Original Article

ISSN (O): 2455-5274; ISSN (P): 2617-5207

Morphological Analysis of Length and Shape Nasopalatine Canal on Human Dry Skulls

Saurabh Chaudhary[1], **Nidhi Sharma**[2], **S. K. Jain**[3]

[1]PG student, Department of Anatomy, TMMC&RC, Moradabad, Uttar Pradesh, India, [2]Professor, Department of Anatomy, TMMC&RC, Moradabad, Uttar Pradesh, India, [3]Professor & HOD, Department of Anatomy, TMMC&RC, Moradabad, Uttar Pradesh, India.

Abstract

Background: To assess length and shape of nasopalatine canal on human dry skulls. **Subjects and Methods:** Fifty- four dry human skulls of either gender was recruited for the study. The length of the nasopalatine canal was measured from the definite point (interproximal region) of the central incisors to the distal end of the incisive foramen. Incisive foramen diameter was calculated in the sagittal plane by measuring the anteroposterior distance of the oral entrance of the NPC. Shape was categorized into 4 types, Cylindrical, funnel, hourglass and spindle shape. **Results:** The mean length of nasopalatine canal was 16.2 mm in males and 13.4 mm in females. A significant difference was observed (P< 0.05). A non- significant difference in male (5.3 mm) and females (4.9 mm) incisive foramen diameter was observed. The most common shape of nasopalatine canal was cylindrical in 23, funnel in 7, hourglass in 21 and spindle shape in 3 skulls. A significant difference was observed (P< 0.05). **Conclusion:** Nasopalatine canal morphology assessment is essential to prevent iatrogenic injury to the anatomical structures. Most common shape found to be hour glass and cylindrical.

Keywords: Nasopalatine Canal, Hour Glass, Cylindrical, Incisive Foramen.

Corresponding Author: Nidhi Sharma, Professor, Department of Anatomy, TMMC&RC, Moradabad, Uttar Pradesh, India.
E-mail: drnidhivarshney@gmail.com

Received: 24 April 2021 **Revised: 13 June 2021** **Accepted: 25 June 2021** **Published: 30 June 2021**

Introduction

The nasopalatine canal is also called incisive canal or anterior palatine canal is located between the maxillary central incisions. It is a long path present in the midline of the anterior maxilla. It is connecting point between palate and floor of the nasal fossae.[1,2] It continuous as a single incisive foramen palatal to central incisors while in the nasal cavity it continues as the foramina of Stenson and scalpa. It is the path for nasopalatine nerves and blood vessels and the sphenopalatine artery whose terminus is situated in the anterior palate.[3,4]

Incisive nerve block in essential for performing surgical procedure such as extraction, endodontic treatment, implant insertion, flap surgeries etc. Failure to achieve sufficient anaesthesia in this region may lead to failure of procedure.[5] There is variation in relation to shape, length, location and diameter, the number of nasopalatine foramen openings at the nasal fossa.[6] Thus, it is mandatory to have sufficient knowledge about location and variation of nasopalatine canal. Shape of the incisive canal is variable in different populations. Cylindrical, funnel shaped and hour-glass shaped canals were the commonest appearances.[7,8]

Length of NPC varies in different populations. The average length of the NPC is variable and can vary from 10 mm to 20 mm.[9] The width of it can be up to 6 mm at the incisive fosse. Even though it can present as a single canal, mostly it divides in to two giving a "Y" shaped appearance. Morphology of the NPC can vary with age, gender and ethnicity.[10,11] Considering this, we conducted this study with the aim to assess length and shape of nasopalatine canal on human dry skulls.

Subjects and Methods

We conducted this morphometric, observation study after consulting institutional ethical & Review committee. Fifty-four dry human skulls of either gender was recruited for the study.

All skulls were studied by trained professional. Maxillary arch with full dentition were considered fit for analysis. All skulls were further subjected to lateral cephalogram using standardized exposure parameters taken with Planmica machine. The length of the nasopalatine canal was measured

from the definite point (interproximal region) of the central incisors to the distal end of the incisive foramen using a digital Vernier caliper in mm. Incisive foramen diameter was calculated in the sagittal plane by measuring the anteroposterior distance of the oral entrance of the NPC. Shape was categorized into 4 types, Cylindrical, funnel, hourglass and spindle shape. Results of the present study after recording all relevant data were subjected for statistical inferences using chi- square test. The level of significance was significant if p value is below 0.05 and highly significant if it is less than 0.01.

