (2001). High-concentration tetracaine for the management of trigeminal neuralgia: quantitative assessment of sensory function after peripheral nerve block. *Clinical Journal of Pain*, 17:323–326.

Singh, R. (2011). Morphometric analysis of infraorbital foramen in Indian dry skulls. *Anatomy Cell Biology,* 44:79–83.

Singh K.A., Preeti Agarwal, P., Singh, N, and Debberma, S. (2015) Accessory Infraorbital Foramen and Morphometric Localization of Infraorbital Foramen in North Indian Region. *National Journal of Integrated Research in Medicine*, 6(5):28-33.

Tungkeeratichai, J., Bhongmakapat, T., Saitongdee, P. and Orathai P. (2013).The Surgical Landmark for Facial Foramen. *International Journal of Otorhinolaryngology*, 5(3):121-124.

Ukoha, U.U., Kosisochukwu, E. U., Onochie, O. U., Henry, C. N., Godwin U. N. and Perpetua, C. N.(2014). Anthropometric Measurement of Infraorbital Foramen in South-East and South-South Nigeria.*National Journal of Medical Research*, 4(3): 225- 227.

Varshney, R. and Sharma, N. (2013).Infraorbital Foramen– Morphometric Study and Clinical Application in Adult Indian Skulls. *Saudi Journal of Health Sciences*, 2(3):151-155.

Williams, P. L., Warwick, R., Dyson, M. and Bannister, L. H. (1989). *Gray's Anatomy*. 37th edition, New York, Churchill Livingstone.

Zide, B. M. and Swift, R. (1998). How to block and tackle the face. *Plastic Reconstructive Surgery*, 101:840–851.