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# Anatomy Meets Prosthetics: Incisive Canal Metrics That Guide Anterior Implant Planning

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***Abstract:***
***Background:***
*The incisive (nasopalatine) canal (IC) exhibits marked morphologic variability that can compromise central incisor implant placement.*
***Objective:***
*To quantify IC morphology using CBCT and evaluate associations with sex, age, and dentition status, translating findings into a risk-stratification scheme for implant planning.*
***Results:***
*30 CBCTs (mean age: 45.6 ± 10.3 years; 50% female. Mean IC length in males 11.42 mm and in females 10.19 mm, canal diameter 3.37 mm in males, females 2.99 mm. cylindrical type observed in 40%. Larger crestal diameters were associated with edentulism (3.75 mm vs. 2.89 mm, p = 0.0001) The average buccal bone thickness was 5.14 mm in males and 4.76 mm in females.*
***Conclusion:***
*IC morphology and buccal bone frequently constrain implant trajectories. Routine CBCT mapping with a simple risk score can guide decisions regarding palatalized placement, narrow/short implants, or staged canal obliteration and ridge augmentation*
**Keywords:** *Incisive canal; nasopalatine canal; CBCT; anterior maxilla; dental implant; risk stratification; esthetics.*

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## I. Introduction

The anterior maxilla is an aesthetically critical region with thin labial cortices and variable bone volume. The incisive canal transmits the nasopalatine neurovascular bundle and may impinge upon the ideal implant trajectory. Encroachment risks haemorrhage, palatal dysesthesia, loss of primary stability, and unfavourable emergence profiles. Prior studies have characterized IC variability, yet few integrate quantitative CBCT metrics with a practical, patient-level risk score directly tied to implant planning. This study quantifies IC dimensions and morphotypes in a local cohort and evaluates predictors of enlarged canals and reduced safety margins to inform a clinical algorithm.

## II. Materials And Methods

Study design

This was a retrospective cross-sectional study conducted using Cone Beam Computed Tomography (CBCT) images to evaluate the anatomical characteristics of the incisive (nasopalatine) canal and its relevance to anterior maxillary implant placement. A total of 30 CBCT scans were collected from the radiology department database of Jaipur Dental College.

Imaging protocol:
- CBCT images were acquired using Tomographic Scanner CS8200C 3D CBCT scanner.

Standard parameters included:
- Field of View (FOV): 8 × 5 cm
- Exposure settings: 120 kV, 15 mA

 The data was reconstructed and analyzed using Care stream 3D Imaging software
• Measurement Parameters The following characteristics of the incisive canal were recorded:

1. Canal Length: From nasal opening to oral (incisive foramen) opening.
2. Canal Diameter:
- At the nasal foramen (superior)
- At the incisive foramen (inferior)
3. Canal Shape/Morphology:
- Categorized as cylindrical, funnel, hourglass, banana, or Y-shaped
4. Canal Position:
- Distance from canal to labial cortical plate
- Distance from canal to alveolar crest
5. Number of Canal Openings:
- Number of nasal and oral foramina (single, double, multiple)
6. Post Implant Changes:
- Distance between the implant and labial cortical plate
- Distance between the implant and alveolar crest
- Distance between the implant and canal
- Encroachment of canal if any

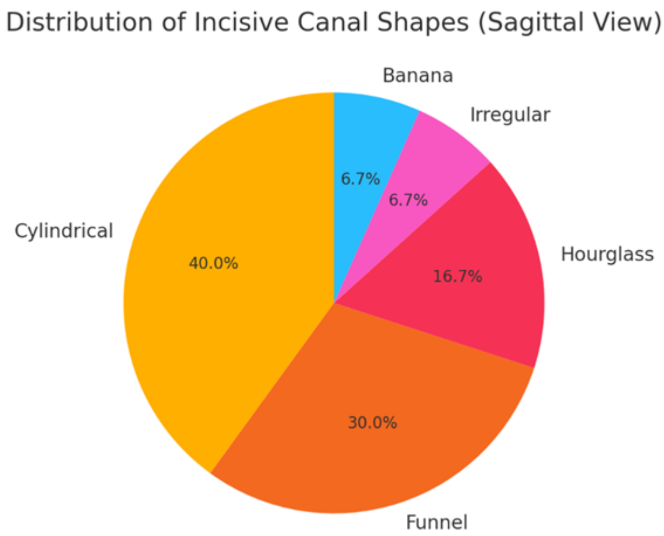
All measurements were taken in axial, sagittal, and coronal sections for accuracy.

