Original Article

Cone Beam Computed Tomographic Assessment of Impacted Mandibular Third Molars in Relation to the Inferior Alveolar Canal: An Observational study

Shreya Verma[1], Ashish Aggarwal[2], Nitin Upadhyay[3], GV Sowmya[4], Nupur Gupta[5], Juhi Srivastava[6]

[1,6]Postgraduate Student, [2]Professor & Head, [3-5]Professor
Dept. of Oral Medicine & Radiology, Institute of Dental Science, Bareilly, Uttar Pradesh, India

ABSTRACT

Background: Assessment of the relationship between impacted mandibular third molars and the inferior alveolar canal (IAC) is crucial for preoperative planning. Accurate evaluation helps minimize the risk of inferior alveolar nerve injury during extraction and improves surgical safety. **Materials and Methods:** The study included 210 CBCT scans obtained from male and female subjects for radiographic evaluation. For statistical analysis, one-way analysis of variance, student independent t-test, and Chi-square test were employed. **Results:** Among the 210 subjects evaluated, Type A impaction was the most prevalent pattern in both males (51.4%) and females (48.6%), with no significant association between gender and impaction type ($p = 0.650$). The apical position was the most common location of the IAC (males 47.6%, females 54.3%), while canal morphology was predominantly oval in males (50.5%) and round in females (56.2%), showing no significant gender differences ($p = 0.195$). The majority of impacted mandibular third molars exhibited no direct contact with the IAC (81.9% in males and 79.0% in females), and proximity status was not significantly associated with gender ($p = 0.728$). **Conclusion:** These findings highlight the anatomical variability of the IAC and emphasize the importance of CBCT in preoperative assessment. Accurate CBCT evaluation aids surgical planning for third molar extractions, mandibular surgeries, and local anaesthesia procedures.

Key words: Impacted third molar, Inferior Alveolar canal, CBCT

INTRODUCTION

An impacted tooth is defined as a pathological condition in which the tooth fails to erupt into its normal functional position due to obstruction by overlying bone, soft tissue, or adjacent teeth.[1] They may lead to several pathological conditions, such as dental caries, periodontal bone loss, root resorption, cyst formation, and tumor development.[2] Impacted third molars are the most frequently encountered impacted teeth in clinical dental practice and account for approximately 98% of all tooth impactions.[3] Their prevalence varies among different populations and racial groups, ranging from 16.7% to 68.6%.[4] Among the various anatomical considerations associated with impacted mandibular third molars, their relationship with the inferior alveolar canal(IAC) is of utmost clinical importance, as proximity between the roots and the mandibular canal significantly increases the risk of inferior alveolar nerve (IAN) injury.[5]

Assessment of the positional relationship between the impacted mandibular third molar and the IAC is therefore essential before surgical intervention.[6] The horizontal and vertical proximity of the roots to the mandibular canal is considered a major anatomical risk factor for nerve damage.[4] In cases where the mandibular third molar is in proximity to the mandibular canal, the incidence of IAN injury has been reported to increase significantly, reaching up to 30% in high-risk cases.[7]

Surgical extraction of impacted mandibular third molars is one of the most commonly performed procedures in oral and maxillofacial surgery.[8] Although generally considered routine, the procedure is associated with several postoperative complications, including pain, edema, trismus, infection, and alveolar osteitis.[9] Among these, temporary or permanent injury to the IAN is

Access this article online - www.jdsor.com	
Quick Response code	Submitted Date - 10/05/2026 Revised Date - 15/05/2026 Accepted - 15/05/2026 Published Date - 20/07/2026

Corresponding Author: Dr. Shreya Verma, Postgraduate Student
Department of Oral Medicine & Radiology, Institute of Dental Science, Bareilly, Uttar Pradesh, India
E-mail: shreyaverma2708@gmail.com

regarded as the most serious complication because of its potential impact on sensation and quality of life.[10] The reported incidence of IAN injury during mandibular third molar surgery ranges from 0.4% to 8%.[11]

Panoramic radiography is commonly used as the initial imaging modality to evaluate this relationship and identify radiographic signs suggestive of IAN involvement.[12] However, panoramic imaging provides only a two-dimensional representation and may present overlapping structures, making accurate assessment of the buccolingual relationship difficult.[10]

