

The Prevalence and Anatomical Characteristics of Accessory Mental Foramen in Qassim Population, Saudi Arabia – A Cone-Beam Computed Tomography Study

Anas Abdul Khader

ABSTRACT

Objective: To establish the prevalence, anatomy, and demographic correlates of AMF in a Saudi sub-population in the Qassim region using Cone-Beam Computed Tomography (CBCT).

Study Design: Cross-sectional retrospective study

Place and Duration of Study: This study was conducted at the Department of Oral and Maxillofacial Radiology, College of Dentistry, Qassim University, Kingdom of Saudi Arabia from August 2025 to October 2025.

Methods: 415 CBCT scans were used to evaluate the frequency, laterality and location of AMFs in relation to mental foramen. SPSS version 2.0 was used for statistical evaluation of correlations with gender and side of occurrence.

Results: AMF was found in 3.4% of the population under study. The diversity was mainly on the left side (78.6%), located superior to the mental foramen (35.7%). Majority (85.7%) cases had one accessory foramen. There was no statistically significant difference in terms of gender or age as per AMF characteristics.

Conclusion: Even a low prevalence of AMFs has significant implications for dental implants in the mandibular premolar region, emphasizing the essential role of preoperative CBCT to ensure safe and precise implant placement.

Key Words: Accessory mental foramen, CBCT, Mental foramen, Anatomical variation

Citation of article: Khader AA. The Prevalence and Anatomical Characteristics of Accessory Mental Foramen in Qassim Population, Saudi Arabia – A Cone-Beam Computed Tomography Study. *Med Forum* 2026;37(2):4-9. doi:10.60110/medforum.370201.

INTRODUCTION

The mental foramen is an important anatomical structure that appears on the anterolateral side of the mandible and is the conduit of the mental nerve and vessels that serve the lower lip, chin and other soft tissues. Its morphology, location, and its potential anatomical changes directly relate to local anesthesia, implantation, endodontic treatment, and managing trauma.^[1,2] These variations include the accessory mental foramen (AMF), which is an extra opening through which branches of the mental nerve can be found, mostly as a result of patterns of neural branching during early mandibular development.^[3]

Department of Periodontology & Implant Dentistry, College of Dentistry, Qassim University, Kingdom of Saudi Arabia.

Correspondence: Anas Abdul Khader, Assistant Professor, Department of Periodontology & Implant Dentistry, College of Dentistry, Qassim University, Kingdom of Saudi Arabia. Pincode-58883

Contact No: +966591506252

Email: an.muhammed@qu.edu.sa

Received: November, 2025

Reviewed: December, 2025

Accepted: January, 2026

The presence of AMF can increase the risk of anesthesia failure, compromised implant osteotomy, postoperative neurosensory deficits, and unintended neurovascular injury during implant placement in the mandibular premolar region.^[4]

AMFs have a significant degree of variation among populations. The reported prevalence can be as low as 1% and as high as over 10% based on ethnicity, sample features, and the imaging technique.^[5,6] The prevalence estimates are more likely to increase when assessment is performed with CBCT, which is more sensitive in the detection of small accessory foramina.^[7,8] Muinelo-Lorenzo et al. explained a high heterogeneity of AMF dimensions and laterality, highlighting the necessity of region-specific anatomical databases.^[3] Morphometric variations were observed in Brazilian and Turkish populations.^[2,9] Similar variations in ethnic populations in South and West Asia were linked to genetic or developmental factors.^[10,11]

In Saudi Arabia, AMFs literature is still small even though there is now developing evidence that mandibular neurovascular anatomy exhibits population-specific features. A multicenter CBCT study in a Saudi-based cohort indicated that detailed mapping of these structures is necessary.^[12] Bilateral asymmetry and other anatomical diversity should be incorporated in clinical treatment planning.^[13]

The accidental damage of accessory mental branches is likely to cause neurosensory losses that are challenging to undo and create complications in the treatment process. Orofacial injury and post-surgery nerve complications are a non-trivial global burden that can lead to functional impairment, decreased oral health-related quality of life, and increased healthcare utilization. By utilizing CBCT, proper identification of AMFs are needed to reduce avoidable iatrogenic damages.

