

Comparative Evaluation of Morphometric Analysis on Infra Orbital Foramen in South Indian Population - An *In Vitro* Study

Research Article

S Syed Shahaab E Noor¹, Pradeep Solete^{2*}

¹ Graduate Student, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.

² Associate Professor, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.

Abstract

Introduction: Effective pain control in dentistry is achieved by local anaesthetic techniques. To achieve it exact morphometric location of the foramen is essential.

Aim: Aim of this study is to do morphometric analysis of infra orbital foramen in south Indian population

Materials and Methods: 96 human dry skull where examined from the department of Anatomy, various dental and medical colleges in Chennai, Tamil Nadu using digital vernier calliper and a survey sheet was used to make a note of the data.

Results: The average distance on left side in females was 13.46 ± 1.99 mm and average perpendicular distance between infra orbital foramen and the line joining canine eminence and base of the orbit on right side in females is 11.39 ± 2.73 mm. The average distance on left side in males was 13.36 ± 2.16 mm and average perpendicular distance between infra orbital foramen and the line joining canine eminence and base of the orbit on right side in males is 11.27 ± 2.05 mm. This study also infers that the location of infraorbital foramen is independent of gender but dependent on the side it is located this is signified by the p value. The $p < 0.05$ value on left side and $p > 0.05$ value on right side.

Conclusion: The average location on left side is more than the right side. Hence when giving block anesthesia one should be well aware of the location as there are many important structures around infraorbital foramen.

Keywords: Anterior Superior Alveolar Nerve; Infra Orbital Foramen; Nerve Block; Skull; Vernier Calliper.

Introduction

The location of infraorbital foramen is 1 cm below the infraorbital margin in maxillary bone [1, 2] and the structures passing through it are infraorbital nerve and vessels. These nerve and vessels supply the lower eyelids, superior lip, ala of the nose and the premolar teeth.

During a surgical procedure around the infra orbital foramen, the most essential thing is infraorbital nerve block. Therefore morphometric analysis of infraorbital foramen assumes greater importance in such important conditions. The analysis of important clinical, surgical and anesthetic aspect of the infraorbital foramen in relation to the infraorbital margin may be summarized as follows [3]: The location of the infraorbital foramen is very much

essential as it determines the orientation of an acupuncture point which is needed in treatment of trigeminal neuralgia [4]. The location of infraorbital foramen helps to locate the infraorbital nerves and vessels which is of high risk zone during plastic surgery [5]. The location of the infraorbital foramen determines morphometric variations from reference points to decrease the risk of orbital surgery [6]. The morphometric analysis of infraorbital foramen plays an important role during regional block anesthesia techniques of the infraorbital nerve [7, 8]. The exact location of the foramen facilitates risk free zygoma fracture surgery [9].

Thus knowledge of the morphometric analysis of infraorbital foramen from various reference points in this area provides important data for local anesthesia during rhinoplasty [10] and for the maxillofacial area during plastic surgery [11]. Modern surgical

*Corresponding Author:

Pradeep Solete,

Associate Professor, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, 162, PH Road, Chennai 600077, TamilNadu, India.

Tel: +91 9710404482

E-mail: pradeeps@saveetha.com

Received: November 05, 2020**Accepted:** November 18, 2020**Published:** November 25, 2020

Citation: S Syed Shahaab E Noor, Pradeep Solete. Comparative Evaluation of Morphometric Analysis on Infra Orbital Foramen in South Indian Population - An In Vitro Study. *Int J Dentistry Oral Sci.* 2020;S10:02:009:50-53. doi: <http://dx.doi.org/10.19070/2377-8075-S102-010009>

Copyright: Pradeep Solete©2020. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

procedures [6], anesthesia [10] and acupuncture require a more exact morphometric location of infraorbital foramen and in understanding of the surrounding anatomy [4].

This study was conducted to compare morphometric location of the infraorbital foramen in left and right side in dry south Indian skulls as there are no data on the location of the infraorbital foramen in the south Indian population.