Cone-beam computed tomography (CBCT) has been employed extensively in clinical work recently because of its three-dimensional capabilities.[10] In addition to providing reconstruction pictures on axial, coronal, and sagittal sections, CBCT displays the three-dimensional architecture of the teeth and surrounding tissues.[13]

Accurate preoperative evaluation of the relationship between the impacted mandibular third molar and the IAC is essential for treatment planning, minimizing surgical complications, and improving patient safety.[14]

With this context, the present study was conducted to radiographically evaluate the anatomical relationship between impacted mandibular third molars and the IAC. Furthermore, the morphology and shape of the IAC, along with its positional relationship to impacted mandibular third molars were evaluated using CBCT.

MATERIALS AND METHODS

In this present study, all CBCT images were collected from Departmental archives and evaluated in the Department of Oral Medicine and Radiology, Institute of Dental Sciences, Bareilly, Uttar Pradesh. CBCT images of sufficient diagnostic quality that covered the adequate tomographic quality with the mandible's complete extension, and Patients of either gender with an age of over 18 years without a history of any pathology, trauma or surgery were included in the study. Developmental deformity affecting the jaws, severe malocclusion, cleft lip-palate, or history of orthognathic surgery were excluded from the study.

All the CBCT images were attained using a Vatech A9 machine (Gyeonggi-do, Seoul, South Korea) in an 8 × 8 cm field of view. The Kodak Dental CS 3D Imaging Software V3.5.7.0 (Carestream Health Inc., St. Rochester, NY, USA) was used. The images obtained from CBCT were created in the Digital Imaging and Communications in Medicine (DICOM) format. The retrieved demographic data of all included cases were recorded on a customised data sheet. Ethical clearance was obtained from the Institutional Ethics Committee of IDS, Bareilly (IEC/435/2026/06). A total of 210 CBCT images were taken in the study, as calculated using G*Power software.

CBCT images were grouped according to the following considerations. (derived from the article Mousa AA et al.,)[1]

A. Determination of impacted third molar position: The position of the impacted third molar was classified based on the height of the occlusal plane of the adjacent second molar into:

- Position A: the highest portion of the tooth is on a level with/above the occlusal line.
- Position B: the highest portion of the tooth is below the occlusal plane, but above the cervical line of the second molar.
- Position C: the highest portion of the tooth is below the cervical line of the second molar tooth in relation to the long axis of the second molar. (Fig. 1)

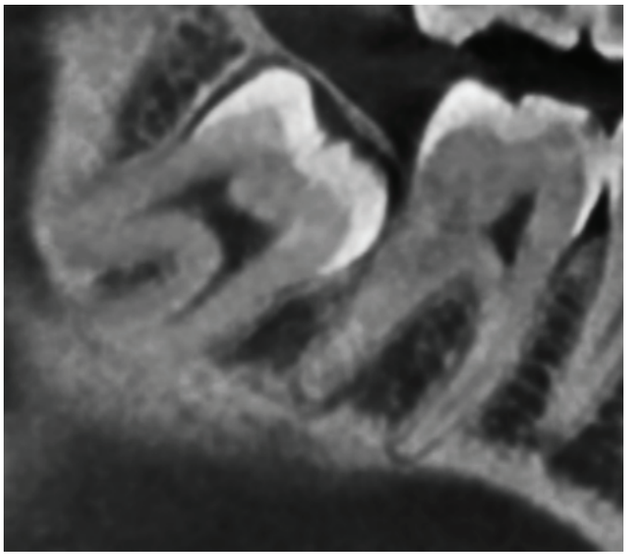


Fig. 1: Impaction Position

B. Determination position of the IAC: The position of the IAC was classified according to buccolingual direction into:

- Buccal position: the IAC is located near the buccal side from the nearest point of the root.
- Inter-radicular position: the IAC is located between the roots.
- Lingual position: the IAC is located near the lingual side from the nearest point of the root.
- Apical position: the IAC is located near the apex from the nearest point of the root. (Fig. 2)