There exists a significant gap in AMF-specific information in the Qassim region, a central population in Saudi that has very specific demographic features. The prevailing national literature has been, in most cases, multicentric or concerned itself with overall morphology of foramen of the mesencephalon without in-depth studies of accessory foramina. Since AMFs have clinical relevance, and geographical variability in the mandibular anatomy is known, the evidence required to establish safe clinical practice and improve surgical planning is region-specific.

The present research offers a CBCT-based analysis of prevalence, laterality, frequency, morphometry, and the related demographic traits of AMFs within a Qassim subpopulation. The study aims to present clinically utilizable anatomical information, to enhance safer and more accurate dental and maxillofacial practices in the area.

METHODS

This cross-sectional, retrospective study was done at the Department of Oral and Maxillofacial Radiology at Qassim University, over a period of 3 months. Ethical clearance was obtained from the institutional ethics committee, with order number 25-37-19. Strict confidentiality was followed by anonymizing the data before analysis. The CBCTs were retrieved from the radiology archives. The sample size was determined to be 415; calculated by taking the expected prevalence of 8.9%.

Inclusion criteria included the presence of high-quality CBCTs of patients of at least 18 years of age (both genders), that were scanned within the period of 2021 to 2025 and had a clear visualization of the mental foramen area. Patients with history of craniofacial syndromes, congenital anomalies, mandibular fractures, prior mandibular surgeries or bone pathology were excluded. Two independent examiners with experience in the special imaging programs were asked to analyze the CBCT images and evaluate the presence, location, side, and number of AMFs. A third expert validated the findings. Position of the AMF was determined in relation to the mental foramen.

SPSS version 26.0 was used to record and analyze data. The data were summarized using descriptive statistics (frequency, meaning percentage, mean, and standard deviation). Categorical differences (gender and side of

occurrence) were determined by chi-square tests, whereas continuous variables (age or distance to the mental foramen) were compared with the help of t-tests. p-value below 0.05 was assumed to be statistically significant.

RESULTS

The scans included 260 males (62.7%) and 155 females (37.3%). 14 participants (3.4%) showed the presence of AMF (Figure 1), which were mostly unilateral. 78.6% (n=11) occurrence was on the left side. A single accessory foramen was the most frequent presentation (85.7%. n=12), while 14.3% (n=2) had two accessory foramina.

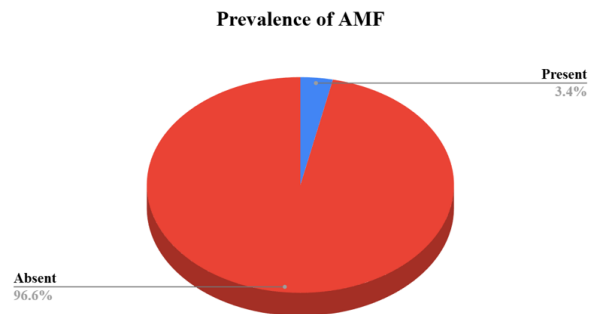


Figure No. 1: Pie Chart representing the prevalence of AMF

The AMF position relative to the primary Mental Foramen (MF) varied (Table 1). The highest prevalence was in the superior aspect of the MF (35.7%).

Table No. 1: Anatomical Location of Accessory Mental Foramina Relative to the Mental Foramen (n=14)

Location Relative to MF	Frequency (n)	Percentage (%)
Superior	5	35.7
Posterior	3	21.4
Anterior	2	14.3
Inferior	2	14.3
Anterior and Inferior	1	7.1
Posterior and Superior	1	7.1
Total	14	100.0

Of the 14 positive cases, 11 were male and 3 were female, with the mean age of the sample being 30.14 years (SD ± 8.23).