Results

Table 1: Measurement of length of nasopalatine canal

Gender	Mean (mm)	P-value
Male	16.2	Significant,
Female	13.4	

The mean length of nasopalatine canal was 16.2 mm in males and 13.4 mm in females. A significant difference was observed (P< 0.05) [Table 1, Figure 1].

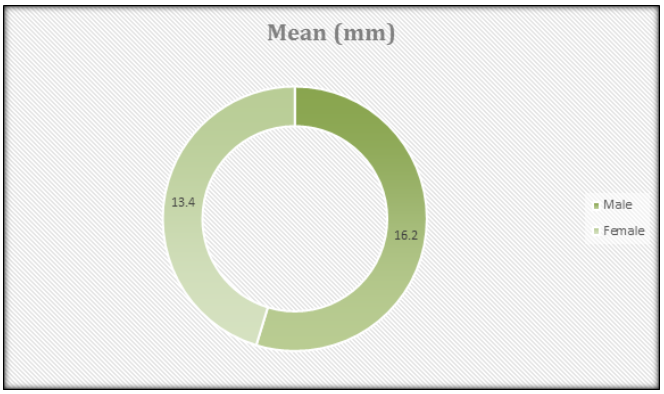

Figure 1: Mean length of nasopalatine canal

Table 2: Measurement of incisive foramen diameter

Gender	Mean (mm)	P-value
Male	5.3	Non- Significant,
Female	4.9	

A non- significant difference in male (5.3 mm) and females (4.9 mm) incisive foramen diameter was observed [Table 2, Figure 2].

The most common shape of nasopalatine canal was cylindrical in 23, funnel in 7, hourglass in 21 and spindle shape in 3 skulls. A significant difference was observed (P< 0.05) [Table 3, Figure 3].

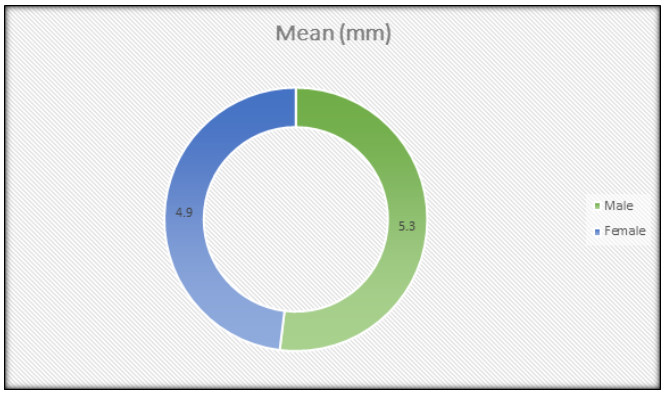

Figure 2: Incisive foramen diameter

Table 3: Assessment of shape of nasopalatine canal

Gender	Number	P-value
Cylindrical	23	Significant,
Funnel	7	
Hourglass	21	
Spindle shape	3	

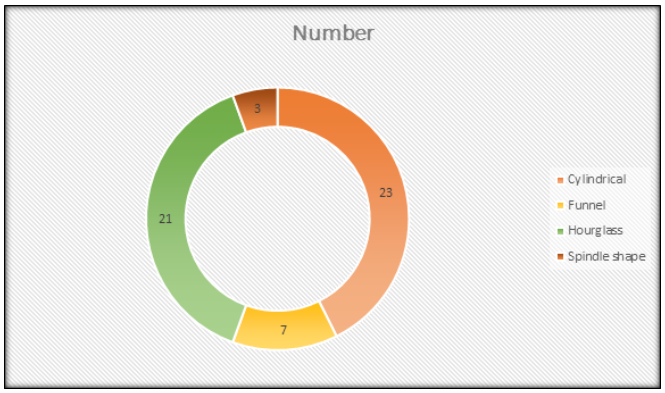

Figure 3: Shape of nasopalatine canal

Discussion

We attempted present study on dry skull (males- 30, females- 24) and assessed various parameters. There is variation in shape and dimension of nasopalatine canal form person to person.[12] Most common shapes are cylindrical, funnel, spindle and hourglass shape. The cylindrical is when the labial and palatal walls of the canal are parallel. The funnel is when the anteroposterior dimension of the canal increased from the nasal fossa to the hard palate.[13] The spindle is when the anteroposterior dimension is widest at the mid-level of the canal compared to the dimensions at the nasal and palatal

levels. The hourglass is when the anteroposterior dimension is narrowest at the mid-level of the canal compared to the dimensions at the nasal and palatal levels.[14]

Our study demonstrated that the mean length of nasopalatine canal was 16.2 mm in males and 13.4 mm in females. Devi et al,[15] measured the variation in position of the incisive foramen in relation to the interproximal region of the central incisors in dry human skull. A total of 61 adult dry human skulls were selected, with full complement of teeth with fully erupted third molars. The study inferred the location of incisive foramen to be about 0.99 cm from the interproximal region of the central incisors.