**Calibration and reliability**

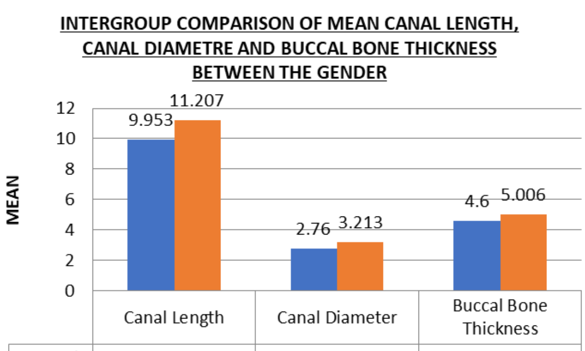
• Descriptive statistics (mean, SD, range) were calculated for each parameter.

• T-tests/ANOVA were used to assess differences by sex, age group, and dentition status (dentate vs. edentulous).

**Statistical analysis:**

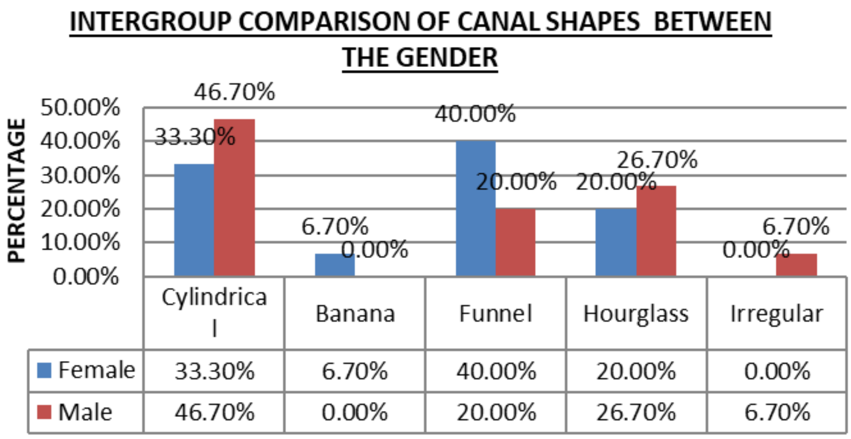


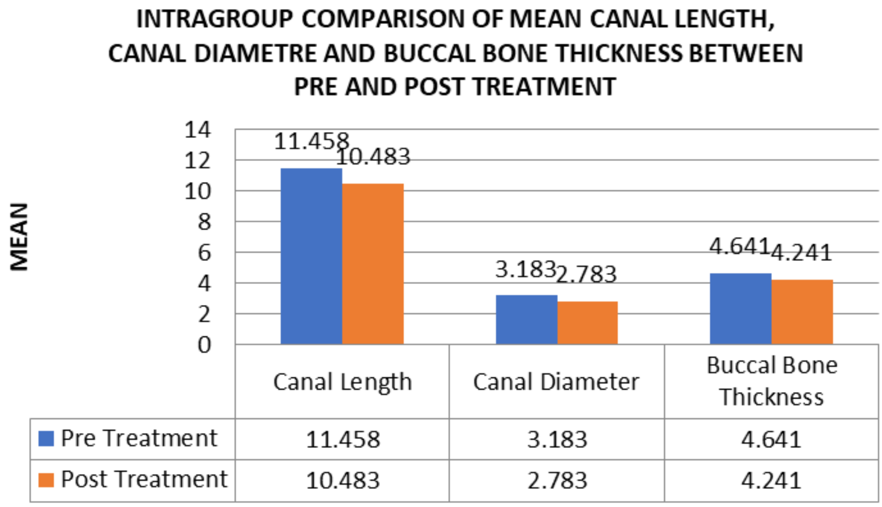

**Graph 1: Distribution of Incisive Canal shapes (Sagittal View)**

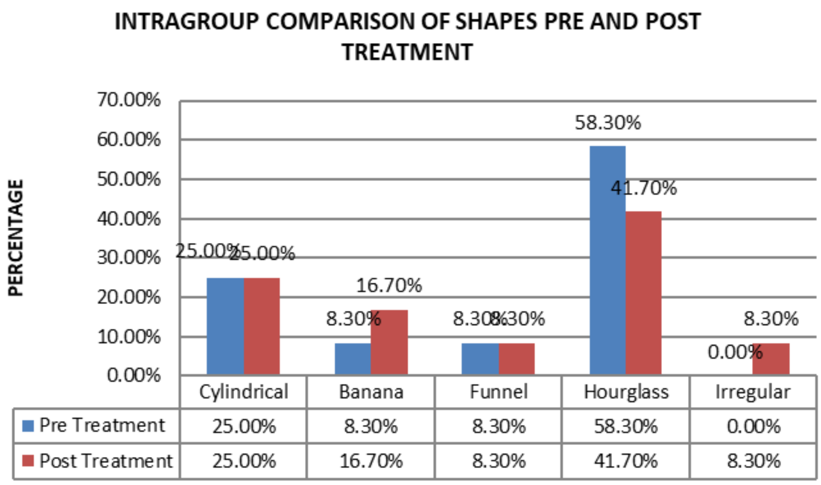


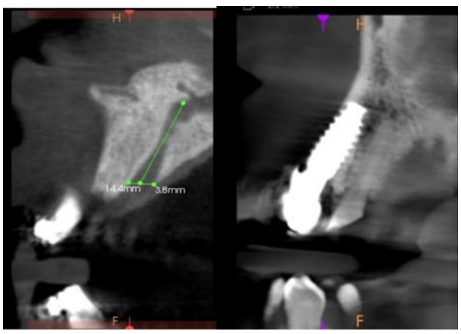

| | Canal Length | Canal Diameter | Buccal Bone Thickness |
|---|---|---|---|
| Female | 9.953 | 2.76 | 4.6 |
| Male | 11.207 | 3.213 | 5.006 |

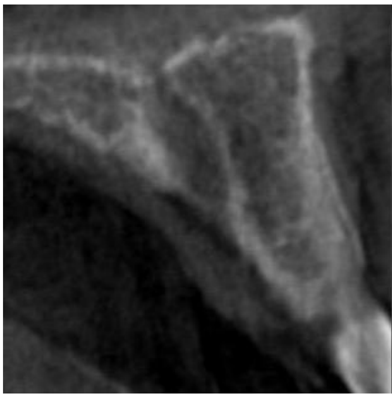
**Graph 2: Intergroup Comparison of Mean Canal Length, Canal Diameter and Buccal Bone Thickness between the Genders**


INTERGROUP COMPARISON OF CANAL SHAPES BETWEEN THE GENDER
PERCENTAGE