Table No. 2: Distribution of Accessory Mental Foramina Characteristics by Gender (n=14)

Characteristic	Category	Female	Male	Total
Side of Occurrence	Left	2	9	11
	Right	1	2	3
Location Relative to MF	Anterior	0	2	2
	Anterior and Inferior	0	1	1
	Inferior	2	0	2
	Posterior	0	3	3
	Posterior and Superior	0	1	1
	Superior	1	4	5

Most of the males presented with AMF on the left-side (n=9). The superior position was most prevalent in

males (n=4), and in females the most prevalent position was inferior to the MF (n=2). (Table 2)

The mean distance between the AMF and the Mental Foramen was 4.82 mm (SD ± 2.21), and had a range of 3.20 mm to 12.00 mm. (Table 3)

Table No. 3: Descriptive Statistics of AMF–MF Distance

Parameter	Mean ± SD (mm)	Median (mm)	Min. (mm)	Max. (mm)	IQR (Q1–Q3) (mm)
AMF–MF Distance	4.82 ± 2.21	4.54	3.20	12.00	3.60 – 5.10

There were no significant gender differences in relation to age (p=0.63) or distance of the AMF to the MF (p=0.489) (Table 4).

Table No. 4: Comparison of Age and AMF–MF Distance Between Male and Female Subjects

Variable	Gender	N	Mean	Std. Deviation	P-Value
Age (years)	Male	11	30.73	9.06	0.630
	Female	3	28.00	4.58	
Distance from MF (mm)	Male	11	5.05	2.43	0.489
	Female	3	4.00	0.96	

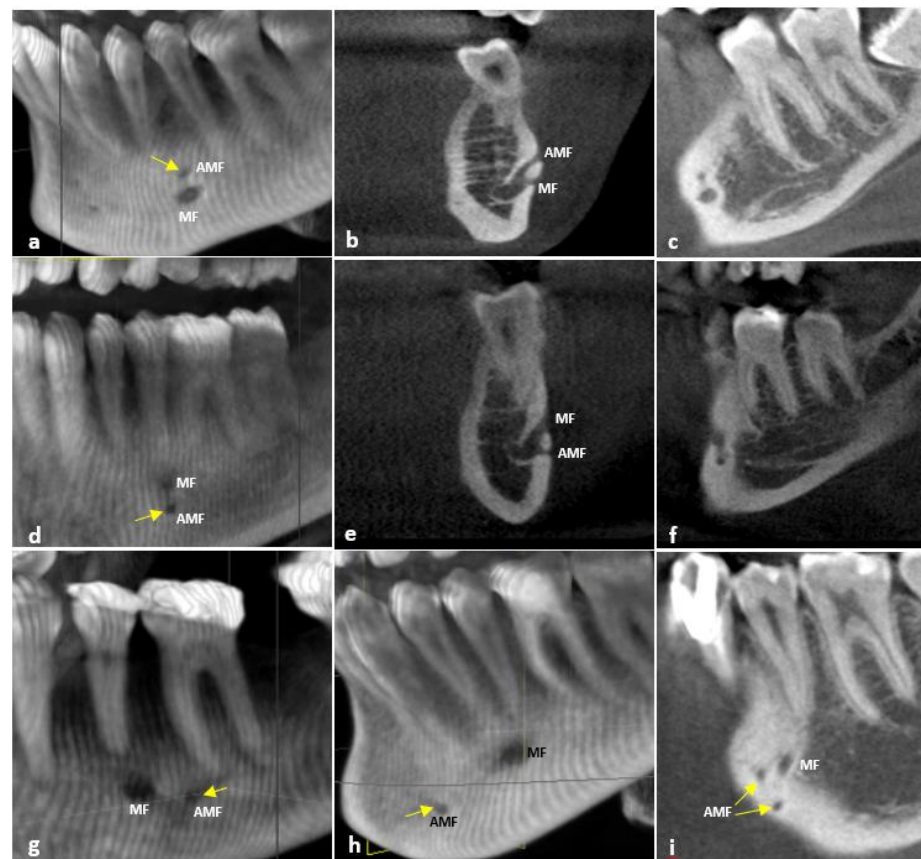


Figure No. 2: Position of AMF (a, b, c – Superior to MF: d, e, f - Inferior to MF: g - Posterior to MF: h – Anterior to MF: i – Multiple AMFs.)

Figure 2 illustrates the various positional relationships of AMFs relative to the primary mental foramen (MF), and multiple accessory openings as visualized on CBCT images.

