



## ASSESSMENT OF MORPHOLOGIC VARIATIONS OF NASOPALATINE CANAL AND NASOPALATINE FORAMEN - A CONE BEAM COMPUTED TOMOGRAPHY STUDY

**Dr. Beena Precilla G S**

Post graduate, department of oral medicine and radiology, Yenepoya dental college and hospital, mangalore

**Dr. Prashanth Shenoy**

Professor, Department Of Oral Medicine And Radiology, Yenepoya Dental College And Hospital, Mangalore

**Dr. Laxmikanth Chatra**

Professor & Hod, Department Of Oral Medicine And Radiology, Yenepoya Dental College And Hospital, Mangalore

### ABSTRACT

**Aims and objectives:** To identify the anatomic characteristics of the Nasopalatine canal(NPC) and Nasopalatine foramen(NPF) in terms of its morphology, to determine the occurrence of anatomical variations; and to look for any correlations of these variables with age and gender. **Methodology:** This study comprised of CBCT images of 100 patients between 15-60 years of age obtained from the archives. The images were assessed in the Romexis viewer. The morphology of Nasopalatine canal and foramen were evaluated in terms of length, shape and size in different sections. The obtained data were then subjected to statistical analysis. **Conclusion:** The present study indicated that the NPC and NPF has a great deal of variability with regard to its dimensions as well as to its morphological appearance. There was also variation in few parameters with respect to gender.

**KEY WORDS :** Nasopalatine canal; Nasopalatine foramen; Anterior maxilla, Neurosensory disturbance.

### INTRODUCTION

The Nasopalatine canal is an important anatomic structure present in the midline of the anterior maxilla that connects the palate to the floor of the nasal cavity<sup>1</sup>. The first complete description of the Nasopalatine canal (NPC) was provided by Stenson in 1683. It is also known as the incisive canal or anterior palatine canal. The oral opening of the canal in the oral cavity is called the incisive foramen (IF) and is located in the middle line of the anterior upper jaw under the incisive papilla<sup>2</sup>. The NPC ends in the nasal cavity with two divided openings at each side of the nasal septum and is known as the Stensen's foramina (SF).

Difficulties and anatomic limitations regarding the location of the nasopalatine canal in relation to the maxillary central incisor implants have been reported. Complications of implant rehabilitation include non-osseointegration of the implant due to contact with nervous tissue or sensory dysfunction<sup>3</sup>. Recent studies have also shown that implants in the nasopalatine canal may be a viable treatment approach for the rehabilitation of the severely atrophied maxilla<sup>4</sup>. Therefore, observing the features of nasopalatine canal imaging is useful in achieving the optimal surgical treatment plan in the anterior maxilla by avoiding the canal neural tissues, which may lead to lack of osseointegration or result of sensory dysfunction.

This study aimed to evaluate the anatomical characteristics of Nasopalatine canal and Nasopalatine foramen. in terms of its morphology, to determine the occurrence of anatomical variations; and to look for any correlations of these variables with age and gender.

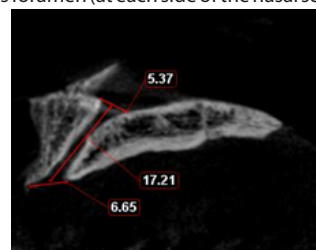
### MATERIALS AND METHODS:

This retrospective study was conducted in the Department of Oral Medicine and Radiology, Yenepoya deemed to be University, Mangalore. 100 subjects (45 females and 55 males) in the age group of 15 to 60 years who had undergone CBCT imaging for various diagnostic and therapeutic purposes were included in the study. Volumes that included anterior part of maxilla and images with

adequate diagnostic quality were selected. Any developmental anomalies, cyst and tumors, maxillofacial trauma, altered bone morphology in the anterior maxilla were excluded.