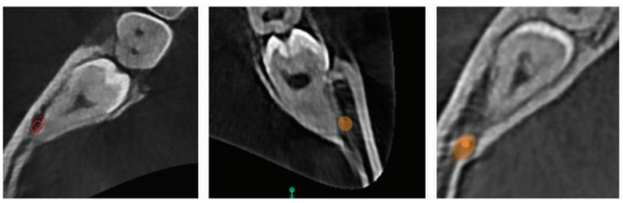


Fig. 2: Position of IAC in relation to third molar

C. Determination of the IAC shape: canal shape was classified into as:

- Round shape: a curved shape without sharp angles, all the ponds had the same round shape.
- Tear drop shape: something that is pointed at the top and round at the bottom like a dropping tear.
- Oval shape: rather like an egg or an ellipse, which may be two or three- dimensional. (Fig. 3)

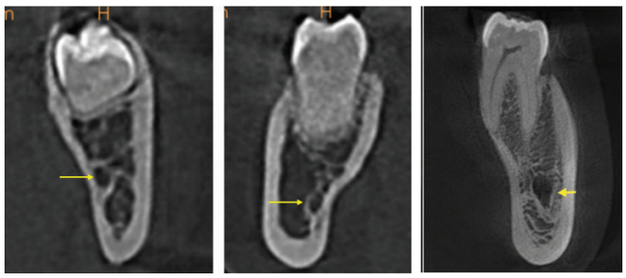


Fig. 3: Inferior Alveolar Canal Shape

D. Determination of proximity and contact of the IAC to the root of impacted mandibular third molar: was rated as a contact or no contact that can be determined on cross section from the nearest apical part of the root.

Statistical Analysis:

The data was entered in Microsoft Excel spreadsheet analysed using Statistical Package for Social Sciences software version 16.0 (Windows version 17.0 SPSS Inc., Chicago, IL, USA). For statistical analysis, student independent t-test were used to study the sample distribution, and Chi-square test were employed to estimate the association and intercomparison with significance amongst the variables.

RESULTS

This study evaluated 210 CBCT scans to assess the anatomical relationship between impacted mandibular third molars and the IAC. Gender-related variations in the position of impacted third molars, IAC position, IAC shape, and proximity of third molars to the IAC were analysed.

Among male participants, Type A impaction was the most frequently observed pattern, accounting for 51.4% of cases, followed by Type B (32.4%) and Type C (16.2%). Similarly, among female participants, Type A impaction was the predominant pattern, representing 48.6% of cases, followed by Type B (38.1%) and Type C (13.3%). The distribution of impaction positions was comparable between males and females. (χ^2 test, p = 0.650). (Table-1)

Table 1: Gender-wise Distribution of Impaction Position.

Impaction Position	Male n (%)	Female n (%)	p-value
Type A	54 (51.4%)	51 (48.6%)	0.650#
Type B	34 (32.4%)	40 (38.1%)	
Type C	17 (16.2%)	14 (13.3%)	

P>0.05 statistically not significant.

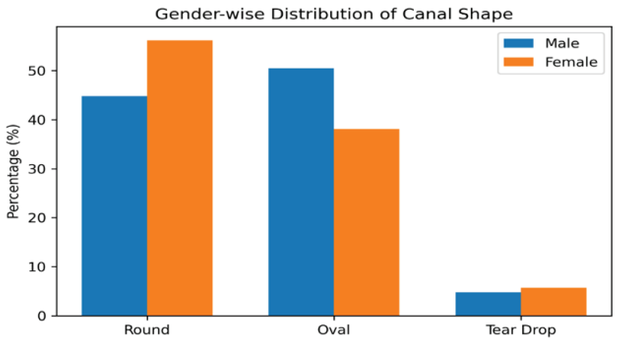
Table 2 illustrates the distribution of IAC positions in relation to impacted mandibular third molars among male and female participants. The apical position was the most common finding in both males (47.6%) and females (54.3%). Buccal positioning of the canal was observed more frequently in males (40.0%) than in females (28.6%), whereas the lingual position was slightly more prevalent among females (17.1%) compared to males (12.4%). Despite these variations, the overall distribution of canal positions was similar between the two genders. (p = 0.195).