DISCUSSION

The current study adds to an accumulating literature which shows that mandibular neurovascular heterogeneity is much more intricate and population-based, and suggests that AMFs, despite being historically discussed as rare anatomical anomalies, do have frequent occurrence such that they should be regarded as common clinical entities.^[6] The observations are in agreement with multiethnic studies that suggest that superior imaging modalities significantly enhance the identification of small accessory openings.^[3,7] Studies that use CBCT always indicate relatively high rates of AMF, which supports the methodological assumption that underreporting in the past was not as a result of biological rarity.^[5,14]

Relative studies with global data shows that there is a large dispersion among the populations. Barbosa et al. showed significant diversity of AMF dimensions in Brazilian people, whereas Alma Voljekova et al. showed the clinical significance of AMF morphology in Bosnian groups.^[9,15] AMFs were found in Turkish cohorts with a range of variability in the number, diameter, and neurovascular pathway.^[2] Coban et al. proposed that craniofacial patterns in the past could be a root of regional variation.^[2,16] Results of studies in Iranian, Indian, and Chinese subpopulations also provide generalized morphometric results, which would support the safe practice of oral surgery.^[10,11,17-19]

The patterns of lateralities in the present research are similar to a number of published data. Bruna-Mejias et al. reported that unilateral double mental foramina prevailed, however Sakalem et al. reported bilateral replications in a smaller proportion of specimens pointing to a possible developmental process in which bilateral replications are rarer than bilateral divergences.^[4,20] The bilateral AMF case-report described by Karabiyık and Kiranatlı is another example of how extensive an anatomical variation can be.^[21] The morphometric parameters in the current study; especially the distance between AMFs and the primary mental foramen, is in line with previous studies, which found that most AMFs are positioned closely to the main mental foramen, and that accessory branches are likely to arise due to early bifurcation of the mental nerve.^[22-25]

The demographic variable is still not fully comprehended, as the data shows that there is inconsistent correlation between AMF characteristics, age, and gender. Khalifa and Ahmad et al. found gender-specific variations in general anatomy of mental

foramen, although they seldom touch conclusively on AMFs.^[26,27] CBCT studies by Mostafavi et al and Çimen et al. have shown no significant demographic effects.^[5,6] The lack of effective demographic predictors in the current results may indicate that AMF formation can be more tied to the developmental morphology rather than the sex-based or age-related variance.

Shan et al. and Muinelo-Lorenzo et al. showed through pooled studies that accessory foramina form a nontrivial anatomical category in world populations, which go against the assumption they are rare anomalies.^[3,8] Thomaidi et al, further explored this knowledge by combining the methods of dry mandible analyses and meta-analytic synthesis, finding that AMFs are present in a wide variety of human populations, albeit with significant changes in their level of expression. Such multi-study syntheses reinforce the interpretive case that AMFs should not be treated as exceptions but as morphological variants to which considerable clinical implications can be expected.^[28]

The results of the current study also add to the overall research of the variations of the mandibular canal and the neural pathways. An example is a study by Muley et al in which the mandibular arch is often characterized by complex accessory canals, making the operation in the areas around the premolar area difficult.^[29] In a similar vein, Shan et al. found heterogeneity in the mandibular canal branching, among which AMFs are a peripheral expression.^[8] Placed in this anatomical context, the existing data supports the notion of the mandibular neurovascular system as a complex construct that can vary and be highly patterned and needs to be captured accurately with regard to safe intervention.

These studies highlight that AMFs are not rare to be considered not of clinical significance. Regional difference is a significant predictor of the anatomical structure.^[30] CBCT is the most dependable method of identification of accessory foramina and surgical planning. The results of the current research can help advance this dynamic area by determining baseline AMF features in the Qassim region. AMFs and their morphometry have a direct impact on surgical safety in case of implant placement, apical surgery, premolar extraction, genioplasty, and periapical curettage. Clinicians must incorporate AMF mapping in their regular diagnostic procedures particularly during the procedures undertaken in the premolar area. In terms of research, the results indicate that more regional databases that would reflect the anatomical variation of the Saudi subpopulations are necessary. In the future, multi-center datasets and three-dimensional mapping of nerve trajectories should be included to better establish

functional pathways associated with accessory foramina.

CONCLUSION

The present research contributes to the anatomical literature on AMFs, with strong region-specific evidence of the existence of anatomically significant variation and quantifiable prevalence in a Qassim subpopulation. Placed in the wider context of the international evidence base, the results support the fact that AMFs are a consistent morphological type that has high implications to dental and maxillofacial interventions.