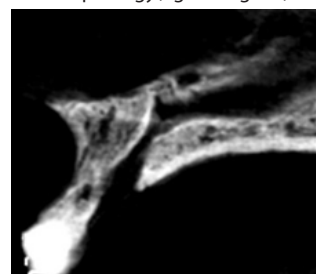
The parameters used in the study is given below

The length of the NPC is measured by a line drawn from the midpoint of the Incisive foramen (oral opening of the canal-located in the middle line under the incisive papilla) towards the Mid-point of the Stenson's foramen (at each side of the nasal septum).



**Figure 1**

2. Shape of the NPC assessed in sagittal section, Classified according to its morphology (eg: Hour glass).



**Figure 2**

3. Size of the nasopalatine foramen diameter (maximum width) of the incisive foramen, Shape includes heart, round, irregular or any other according to morphology.(D- Maximum width)

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\*Corresponding Author Dr. Beena Precilla G S

Post Graduate, Department Of Oral Medicine And Radiology, Yenepoya Dental College And Hospital, Mangalore  
beenashanmugam@gmail.com

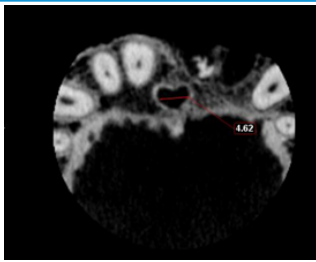


Figure 3

RESULTS

Table 1- length of the Nasopalatine canal

	N	Maximum	Mean	Std. Deviation
AGE	100	60	31.22	12.630
NPC-LENGTH	100	20	12.99	2.510

Table 2 size of the nasopalatine foramen

	N	Minim-um	Maxi-mum	Mean	Std. Deviation
AGE	100	10	60	31.22	12.630
NPF-SIZE	100	1	7	3.22	1.055

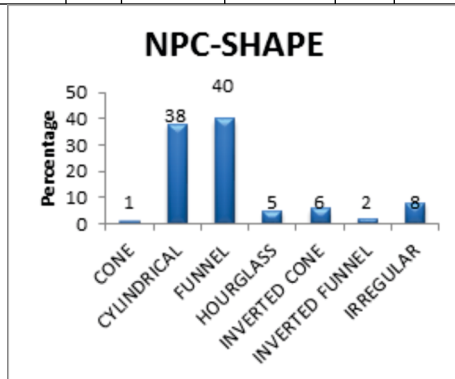


Chart 1

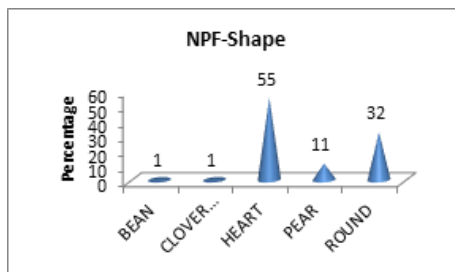
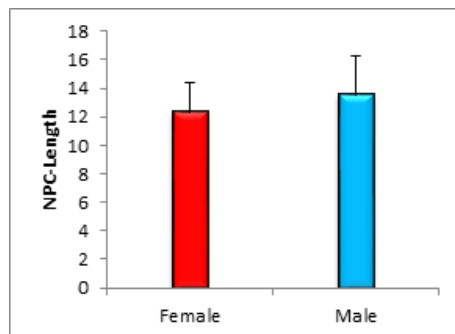


Chart 2



DISCUSSION:

The average length of the nasopalatine canal was found to be 12.9mm. In males, the mean NPC length was found to be 13.5 with a standard deviation of 2.7 and in females, it was found to be 12.3 with a standard deviation of 2.0. (Table.1). Similar results were found in the studies done by Kajan ZD et al<sup>5</sup> and Safi Y et al<sup>6</sup>. But few studies conducted by Rad AB et al<sup>7</sup>, Maraiwa et al<sup>8</sup>, Rose MB et al<sup>9</sup>, Sekerci

AE<sup>10</sup> showed lesser Nasopalatine canal length with a mean value of 7.9mm, 8.1mm, 9.1mm, 10.8mm respectively and in a study by Al-Amery et al<sup>11</sup> higher length of the canal was found with a mean value of 16.3mm.