The Infraorbital foramen [IOF] is an anatomical structure present bilaterally on the maxillary bone, at the uppermost part of the canine fossa. The infraorbital nerve is a terminal branch of the second division of the trigeminal nerve [maxillary], and exits through the Infraorbital foramen lying in the same vertical plane as the pupil when the eye is in forward gaze [12]. The infraorbital nerve is sensitive and it lengthens the maxillary nerve which crosses the infraorbital foramen and branches to feed the skin in the upper portion of the face, the maxillary sinus mucosa, the maxillary incisor, the canine and premolar teeth and the adjacent gums portion, the lower eyelid skin and conjunctiva, part of the nose, skin and mucosa of the upper lip [13].

The infraorbital foramen is an opening to the external surface of the skull through which the infra orbital canal giving passage to the infra orbital artery, vein and nerve communicates with the face. The infraorbital foramen is a vital structure for oral and maxillofacial surgeons when looked from the perspectives of surgery and local anesthesia [14]. There is variation in its anatomy based on the site, shape, size, laterality and incidence of accessory foramina. The morphometric analysis of the infraorbital foramen is significant in local anesthetic procedures in maxillofacial surgeries and consequently in protection against procedural neurovascular injuries. In intractable and pharmacologically unresponsive trigeminal neuralgia Therapeutic infraorbital nerve blocks are used [15]. It has a relatively big diameter if it is compared to the supraorbital foramen and can vary on the form and situation [16]. The presence of accessory infra orbital foramen may be difficult during anesthetization of the region innervated by infra orbital nerve [17, 18].

Materials and Methods

96 dry adult human skulls of unknown age were selected from the Departments of Anatomy of various dental, medical Colleges

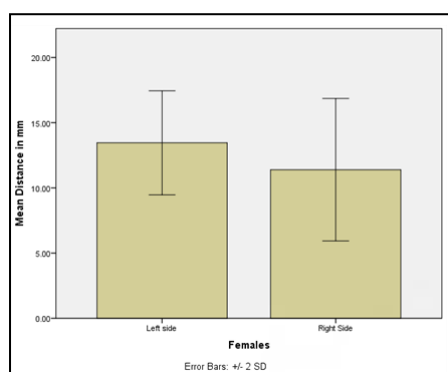
and Hospitals in Chennai, Tamilnadu. This study was approved by the Institutional Research and Ethics Committee. A criteria of exclusion was adopted. Any skull showing signs of damage to orbital margin, canine eminence, buccal surface of maxilla as well as skulls where the Infra orbital foramen was found to be damaged unilaterally or bilaterally. In all the samples the presence of a complete maxillary bone was taken to be mandatory along with intact lower border of the orbit. Total sides studied were 112.22 skulls were female skulls and 34 skulls were found to be of males. The following measurements were made after aligning the skull in Frankfurt horizontal plane, by using digital Vernier calliper with least count of 0.01mm, ruler and divider by direct vision method to evaluate the location of IOF on both sides of all skulls, the measurements were taken by two different individuals and observations were recorded in the data collection form. The following measurement was observed. The perpendicular measurement from the infraorbital foramen to the line joining canine eminence to the base of the orbit. The collected data was noted down on a survey sheet. Observations thus made were compiled and tabulated.

Results and Discussion

According to this study following were the results obtained. The average distance on left side in females was found to be 13.46 ± 1.99 mm and average perpendicular distance between infra orbital foramen and the line joining canine eminence and base of the orbit on right side in females is found to be 11.39 ± 2.73 mm. Hence it is clear that the average distance in females is seem to be higher in left side when compared to that of that seen on the right side. The average distance on left side in males was found to be 13.36 ± 2.16 mm and average perpendicular distance between infra orbital foramen and the line joining canine eminence and base of the orbit on right side in males is found to be 11.27 ± 2.05 mm. Hence it is clear that the average distance in males is seem to be higher in left side when compared to that of that seen on the right side.

Rajani Singh [19] reported in his study the average distance from the infraorbital foramen to that of piriform aperture to be 15.56 mm, along with him other researches also used piriform aperture as one of the reference point. Other studies with similar results include that of Hindy and Abdel Raouf et.al., [20], they found the average distance from the infraorbital foramen to the piriform aperture to be 17.23 mm.

Graph 1. Average Distance of Infraorbital Foramen in Female Patients- Graph I shows that the average distance on left side in females was found to be 13.46 ± 1.99 mm and average perpendicular distance between infra orbital foramen and the line joining canine eminence and base of the orbit on right side in females is found to be 11.39 ± 2.73 mm. Hence it is clear that the average distance in females is seem to be higher in left side when compared to that of that seen on the right side.