Our study found that in males, incisive foramen diameter was 5.3 mm and in females was 4.9 mm. Nasseh et al,[16] evaluated the anatomy of the nasopalatine canal in a Lebanese population using cone-beam computed tomography (CBCT) technology. CBCT images of 63 Lebanese adult patients were included in this study. The length, shape, diameter of the oral opening corresponding to the incisive foramen and inclination in relation to the hard palate of the nasopalatine canal were analyzed. Of all canals assessed, 13 were hourglass-shaped, 23 were cylindrical-shaped, 23 were funnel-shaped and 4 were spindle-shaped. The mean canal length and the incisive foramen anteroposterior diameter were respectively 11.52 mm and 4.91 mm. The average canal inclination related to the hard palate was 17.09 degrees.

We found that the most common shape of nasopalatine canal was cylindrical in 23, funnel in 7, hourglass in 21 and spindle shape in 3 skulls. Jayasinghe et al,[17] obtained fifty maxillary CBCT images of anterior maxilla and analyzed the position of the NPC. Morphology, canal dimension of NPC and its relation to the maxilla. Majority had a single opening (48%) or 2 openings (46%). Average diameter of the canal was 3.692 mm with a range of 2–6 mm. Majority of the canals had funnel shape and were vertically curved. Average length of canal was 12.142 mm and angulations of the curvature was 115.694^0. Average antero-posterior diameter at nasal fossa was 2.852 mm, at mid-palate 2.366 mm and at hard palate 3.034 mm. Our findings were different from the findings reported in the literature. This may be due to the differences in ethnicity or limited size of sample.

A study conducted by Tözüm et al,[18] reported that the length of the incisive canal was shortened in edentulous maxilla than dentate maxilla. According to a study conducted by Mardinger et al,[19] the canal diameter increases anteriorly and decreases posteriorly during ridge resorption. Hence, adequate relief must be given during denture making and care should be taken during placement of implant. Etoz et al,[20] had classified NPC shape into six groups: tree branch, cylindrical, banana-like, funnel-like, cone-like, and hourglass. Mardinegar et al[19] considered four categories(hourglass, funnel, banana, and cylindrical).

Conclusion

Nasopalatine canal morphology assessment is essential to prevent iatrogenic injury to the anatomical structures. Most common shape found to be hour glass and cylindrical.

References

1. Fukuda M, Matsunaga S, Odaka K, Oomine Y, Kasahara M, Yamamoto M, et al. Three-dimensional analysis of incisive canals in human dentulous and edentulous maxillary bones. Int J Implant Dent;1:12. Available from: https://dx.doi.org/10.1186/s40729-015-0012-4.
2. Liang X, Jacobs R, Martens W, Hu Y, Adriaensens P, Quirynen M. Macro- and micro-anatomical, histological and computed tomography scan characterization of the nasopalatine canal. J Clin Periodontol. 2009;36(7):598–603. Available from: https://doi.org/10.1111/j.1600-051x.2009.01429.x.
3. Song WC, Jo DI, Lee JY, Kim JN, Hur MS, Hu KS. Microanatomy of the incisive canal using three-dimensional reconstruction of microCT images: an ex vivo study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009;108(4):583–590. Available from: https://doi.org/10.1016/j.tripleo.2009.06.036.
4. Cavalcanti MG, Yang J, Ruprecht A, Vannier MW. Accurate linear measurements in the anterior maxilla using orthoradially reformatted spiral computed tomography. Dentomaxillofac Radiol. 1999;28:137–177. Available from: https://doi.org/10.1038/sj/dmfr/4600426.
5. Sato S, Arai Y, Shinoda K, Ito K. Clinical application of a new cone-beam computerized tomography system to assess multiple two-dimensional images for the preoperative treatment planning of maxillary implants: Case reports. Quintessence Int. 2004;35(7):525–533.
6. Jacob S, Zelano B, Gungor A, Abbott D, Naclerio R, Mcclintock MK. Location and gross morphology of the nasopalatine duct in human adults. Arch Otolaryngol Head Neck Surg. 2000;126(6):741–749. Available from: https://doi.org/10.1001/archotol.126.6.741.
7. Mraiwa N, Jacobs R, Cleynenbreugel JV, Sanderink G, Schutyser F, Suetens P. The nasopalatine canal revisited using 2D and 3D CT imaging. Dentomaxillofac Radiol. 2004;33:396–402. Available from: https://doi.org/10.1259/dmfr/53801969.
8. Bornstein MM, Balsiger R, Sendi P, Arx TV. Morphology of the nasopalatine canal and dental implant surgery: A radiographic analysis of 100 consecutive patients using limited cone-beam computed tomography. Clin Oral Implants Res. 2011;22(3):295–301. Available from: https://doi.org/10.1111/j.1600-0501.2010.02010.x.
9. Thakur AR, Burde K, Guttal K, Naikmasur VG. Anatomy and morphology of the nasopalatine canal using cone-beam computed tomography. Imaging Sci Dent. 2013;43(4):273–281. Available from: https://dx.doi.org/10.5624/isd.2013.43.4.273.