Among 100 images, only one showed the presence of trifurcation of the nasopalatine canal each channel was separated by bony septa. A wider channel of 1mm was observed in front of the two canals, posterior canals were measuring 0.8 and 0.6mm respectively. Similar appearance was reported by Marianna Guanaes Gomes Torres et al<sup>12</sup> as a rare anatomic variation.

A comparison of obtained mean length of the canal is made between males and females. A significant difference is found in our study with p-value 0.01. Males had a higher length of the canal when compared to females (Chart 3). Similar results were found in the studies conducted by Sekerci AE et al<sup>10</sup>, M Etoz et al<sup>13</sup> and Safi Y et al<sup>6</sup>. The greater length of the NPC in the males can be attributed to the relatively larger craniocaudal dimension of the face observed in the males as compared to the females. In contrast to this, in a study done by Rad et al<sup>7</sup>, the length of the canal was found to be higher in females.

When the obtained length is compared between the age groups there is no significant difference found which is in accordance with the study conducted by Al-Amery et al<sup>11</sup>. and Esmaeili et al<sup>14</sup>. However in the study done by Mishra et al<sup>15</sup> Fernández-Alonso et al<sup>16</sup> it was found that the length of NPC decreases with increasing age. The main reason is ridge atrophy due to tooth loss<sup>17</sup>. This finding suggests that the presence of teeth ensure stability in the size and length of the NPC.

The most common shape of the canal is found to be a funnel with a frequency of 40 which includes 40 percent of the total individuals included in the study (Chart 1). It is then followed by a cylindrical with a frequency of 38. This is in accordance with the study conducted by Mraiwa et al<sup>8</sup>. The funnel-shaped canal is formed by the increasing anteroposterior dimension of the nasopalatine canal from the nasal fossa to the hard palate.

The diameter of the incisive foramen is usually considered to be below 6 mm; when it exceeds 10 mm, pathological conditions should be considered<sup>8</sup>. In this study, the size ranged from 1mm to 7mm and the average size of the nasopalatine foramen was 3.2mm (Table 2). These values were lower than those reported in the previous study by Mraiwa et al<sup>8</sup> (4.6 mm) but comparable to results found in the studies conducted by Rad AB et al<sup>7</sup> and Al-Amery SM et al<sup>11</sup>. Comparison of the size of the incisive foramen is made between males and females. In males, the mean size of NPF is 3.26 and in females, it is found to be 3.16. There is no significant variation found between males and females in the size of NPF. Similar results were obtained in the studies conducted by Thakur AR et al<sup>5</sup>. Mraiwa et al<sup>8</sup>, but are in contrast to that reported by Güncü et al<sup>18</sup> in which men had a greater dimension of the NPF. When the size of NPF is compared between the age groups there is no significant difference found.

Different shapes of the incisive foramen are found which includes heart, round, pear, cloverleaf and bean. The most common shape of the incisive foramen in our study is heart (Chart.2). In contrast to this, a study conducted by Nader Tlili et al<sup>19</sup> and Thakur et al<sup>3</sup> showed oval shaped foramen in about 62% of the total sample size. However, round and heart-shaped foramen were also equally found in different populations.

CONCLUSION:

When any invasive procedures are considered in the maxillary anterior region the proximity of nasopalatine canal and foramen needs to be accounted for. Neurosensory disturbances have been noted in several invasive procedures in the anterior maxilla. The present study indicated that the NPC and NPF has a great deal of anatomic variability with regard to its dimensions as well as to its morphological appearance. The limitation of 2D imaging has been

overcome by the advent of CBCT. With this imaging technique, the exact approximation of this anatomical structure from dental the implant can be determined, thus ensuring the success of treatment and reduced complications.

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