Graph 2. Average Distance of Infraorbital Foramen in Male Patients- Graph II states that the average distance on left side in males was found to be 13.36 ± 2.16 mm and average perpendicular distance between infra orbital foramen and the line joining canine eminence and base of the orbit on right side in males is found to be 11.27 ± 2.05 mm . Hence it is clear that the average distance in males is seem to be higher in left side when compared to that of that seen on the right side.

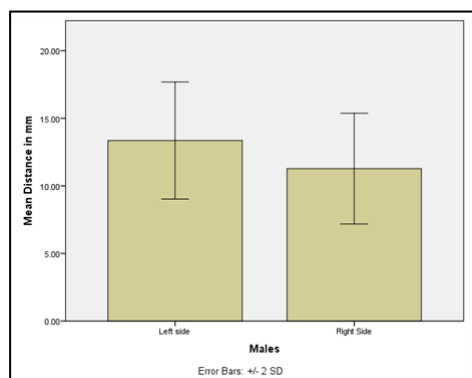


Table 1. Average Distance of Left Side Infraorbital Foramen Amongst Male And Female Patients. Table I give us clear idea that there is not much variation among genders on the respective side. That is average morphometric location of infraorbital foramen on left side in females and males were found to be 13.45 ± 1.99 mm and 13.35 ± 2.16 mm respectively. Which are almost the same [p value- 0.505], hence it can be confirmed that location of infraorbital foramen on left and right side is irrespective of their gender.

Distance in mm			
Left Side	Mean	Std. Deviation	p Value [<0.05]
Females	13.4576	1.99610	0.505 [NS]
Males	13.3571	2.16354	

Table 2. Average Distance of Right Side Infraorbital Foramen Amongst Male and Female Patients. Table II infers that the average morphometric location of infraorbital foramen on right side in female and males were found to be 11.39 ± 2.73 mm and 11.08 ± 1.90 mm respectively [p value – 0.048]. This also verifies our previous statement that that location of infraorbital foramen on left and right side is irrespective of their gender.

Distance in mm			
Right Side	Mean	Std. Deviation	p Value [<0.05]
Females	11.3938	2.73168	0.048 [NS]
Males	11.0871	1.90967	

Kazkayasi et al., [21] found the average distance to be 14.70 mm, Macedo et al., [3] Reported it to be 17.67 mm, however according to present study based on the selected reference point the average distance was found to be 12.14 mm which correlates with that of the above studies which has used piriform aperture as reference point. Hence our study is in accordance with the above mentioned studies. We had done many *in vitro* studies, case reports and clinical trial. Now we are focussing on foramen location amongst various genders in Indian population [22-36].

Bruno et al., [37] also reported the average distance of infra orbital foramen on right side from piriform aperture to be 14.65 mm and the average distance of infraorbital foramen on left side from piriform aperture was found to be 14.79 mm. This result is also in much accordance with our results which are 13.28mm on left side and 11.00 mm on right side.

Conclusion

Within the limitation of this study we can conclude that the average location on left side is more than the average location on

right side. Hence when giving block anesthesia one should be well aware of the location as there are many important structures around infraorbital foramen.

Clinical Significance

Thorough knowledge of the possible anatomical and morphometric variations of the infra orbital foramen and accessory foramen is important for safe and successful regional anesthesia and for avoiding nerve injuries during surgery.

Acknowledgments

I thank all the faculty members of department of conservative dentistry and endodontics.

References

- [1]. Gardner E, Gray DJ, O’Rahilly R, Benevento R. Anatomy: regional study of the human body. In Anatomy: regional study of the human body 1978.
- [2]. Williams PL, Warwick R, Dyson M, Bannister LH. Gray’s anatomy. Churchill Livingstone (37th edtn). United Kingdom. 1989; 635-40.