Table 2: Gender-wise Distribution of Canal Position.

Canal Position	Male n (%)	Female n (%)	p-value
Buccal	42 (40.0%)	30 (28.6%)	0.195#
Apical	50 (47.6%)	57 (54.3%)	
Lingual	13 (12.4%)	18 (17.1%)	

P>0.05 statistically not significant.

In males, the oval-shaped canal was the most frequently observed morphology, accounting for 50.5% of cases, followed by the round shape (44.8%) and tear-drop shape (4.8%). In contrast, the round-shaped canal was the predominant morphology among females, representing 56.2% of cases, while the oval and tear-drop shapes accounted for 38.1% and 5.7% of cases, respectively. (p = 0.195). (Graph-1)



Graph-1: Gender-wise Distribution of Canal Shape.

Table 3 presents the distribution of proximity between impacted mandibular third molars and the IAC according to gender. The majority of male participants (81.9%) exhibited no contact between the impacted tooth and the canal, while direct contact was observed in 18.1% of cases. Similarly, among female participants, 79.0% showed no contact, whereas 21.0% demonstrated direct contact between the impacted third molar and the IAC. (p = 0.728).

Table 3: Gender-wise Distribution of Proximity.

Proximity	Male n (%)	Female n (%)	p-value
Contact	19 (18.1%)	22 (21.0%)	0.728#
No Contact	86 (81.9%)	83 (79.0%)	

P>0.05 statistically not significant.

DISCUSSION

To confirm the precise location and morphology of the anatomical landmarks, a comprehensive radiographic assessment in the mandible region is necessary before surgical procedures.

Numerous studies on the evaluation of impacted third molars and the IAC using CBCT are available in the literature. Similar study done by Yang Y et al. (2023)[4] evaluated that the mandibular

canal was most commonly located in the apical position (59.86%), followed by the buccal (23.23%) and lingual (19%) positions. These findings are consistent with the present study, where the apical position was also the most prevalent. However, Yang et al. observed proximity between the canal and impacted third molar roots in 88.03% of cases, which is in contrast to the present study that showed no direct contact between the inferior alveolar canal and the roots.

Another study by Jacob JE et al. (2022)[3] assessed 300 CBCT scans and found direct contact between impacted mandibular third molars and the mandibular canal in 61.7% of cases ($P < 0.05$), indicating a strong association and increased risk of IAN injury. In contrast, the majority of cases in the present study showed no contact (79.05% in females and 81.90% in males).

A similar study by Zain-Alabdeen EH et al. (2023)[5] reported that Level A impaction (49.80%) was the most prevalent impaction level. Similar findings were observed in the present study, where Type A impaction was the most common pattern in both females (48.57%) and males (51.43%), followed by Types B and C. The predominance of Type A impactions in both studies indicates that this is the most frequently encountered impaction pattern.

Compared with the study by Wang D et al.,(2018)[13] which reported direct contact between the impacted mandibular third molar and the IAC in 50.58% of cases and identified it as a significant predictor of IAN injury, the present study demonstrated a much lower prevalence of contact (19.05%), with the majority of cases showing no contact between the canal and tooth. In terms of canal morphology, both studies reported round/oval canal shapes as the most frequent, while teardrop canals were relatively uncommon.

CONCLUSION

This CBCT-based study found Type A impaction was the most common impacted mandibular third molar position in both male and female participants. The apical position was the most frequently observed location of the IAC in relation to impacted mandibular third molars. Round and oval canal morphologies constituted the majority of canal shapes, while the tear-drop shape was comparatively uncommon. Most cases demonstrated no direct contact between the impacted mandibular third molar and the IAC. These findings highlight the anatomical variability of the canal and the importance of CBCT in preoperative assessment. Accurate CBCT evaluation can aid surgical planning, improve treatment outcomes, and reduce the risk of nerve-related complications during third molar surgery.