10. Fernández-Alonso A, Suárez-Quintanilla JA, Lorenzo J, Bornstein MM, Blanco-Carrión A, Suárez&#8209, et al. Three-dimensional study of nasopalatine canal morphology: A descriptive retrospective analysis using cone-beam computed tomography. Surg Radiol Anat. 2014;36(9):895–905. Available from: https://doi.org/10.1007/s00276-014-1297-3.
11. Asaumi R, Kawai T, Sato I, Yoshida S, Yosue T. Three-dimensional observation of the incisive canal and the surrounding bone using cone-beam computed tomography. Oral Radiol. 2010;26(1):20–28. Available from: https://doi.org/10.1007/s11282-010-0039-4.
12. Khojastepour L, Haghnegahdar A, Keshtkar M. Morphology and Dimensions of Nasopalatine Canal: a Radiographic Analysis Using Cone Beam Computed Tomography. J Dent (Shiraz). 2017;18(4):244–250.
13. Nasseh I, Aoun G, Sokhn S. Assessment of the Nasopalatine Canal: an Anatomical Study. Acta Inform Med . 2017;25(1):34–38.
14. Salemi F, Moghadam FA, Shakibai Z, Farhadian M. Three-dimensional assessment of the nasopalatine canal and the surrounding bone using cone-beam computed tomography. J Periodontal Implant Dent. 2016;8(1):1–7. Available from: http://dx.doi.org/10.15171/jpid.2016.001.
15. Devi VA, Dhanraj M, Jain AR. Variation in location of the nasopalatine foramen in dry human skulls. Drug Invention Today. 2018;10(4):546–548.
16. Nasseh I, Aoun G, Sokhn S. Assessment of the nasopalatine canal: An anatomical study. Acta Informatica Medica. 2017;25(1):34–38. Available from: https://dx.doi.org/10.5455/aim.2017.25.34-38.
17. Jayasinghe RM, Hettiarachchi PV, Fonseka MC, Nanayakkara D, Jayasighe RD. Morphometric analysis of nasopalatine foramen in Sri Lankan population using CBCT. J Oral Biol Craniofac Res . 2020;10(2):238–278. Available from: https://dx.doi.org/10.1016/j.jobcr.2019.11.002.
18. Tözüm TF, Güncü GN, Yıldırım YD, Yılmaz HG, Galindo-moreno P, Velasco-Torres M. Evaluation of maxillary incisive canal characteristics related to dental implant treatment with computerized tomography: A clinical multicenter study. J Periodontol. 2012;83(3):337–380. Available from: https://doi.org/10.1902/jop.2011.110326.
19. Mardinger O, Namani-Sadan N, Chaushu G, Schwartz-Arad D. Morphologic changes of the nasopalatine canal related to dental implantation: A radiologic study in different degrees of absorbed maxillae. J Periodontol. 2008;79:1659–1662. Available from: https://doi.org/10.1902/jop.2008.080043.
20. Etoz M, Sisman Y. Evaluation of the nasopalatine canal and variations with cone-beam computed tomography. Surg Radiol Anat. 2014;36(8):805–817. Available from: https://doi.org/10.1007/s00276-014-1259-9.

How to cite this article: Chaudhary S, Sharma N, Jain SK. Morphological Analysis of Length and Shape Nasopalatine Canal on Human Dry Skulls. Acad. Anat. Int. 2021;7(1):12-15.

DOI: dx.doi.org/10.21276/aanat.2021.7.1.4

Source of Support: Nil, **Conflict of Interest:** None declared.