ORIGINAL ARTICLE

ANTHROPOMETRIC MEASUREMENT OF INFRAORBITAL FORAMEN IN SOUTH-EAST AND SOUTH-SOUTH NIGERIA

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ABSTRACT

Introduction: The study aimed to determine a more precise location of the infraorbital foramen (IOF) in relation to the piriform aperture (PA), infraorbital margin (IOM) and the anterior nasal spine(ANS) with the aim of improving the efficiency in clinical situations such as surgery and anesthetic procedures.

Methods: A total of 130 skulls of unknown sex and age were used for the study; they were measured on both sides (right and left). With a vernier caliper the distances between the infraorbital foramen and the piriform aperture, infraorbital margin and anterior nasal spine were measured. The vertical orientation of the infraorbital foramen (IOF) with the upper teeth was also determined by direct visual inspection.

Results: The mean distance and standard deviation (mean ± SD) between the right IOF and the PA, right IOM and ANS were 19.36±3.54mm, 6.94±2.57mm, and 30.02±3.55mm, respectively, and between the left IOF and the PA, left IOM and ANS were 18.27±2.94mm, 7.83±1.86mm, and 29.01±3.59mm, respectively.There was significant difference ($p<0.05$) in the parameters between the two sides. The majority of IOF were vertically oriented to the 2nd premolar teeth (46%).

Conclusion: The results may provide guidance to the maxillofacial surgeons and anesthesiologists to localize infraorbital foramen and so contribute to better outcome of diagnostic or therapeutic procedures.

Keywords: Infraorbital Foramen, Infraorbital Margin, Piriform Aperture, Anterior Nasal Spine, Infraorbital Nerve

INTRODUCTION

The infraorbital foramen (IOF) is an opening in the maxillary bone of the skull located below the infraorbital margin of the orbit. The infraorbital nerve, a branch of the maxillarydivision of trigeminal nerve, passes through the IOF where its terminating branches supply the conjunctiva, skin over the lower eyelid, lateral aspect of external surface of nose & upper lip.[1,2]

The study of the location of IOF and knowledge of its anatomical variations are therefore important in local anaesthetic procedures such as blockage of the infraorbital nerve,[3] in the treatment of the trigeminal neuralgia,[4]and in maxillofacial surgeries.[5,6]

The infraorbital foramen has been analyzed in several studies in order to determine its location in dry skulls, by direct or indirect means. A study was conducted on human skulls in Poland to locate the IOFfrom chosen anatomical landmarks such as the nasion, rhinion and frontomalare orbitale.[7]Other studies in Thailand, Korea, Sri Lanka and Europe were targeted at localizing the infraorbital foramen for better diagnostic and therapeutic procedures.[6,8-10]The lack of reported studies on the infraorbital foramen in the Southern part of Nigeria therefore gave rise to the study.

METHODS

This study was carried out with 130 dry skulls obtained from universities in South-East and South-South Nigeria. The skullswere measured on both sides (right and left) totaling 260 sides of undetermined sex and age. Deformed or fractured skull samples at the piriform aperture, infraorbital foramen, and anterior nasal spine or at the infraorbital margin which made it impossible to measure them correctly, were discarded.

The skulls were first placed in the anatomical position before the measurements were taken. With a Mitsutoyovernier caliper (Japan; accuracy: 0.01mm), the following landmarks were measured and recorded:

1. The distance between the infraorbital foramen and the piriform aperture (PA).

2. The distance from the infraorbital foramen up to the infraorbital margin (IOM).
3. The distance between the infraorbital foramen and the anterior nasal spine (ANS).

The vertical orientation of the infraorbital foramen (IOF) with the upper teeth was obtained by direct visual inspection.

Statistical Analysis: The data was summarized with SPSS 16.0 using descriptive statistics of mean, standard deviation and frequency, and analysed using students t-test analysis. Level of significance was set at $p < 0.05$.

RESULTS

Table 1: Descriptive of the bilateral measurements of the infraorbital foramen

Measure-ment(s)	RIGHT (mm)	LEFT (mm)	BOTH	P-Value
IOF-PA	19.36±3.54	18.27±2.94	18.82±3.29	0.007
IOF-ANS	30.02±3.55	29.01±3.59	29.52±3.60	0.002
IOF-IOM	6.94±2.57	7.83±1.86	7.38±2.28	0.023

IOF-PA: The distance between the infraorbital foramen and the piriform aperture; IOF-ANS: The distance between the infraorbital foramen and the anterior nasal spine; IOF-IOM: The distance between the infraorbital foramen and the infraorbital margin.

Data are means and standard deviation. Independent sample t-test was used to compare the two sides. The right side had significantly higher IOF-PA ($p<0.05$) and IOF-ANS ($p<0.05$), but had significantly lower IOF-IOM ($p<0.05$) when compared to the left.

Table 2: Vertical orientation of infraorbital foramen with the teeth

Teeth	Number	Percentage (to the nearest %)
1st molar	18	14
2nd premolar/1st molar	40	31
1st/2nd premolar	11	8
2nd premolar	60	46
2nd molar	1	1

The 2nd premolar had the most frequent vertical orientation (46%) with the infraorbital foramen, followed by the interval between the 2nd premolar and the 1st molar (31%).