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
46.70%
33.30%
6.70%
0.00%
40.00%
20.00%
20.00%
26.70%
6.70%
0.00%
Cylindrical
Banana
Funnel
Hourglass
Irregular
Female 33.30% 6.70% 40.00% 20.00% 0.00%
Male 46.70% 0.00% 20.00% 26.70% 6.70%

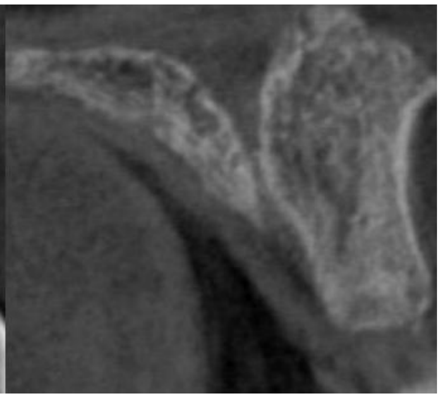

INTRAGROUP COMPARISON OF MEAN CANAL LENGTH, CANAL DIAMETRE AND BUCCAL BONE THICKNESS BETWEEN PRE AND POST TREATMENT
MEAN
14
12
10
8
6
4
2
0
11.458
10.483
3.183
2.783
4.641
4.241
Canal Length
Canal Diameter
Buccal Bone Thickness
Pre Treatment 11.458 3.183 4.641
Post Treatment 10.483 2.783 4.241


INTRAGROUP COMPARISON OF SHAPES PRE AND POST TREATMENT
PERCENTAGE
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
25.00%
25.00%
8.30%
16.70%
8.30%
8.30%
58.30%
41.70%
0.00%
8.30%
Cylindrical
Banana
Funnel
Hourglass
Irregular
Pre Treatment 25.00% 8.30% 8.30% 58.30% 0.00%
Post Treatment 25.00% 16.70% 8.30% 41.70% 8.30%