Acknowledgments

The author acknowledges the support of Dr. Abdul Kalam Azad and Dr. Shaul Hameed Kolarkodi for assisting with the evaluation of the CBCTs.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Anas Abdul Khader
Drafting or Revising Critically:	Anas Abdul Khader
Final Approval of version:	The above author
Agreement to accountable for all aspects of work:	The above author

Conflict of Interest: The study has no conflict of interest to declare by any author.

Source of Funding: None

Ethical Approval: No.35-37-19 Dated 13.05.2025

REFERENCES

- Wei Cheong Ngeow, Yee Fan Choon, Krishan Sarna. Mental Foramen: A Comprehensive Review of the Distal Exit of the Mandibular Canal. *Arch Orofac Sci* 2025;20(2): 69–91.
- Çelebi A, Gülsün B. Evaluation of accessory mental foramen and accessory infraorbital foramen with cone-beam computed tomography in Turkish population. *Aust Endod J* 2023;49(1):13-19.
- Muinel-Lorenzo J, Rodríguez-Pato R, Martínez-Reglero C, Salgado-Barreira A, Suárez-Cunqueiro MM. Detection of the Accessory Mental Foramina on Human Mandibles Using Cone-beam Computed Tomography: A Systematic Review and Meta-analysis. *J Endod* 2021;47(8):1215-1228.
- Bruna-Mejias A, Nova-Baeza P, Torres-Riquelme F, Delgado-Retamal MF, Orellana-Donoso M, Suazo-Santibañez A, et al. Morphological Characteristics of the Double Mental Foramen and Its Relevance in Clinical Practice: An Observational Study. *Diagnostics (Basel)* 2024;14(12):1277.
- Çimen T, Saka YY, Kayacan Ünel H, Duruel O. Evaluation of the Mental Foramen and Accessory Mental Foramen with Cone Beam Computed Tomography. *Selcuk Dent J* 2025;12(2):230-3.
- Mostafavi M, Zarch SHH, Eshghpour M, Khodadadzadeh P. Prevalence of accessory mental foramen and lateral lingual foramen using cone beam computed tomography: A single-center cross-sectional study. *Oral Maxillofac Surg* 2024;28(4):1623-1633.
- Pelé A, Berry PA, Evanno C, Jordana F. Evaluation of Mental Foramen with Cone Beam Computed Tomography: A Systematic Review of Literature. *Radiol Res Pract* 2021;2021:8897275.
- Shan S, Zhong S, Li J, Wang T. Systematic review and meta-analysis of mandibular canal variations on cone beam computed tomography. *Oral Radiol* 2022;38(4):445-451.
- Barbosa DAF, Maferano EFE, Teixeira RC, Kurita LM, Pimenta AVM, Silva PGB, et al. Epidemiological and Radiomorphometric Aspects of the Accessory Mental Foramen in Brazilian Individuals: An Analysis by Cone Beam Computed Tomography. *J Clin Exp Dent* 2024;16(11):e1379-e1385.
- Shokri, A., M. M. Maleki, and L. Tapak. Identification and Characterization of the Anterior Loop (AL), Accessory Mental Foramen (AMF), and Lateral Lingual Foramen (LLF) Using Cone-Beam Computed Tomography in an Iranian Population 2024; (Preprint) 1–16.
- Biswas S, Saha J, Majumdar A, Poddar R, Ghosh S, Kar M. Mental Foramen as a Guide to Establish Sexual Dimorphism among Eastern Indian Population: An Observational Cross-sectional Study on Dry Bones. *J Scientific Society* 2024;51(4):592-597.
- Aljarbou F, Riyahi AM, Altamimi A, Alabdulsalam A, Jabhan N, Aldosimani M, et al. Anatomy of the accessory mental foramen in a Saudi subpopulation: A multicenter CBCT study. *Saudi Dent J* 2021;33(8):1012-1017.
- Algabri R, Abulohoom F, Fadag A, Al-Sharani H, Al-Aqab S, Al-Hutbany N, et al. A Comprehensive Analysis of the Radiographic Characteristics and Bilateral Symmetry of the Mental Foramen. *Clin Exp Dent Res* 2025;11(1):e70081.
- Rath R, Sangamesh NC, Bajoria AA, Pani SR. Cone-beam computed tomography study of morphologic and morphometric characteristics of mental foramen in an eastern Indian population. *Forensic Imaging* 2023; 33:200538.
- Alma Voljevica A, Pleho – Kapic A, Catovic A, Talovic E. Practical importance of knowing the morphological characteristics of the accessory mental foramina (AMF) of the human mandibles of