- [3]. Macedo VC, Cabrini RR, Faig-Leite H. Infraorbital foramen location in dry human skulls. *Braz J Morphol Sci.* 2009; 26: 35–38.
- [4]. Silva RE, Juliano Y, Yamamura Y, Cricenti SV. Anatomical relationships of acupuncture point E-2 (Sibai) located in the infraorbital foramen. *Rev. paul. acupunct.* 1998; 4 (1): 19-22.
- [5]. Hwang K, Han JY, Battuvshin D, Kim DJ, Chung IH. Communication of infraorbital nerve and facial nerve: anatomic and histologic study. *J Craniofac Surg.* 2004; 15: 88–91. PMID: 14704571.
- [6]. Karakaş P, Bozkır MG, Oğuz O. Morphometric measurements from various reference points in the orbit of male Caucasians. *Surg Radiol Anat.* 2003; 24: 358–362. PMID: 12652362.
- [7]. Chung MS, Kim HJ, Kang HS, Chung IH. Locational relationship of the supraorbital notch or foramen and infraorbital and mental foramina in Koreans. *Acta Anat [Basel].* 1995; 154: 162–166. PMID: 8722516.
- [8]. Radwan IA, Saito S, Goto F. High-concentration tetracaine for the management of trigeminal neuralgia: quantitative assessment of sensory function after peripheral nerve block. *Clin J Pain.* 2001; 17: 323–326. PMID: 11783812.
- [9]. Du Tolt DF, Nortjé C. The maxillae: integrated and applied anatomy relevant to dentistry. *SADJ.* 2003; 58: 325–330. PMID: 14648914.
- [10]. Zide BM, Swift R. How to block and tackle the face. *Plast Reconstr Surg.* 1998; 101: 840–851. PMID: 9500408.
- [11]. Aziz SR, Marchena JM, Puran A. Anatomic characteristics of the infraorbital foramen: a cadaver study. *J Oral Maxillofac Surg.* 2000; 58: 992–996. PMID: 10981979.
- [12]. Lee UY, Nam SH, Han SH, Choi KN, Kim TJ. Morphological characteristics of the infraorbital foramen and infraorbital canal using three dimensional models. *Surg Radiol Anat.* 2006; 28: 115-20. PMID: 16432643.
- [13]. Lopes PT, Pereira GA, Santos AM, Freitas CR, Abreu BR, Malafaia AC. Morphometric analysis of the infraorbital foramen related to gender and laterality in dry skulls of adult individuals in southern Brazil. *Journal of Morphological Sciences.* 2017 Jan 16; 26(1).
- [14]. Tezer M, Öztürk A, Akgül M, Gayretli Ö, Kale A. Anatomic and morphometric features of the accessory infraorbital foramen. *Journal of Morphological Sciences.* 2017 Jan 16; 28(2).
- [15]. Gnanagurudasan E, Ahamed SR, Deepalaxmi S, Gnanadesigan E. A gender-wise study on the morphometry of infraorbital foramen and its laterality in dry adult skulls of south Indian population. *International Journal of Medical Science and Public Health.* 2014 May 1; 3(5).
- [16]. Elias MG, Silva RB, Pimentel ML, Cardoso VT, Rivello T, Babinski MA. Morphometric analysis of the infraorbital foramen and accessories foramina in Brazilian skulls. *Int J Morphol.* 2004; 22(4): 273-8.
- [17]. Krishna Reddy D. Morphometric study of infra orbital foramen in dry adult skulls and its surgical relevance. *International Journal of Bioassays.* 2013.
- [18]. Thenmozhi MS. A study of morphometric analysis of infraorbital foramen in South Indian dry skulls. *Journal of Pharmaceutical Sciences and Research.* 2016 Nov 1; 8[11]: 1318.
- [19]. Singh R. Morphometric analysis of infraorbital foramen in Indian dry skulls. *Anatomy & cell biology.* 2011 Mar 1; 44[1]: 79-83. PMID: 21519552.
- [20]. Hindy AM, Abdel-Raouf F. A study of infraorbital foramen, canal and nerve in adult Egyptians. *Egypt Dent J.* 1993; 39: 573–580. PMID: 9588126.
- [21]. Kazkayasi M, Ergin A, Ersoy M, Bengi O, Tekdemir I, Elhan A. Certain anatomical relations and the precise morphology of the infraorbital foramen. Canal and groove: an anatomical and cephalometric study. *Laryngoscope.* 2001; 111: 609–614. PMID: 11359128.