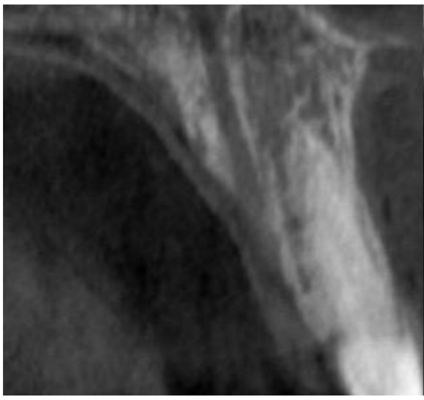




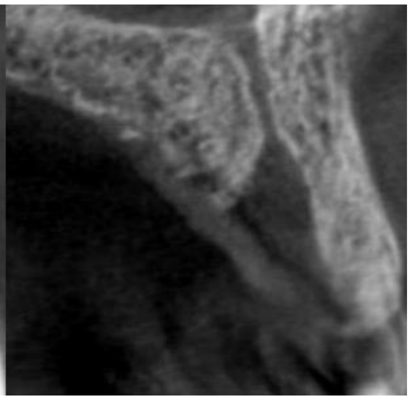
Banana Shaped Incisive Canal



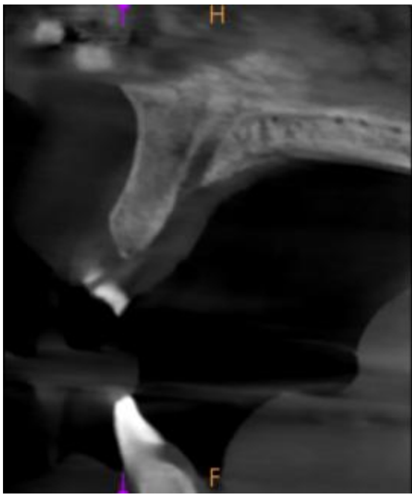
Hour Glass Shaped Incisive Canal



Cylindrical Shaped Incisive Canal



Funnel Shaped Incisive Canal




Pre-OP Canal Morphology


Post-Op Canal Morphology

## III. Discussion:

This cohort demonstrates substantial IC variability with a clinically relevant proportion having crestal diameters and trajectories that constrain ideal implant positioning. Consistent with prior CBCT studies, males and edentulous patients exhibited larger canals and thinner labial plates. The proposed risk score—combining NPF size, LPT, and canal-to-axis clearance—identifies patients who benefit from palatalized trajectories, narrow/short implants, or staged canal obliteration with ridge augmentation.

**Clinical implications:** Incorporating IC metrics into routine digital planning may lower neurosensory events and improve midfacial aesthetics by enabling safer, prosthetically driven trajectories and timely augmentation when indicated.

**Strengths and limitations:** Strengths include standardized measurements, reliability testing, and multivariable modelling with cluster-robust errors. Limitations include retrospective single-centre design, potential selection bias, and lack of longitudinal implant outcomes; prospective validation is warranted.

## IV. Conclusion:

IC morphology and labial plate dimensions vary widely and frequently encroach upon prosthetically ideal implant paths. A simple CBCT-based risk score can guide safe planning and case staging in the anterior maxilla.

## References:

[1]. Mardinger O, Namani-Sztern N, Chaushu G, Schwartz-Arad D. Morphologic Changes Of The Nasopalatine Canal Related To Dental Implantation: A Radiologic Study. J Periodontol. 2008;79(9):1659-62.
[2]. Bornstein MM, Balsiger R, Sendi P, Von Arx T. Morphology Of The Nasopalatine Canal And Dental Implant Surgery: A Radiographic Analysis Using Limited CBCT. Clin Oral Implants Res. 2011;22(3):295-301.
[3]. Song WC, Jo DI, Lee JY, Et Al. Microanatomy Of The Incisive Canal Using 3-D Reconstruction Of Micro-CT Images. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009;107(5): E1-E8.
[4]. Etoz M, Sisman Y. Evaluation Of The Nasopalatine Canal And Variations With CBCT. Surg Radiol Anat. 2014;36(8):805-812.
[5]. Al-Amery SM, Nambiar P, Jamaludin M, John J, Ngeow WC. CBCT Assessment Of The Maxillary Incisive Canal And Foramen: Considerations For Immediate Implants. Plos ONE. 2015;10(2): E0117251.
[6]. Jia X, Hou R, Shi J, Et Al. Relationship Of Central Incisor Implant Placement To The Nasopalatine Canal: A CBCT Study. Plos ONE. 2015;10(11): E0140537.
[7]. Peñarrocha D, Candel E, Guirado JLC, Canullo L, Peñarrocha M. Implants Placed In The Nasopalatine Canal To Rehabilitate Severely Atrophic Maxillae: Retrospective Study With Long Follow-Up. J Oral Implantol. 2014; 40:699-706.
[8]. Verardi S, Pastagia J. Obliteration Of The Nasopalatine Canal In Conjunction With Horizontal Ridge Augmentation. Compend Contin Educ Dent. 2012;33(2):130-4.
[9]. Takeshita K, Kanazawa M, Minakuchi S. Nasopalatine Duct Cyst Developed In Association With Dental Implant Treatment: Case Report. Case Rep Dent. 2013; 2013:201926.
[10]. Khojastepour L, Haghnegahdar A, Keshtkar M. Morphology And Dimensions Of Nasopalatine Canal: A Radiographic Analysis Using CBCT. J Dent (Shiraz). 2017;18(4):244-250.
[11]. Özeren Keşkek C, Gökçe E, Aydin E, Et Al. Retrospective Assessment Of The Anatomy And Dimensions Of The Nasopalatine Canal On CBCT. J Oral Maxillofac Res. 2022;13(2): E4.
[12]. Todorovic VS, Et Al. Micro-XCT Analysis Of Anatomical Features And Dimensions Of The Maxillary Incisive Canal In A South African Population. BMC Oral Health. 2024; 24:5046