- Bosnia and Herzegovina population. Health MED 2021;15(3-4):31.
16. Coban D, Unal Erzurumlu Z, Sadik E, Yasa Y. Evaluation of mental foramen and accessory mental foramen using cone beam computed tomography in a Turkish population. BMC Med Imaging 2025;25(1):140.
 17. Safi Y, Amid R, Kadkhodazadeh M, Rezaei S, Kazeminia M. Anatomical Variations of the Mandibular Canal and Mental Foramen in Full Edentulous Iranian Subpopulation: A Cone-Beam Computed Tomographic Study. Shiraz E Med J 2022;23(11): e121613.
 18. Sheth K, Banga KS, Pawar AM, Gutmann JL, Kim HC. Shape and anatomical relationship of the mental foramen to the mandibular premolars in an Indian sub-population: a retrospective CBCT analysis. Restor Dent Endod 2021;47(1):e1.
 19. Tiwari N. Left Accessory Mental Foramen in Dry Mandibles in Department of Anatomy in a Medical College: A Descriptive Cross-sectional Study. JNMA J Nepal Med Assoc 2022;60(253):805-807.
 20. Sakalem ME, Sestario CS, Motta AL, Quintilhan D, Myszynski SL, Hiroaki Sato VA. Anatomical variations of the human mandible and prevalence of duplicated mental and mandibular foramina in the collection of the State University of Londrina. Translational Res Anat 2024;37:100357.
 21. Karabiyik Z, Kiranatli M. A Rare Anatomical Finding: Bilateral Accessory Mental Foramen. Case Rep Dent 2021;21:6020515.
 22. Nalbantoğlu AM, Yanık D, Albay S. Location and Anatomic Characteristics of Mental Foramen in Dry Adult Human Mandibles. ADO Klinik Bilimler Dergisi 2024;13(1):51-8.
 23. Priyanka S, Alok K, Avanish K. Study of Position, Shape, Size, Incidence of Mental Foramen and Accessory Mental Foramen and Its Clinical Significance. Eur J Cardiovasc Med 2024;14(3): 1286 – 1290.
 24. Cellina M, Martinenghi C, De Nardi S, Palamenghi A, Cè M, Sforza C, et al. Anatomy of the Mental Foramen: Relationship among Different Metrical Parameters for Accurate Localization. Applied Sciences 2023; 13(16):9235.
 25. Kumar VS, Kumar M, Rani S, Anant G, Madhukar PK, Bharti JP, et al. Mental Foramen Morphometry in Adult Human Mandibles: An Anatomical Analysis. Eur J Cardiovasc. Med 2023;13(4):176.
 26. Khalifa S. Assessment of position, shape and radiographic appearance of the mental foramen in terms of gender: A radiographic study. Egypt Dent J 2022;68(3):2199-2207.
 27. Ahmad M, Shabbir A, Ghazanfar S, et al. Radiographic Assessment of Variability in Position of Mental Foramen in Relation to Gender and Age in Local Population of Punjab. Bio Medica 2024;40(4):170-5.
 28. Thomaidi ZM, Tsatsarelis C, Papadopoulos V. Accessory Mental Foramina in Dry Mandibles: An Observational Study Along with Systematic Review and Meta-Analysis. Dent J (Basel) 2025;13(3):94.
 29. Muley P, Kale L, Choudhary S, Aldhuwayhi S, Thakare A, Mallineni SK. Assessment of Accessory Canals and Foramina in the Mandibular Arch Using Cone-Beam Computed Tomography and a New Classification for Mandibular Accessory Canals. Biomed Res Int 2022;2022: 5542030.
 30. Alhudaithi A, Aljuailan AI, Alzaidan H, Almutairi F, Alrashaid AA, Kolarkodi SH. Patterns of Mental Foramen and Anterior Loop in Patients Attending Qassim University. A CBCT-based cross-sectional study. J Contemporary Dental Sciences 2025;2(1): 34-42.