Table 3: Comparative distance between infraorbital foramen (IOF) and infraobital margin (IOM)

Authors	Year	Country	Samples	Mean Distance (mm)*
Aziz *et al*[6]	2000	USA	47	8.50
Kazkayasi[15]	2001	Turkey	35	7.19
Ghaus and Faruqi[21]	2008	India	125	6.50
Macedo*et al*[16]	2009	Brazil	295	6.37
Singh[17]	2011	India	55	6.16
Gour*et al*[14]	2012	India	100	7.39
Present study	2014	Nigeria	130	7.38

*Mean Distance between IOF and IOM (mm)

Table 4: Comparative distance between infraorbital foramen (IOF) and piriform aperture (PA)

Study	Yr	Country	Samples	Mean Distance (mm)*
Hindy and Abdel-Raouf[18]	1993	Egypt	15	17.23
Macedo*et al*[16]	2009	Brazil	295	17.67
Singh[17]	2011	India	55	15.56
Present study	2014	Nigeria	130	18.82

* Mean Distance of IOF and PA (mm)

Table 5: Comparative distance between infraorbital foramen (IOF) and anterior nasal spine (ANS)

Authors	Year	Country	Samples	Mean Distance (mm)*
Agthong *et al*[20]	2005	Thailand	110	33.93
Lopes *et al*[19]	2009	Brazil	99	35.18
Present study	2014	Nigeria	130	29.52

***Mean Distance between IOF and ANS (mm)**

Table 6: Comparison of infraorbital foramen (IOF) in relation to its vertical orientation with the teeth

Study	Year	No	Orientation With Teeth	%
Hindy and Abdel-Raouf[18]	1993	15	2nd premolar	50
Ghaus and Faruqi[21]	2008	125	2nd premolar	43
Gour*et al*[14]	2012	100	2nd premolar	43
Present study	2014	130	2nd premolar	46

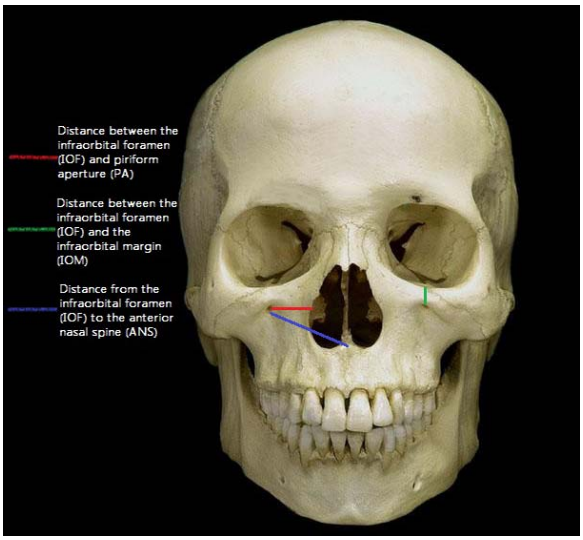

Figure 1: Graphical representation of the distances from the infraorbital foramen to the piriform aperture, infraorbital margin and anterior nasal spine

DISCUSSION

A sound knowledge of the location of the infraorbital foramen will be helpful to surgeons and anaesthesiologists in providing a safer performance of clinical procedures such as administering regional anaesthesia as in the case of repair of cleft lip and other maxillofacial

surgeries, and to determine the acupuncture point in case of treating trigeminal neuralgia.[11] It is also an important reference point used in orbital surgeries[12]and is an important surgical parameter for external access to the maxillary sinus – Caldwell-Luc operations.[13]

According to the present study, the infraorbital foramen had a mean distance of 7.38mm in relation to infraorbital margin, which was similar to the work done by Gour*et al*[14]whose reported distance was 7.39mm. The present work also showed similarity with data given by Kazkayasi[15]but was lower than the previous work done by Aziz *et al*[6] (see Table 3). Racial differences could be suggested for the disparity.

The present work revealed that the mean distance of infraorbital foramen from the piriform aperture was 18.82mm. Table 4 compares the results with those of other authors. This was higher than the result obtained from measuring the same parameter by Macedo*et al*,[16]Singh,[17]and Hindyand Abdel-Raouf.[18]Such differences could be attributed to racial differences and ethnicity.

The present studyreported the distance of infraorbital foramen in relation to anterior nasal spine (ANS) to be 29.52mm. From Table 5, the result was lower than those obtained by Lopes *et al*[19]and Agthong*et al*.[20] It goes to say that data from one population cannot be transposed to another population, because they are population-specific.

From Table 2, 46% of the infraorbital foramen were vertically oriented to the 2nd premolar teeth. Table 6 compares it with other authors, and it is lower than the report by Hindy and Abdel-Raouf.[18]However, Ghaus and Faruqi[21]and Gour*et al*[14]reported that the majority of skulls had their infraorbital foramen vertically oriented to the 2nd premolar teeth (43%). Population variation is once again implicated here in terms of the percentage level, but all the authors reported that the 2nd premolar teeth had the most predominant vertical orientation with the IOF.

CONCLUSION

This investigation suggests that local difference in the position of infraorbital foramen may occur in population; knowledge obtained from anthropometric measurement of infraorbital foramen in dry human skulls conducted in South East and South South Nigeria by present work may provide guidance to the maxillofacial surgeons and anesthesiologists to localize infraorbital foramen and so may be considered for the better outcome of diagnostic or therapeutic procedures

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