- [22]. Rajendran R, Kunjusankaran RN, Sandhya R, Anilkumar A, Santhosh R, Patil SR. Comparative Evaluation of Remineralizing Potential of a Paste Containing Bioactive Glass and a Topical Cream Containing Casein Phosphopeptide-Amorphous Calcium Phosphate: An in Vitro Study. *Pesquisa Brasileira em Odontopediatria e Clínica Integrada.* 2019; 19.
- [23]. Nandakumar M, Nasim I. Comparative evaluation of grape seed and cranberry extracts in preventing enamel erosion: An optical emission spectrometric analysis. *J Conserv Dent.* 2018; 21: 516–520. PMID: 30294113.
- [24]. Rajakeerthi R, Ms N. Natural Product as the Storage medium for an avulsed tooth—A Systematic Review. *Cumhuriyet Dental Journal.* 2019; 22(2): 249-56.
- [25]. Manohar MP, Sharma S. A survey of the knowledge, attitude, and awareness about the principal choice of intracanal medicaments among the general dental practitioners and nonendodontic specialists. *Indian J Dent Res.* 2018; 29: 716 - 720. PMID: 30588997.
- [26]. Siddique R, Sureshbabu NM, Somasundaram J, Benoy Jacob, Deepak Selvam. Qualitative and quantitative analysis of precipitate formation following interaction of chlorhexidine with sodium hypochlorite, neem, and tulsi. *J Conserv Dent.* 2019; 22: 40–47. PMID: 30820081.
- [27]. Teja KV, Ramesh S, Priya V. Regulation of matrix metalloproteinase-3 gene expression in inflammation: A molecular study. *J Conserv Dent.* 2018; 21: 592–596. PMID: 30546201.
- [28]. Azeem RA, Sureshbabu NM. Clinical performance of direct versus indirect composite restorations in posterior teeth: A systematic review. *J Conserv Dent.* 2018; 21: 2-9. PMID: 29628639.
- [29]. Poorni S, Srinivasan MR, Nivedhitha MS. Probiotic Streptococcus strains in caries prevention: A systematic review. *J Conserv Dent.* 2019; 22: 123-8. PMID: 31142979.
- [30]. Jenarathanan S, Subbarao C. Comparative evaluation of the efficacy of diclofenac sodium administered using different delivery routes in the management of endodontic pain: A randomized controlled clinical trial. *J Conserv Dent.* 2018; 21: 297-301. PMID: 29899633.
- [31]. Nivedhitha Malli Sureshbabu, Kathiravan Selvarasu, Jayanth Kumar V, Mahalakshmi Nandakumar, Deepak Selvam. Concentrated Growth Factors as an Ingenious Biomaterial in Regeneration of Bony Defects after Periapical Surgery: A Report of Two Cases. *Case Reports in Dentistry.* 2019; 2019: 7046203. PMID: 30805222.
- [32]. Govindaraju L, Neelakantan P, Gutmann JL. Effect of root canal irrigating solutions on the compressive strength of tricalcium silicate cements. *Clin Oral Investig.* 2017; 21(2): 567-571. PMID: 27469101.
- [33]. Khandelwal A, Palanivelu A. Correlation between dental caries and salivary albumin in adult population in Chennai: An in vivo study. *Brazilian Dental Science.* 2019 Apr 30; 22(2): 228-33.
- [34]. Ramarao S, Sathyanarayanan U. CRA Grid - A preliminary development and calibration of a paper-based objectivization of caries risk assessment in undergraduate dental education. *J Conserv Dent.* 2019; 22: 185-90. PMID: 31142991.
- [35]. Siddique R, Nivedhitha MS. Effectiveness of rotary and reciprocating systems on microbial reduction: A systematic review. *J Conserv Dent.* 2019; 22: 114-22. PMID: 31142978.
- [36]. Janani K, Sandhya R. A survey on skills for cone beam computed tomography interpretation among endodontists for endodontic treatment procedure. *Indian J Dent Res.* 2019; 30: 834–838. PMID: 31939356.
- [37]. Chrcanovic BR, Abreu MH, Custódio AL. A morphometric analysis of supraorbital and infraorbital foramina relative to surgical landmarks. *Surgical and radiologic anatomy.* 2011 May 1; 33[4]: 329-35. PMID: 20625730.