How to cite this article: Verma S, Aggarwal A, Upadhyay N, Sowmya GV, Gupta N, Srivastava J. Cone Beam Computed Tomographic Assessment of Impacted Mandibular Third Molars in Relation to the Inferior Alveolar Canal: An Observational study. J Dent Sci Oral Rehabil. 2026;17(1):16-20.

Conflicts of Interest: None. **Source of Support:** None.

REFERENCES

1. Mousa AA, Ali HE, Ibrahim IH. Assessment of the Relationship Between the Impacted Mandibular Third Molar and Inferior Alveolar Canal Using Cone Beam Computed Tomography. Al-Azhar Assiut Dent. J. 2023;6(2):167-78.
2. Sayeed G, Soman C, Aloufi R, Almatooq AS, Alshahrani NA, Abuhaimed RA. et al., CBCT-based evaluation of mandibular third molar impaction and its effects on adjacent second molars in a Saudi population: a retrospective study of 420 scans. BMC Oral Health. 2026;1(1);1-32
3. Jacob JE, Balan A, Bose TC, Nabeel AK, Girija KL, Ramachandran S. Evaluation of the Spatial Relationship of Impacted Mandibular Third Molar to Mandibular Canal using CBCT: A Descriptive Study. J Indian Acad Oral Med Radiol. 2022;34(4):423-7.
4. Yang Y, Bao DY, Ni C, Li Z. Three-dimensional positional relationship between impacted mandibular third molars and the mandibular canal. BMC Oral Health. 2023;23(1):831-9.
5. Zain-Alabdeen EH. Pattern of mandibular third molar impaction: a cross-sectional CBCT study. Int J Med Dev Ctries. 2023;7(12):1724-30.
6. Segantin JD, Bisson GB, Chihara LL, Ferreira Júnior O. Tomographic analysis of relationship of mandibular morphology and third molars eruption. BMC Oral Health. 2023;23(1):915-23.
7. Joshi J, Dudhia B, Mehta D, Thaker N, Patel H. Comparative analysis of impacted mandibular third molar root proximity to the mandibular canal using orthopantomography and cone-beam computed tomography imaging modalities: A pilot study. J. Adv. Sci. 2025;15(1):113-7.
8. Urechescu H, Banu A, Pricop M, Streian F, Pricop A, Cuzic C. The Positional Relationship Between the Mandibular Canal and the Lower Third Molar Determined on Cone-Beam Computed Tomography. Medicina. 2025;61(7):1-13.
9. Gu L, Zhu C, Chen K, Liu X, Tang Z. Anatomic study of the position of the mandibular canal and corresponding mandibular third molar on cone-beam computed tomography images. Surg Radiol Anat. 2018;40(6):609-14.
10. Pippi R, Santoro M, D'Ambrosio F. Accuracy of cone-beam computed tomography in defining spatial relationships between third molar roots and inferior alveolar nerve. Eur. J. Dent. 2016;10(04):454-8.
11. Priyank H, Viswanath B, Sriwastwa A, Hegde P, Abdul NS, Golgeri MS, et al. Radiographical evaluation of morphological alterations of mandibular third molars: A cone beam computed tomography (CBCT) Study. Cureus. 2023;15(1):1-8.
12. Chen K, Chen Y, Chen P, Jiang J, Wang E, Guo C, et al. Is cone beam computed tomography accurate in predicting inferior alveolar nerve exposure during mandibular third molar extraction? BMC Oral Health. 2025;25(1):1-17.
13. Wang D, Lin T, Wang Y, Sun C, Yang L, Jiang H, et al. Radiographic features of anatomic relationship between impacted third molar and inferior alveolar canal on coronal CBCT images: risk factors for nerve injury after tooth extraction. J Arch Med Sci. 2018; 14(3):532- 40.
14. Liqun Gu, Chao Zhu, Kejia Chen, Xianchu Liu, Tang Z. Anatomic study of the position of the mandibular canal and corresponding mandibular third molar on cone-beam computed tomography images. Surg Radiol Anat. 2018;40(6):609–14.

© The Author(s). 2026 Open Access. This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (https://creativecommons. org/licenses/by-nc/4.0/), which permits unrestricted use, distribution, and non-commercial reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/ zero/1.0/) applies to the data made available in this article, unless otherwise stated.