Original Article

The Frequency of Accessary Mental Foramen Using Cone Beam Computed Tomographic Images

Accessary Mental Foramen Using Cone Beam CT Images

Asma Sattar[1], Muhammad Ishfaq[2], Naheed Imran[1], Bushra mehboob[2], Nadia ashraf[2] and Fatima Abdul Qaiyum[3]

ABSTRACT

Objective: To examine the frequency of AMF using cone beam computed tomography (CBCT) scans.
Study Design: cross-sectional retrospective investigation.
Place and Duration of Study: This study was conducted at the Radiology Department of Khyber College of Dentistry (KCD), Peshawar, Pakistan from 31 January 2024 to April 2024.
Methods: This radio-anatomical research initially evaluated 1000 CBCT radiographs belonging to patients treated over a span of two years. The amount of MF and AMF were recorded. Patients with AMF had their age and sex recorded.
Results: 134 accessory mental foramina belong to males while 25 belong to females aged between 15 and 70 years old, with a mean age of 47.0 years (SD:±17.2). According to the findings of this study, AMF was found in 78 of the 1,000 instances studied. There were 64 cases of unilateral AMF (37 right, 26 left) and 14 bilateral AMF cases (11 with two right and two left, 2 with two right and three left, and 1 with three right and three left). There was only one case when MF was not present.
Conclusion: According to the findings of this study, AMF was found in 78 of the 1,000 instances studied.
Key Words: Cone beam computed tomography; accessory mental foramina; anatomic variation; mental foramen.

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INTRODUCTION

The mental foramen (MF) is an isolated, oval-shaped structure on both sides of the jaw that is located next to the apex of the second premolar(1). The mental foramen is a crucial anatomical characteristic of the buccal region of the jaw(2). It permits the inferior alveolar nerve to mature into the mental nerve, providing sensory innervation to the skin, lower lip mucosal membrane, mandibular anterior teeth gingival tissue, and chin skin(2,3). It has neurovascular bundles, which are mainly composed of tiny arteries and big nerves(3). Published research has revealed certain structural peculiarities of the MF, including the existence of auxiliary mental foramina (AMFs)(4–6). The nerves and veins that cross the mental foramen must take different routes when AMF is present, and special safety measures need to be taken while scheduling dental procedures. The supplementary mental foramen is described in several ways in the literature. AMF has been defined by some authors as any foramina that is not the major MF(7). Conversely, some research indicates that AMFs are simply those foramina that are integrated with the mandibular canal (8). Conversely, a nutrient foramen is a very small foramen that does not originate in the mandibular canal. (9).

The neurovascular structures that the MF transmits change due to the alteration of AMF, leading to alternative routes. According to Toh et al., the AMF supplied a route for extra mental nerve branches to innervate the skin and mucous membrane, reaching from the corner of the mouth to the median labial area(10). The cadaver investigation by showed that the arteries and nerves passing through the AMF varied in composition and that there was a propensity for an artery to be present in an AMF that was fairly large and distant(11). As a result, insufficient knowledge of AMF could explain why local anesthesia levels were insufficient or cause postoperative issues including haemorrhages and neurosensory abnormalities by harming these neurovascular components(12).

In the case of trigeminal neuralgia, Jha et al. also said that the length of neuralgic pain would increase if an auxiliary mental nerve was not excised during the neurectomy of the mental nerve(13). Based on these findings, it was essential to identify the AMF before

1. Department of Oral Biology / Oral & Maxillofacial Surgery[2] / Dental Education[3], Peshawar Dental College, Peshawar, KP, Pakistan.

Correspondence: Dr. Asma Sattar, Department of Oral Biology, Peshawar Dental College, Peshawar, KP, Pakistan.
Contact No: 0318-9555917
Email: dr.asmasattar@gmail.com

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any surgical operations including local anesthetic, endodontic and periodontal care, and surgery (including neurectomy, dental implant placement, orthognathic surgery, etc.) could begin in order to achieve beneficial therapeutic outcomes [14].

AMF can be detected using a variety of techniques, including macroscopic examinations of dry skulls, plane radiographs (including periapical, orthopantomogram OPG) and CT scan or cone beam computed tomographic images[15]. Cone-beam computed tomography (CBCT)'s ability to provide three-dimensional (3D) pictures that enable thorough analysis of the anatomy of the selected region allows it to overcome the drawbacks of conventional radiography [16]. With its comprehensive information on the structures of the maxillofacial complex, CBCT is a priceless instrument that makes it possible to identify and evaluate anatomical differences [17].

To our knowledge till date no studies have been conducted on this topic among the local population. The purpose of this study was to investigate the frequency of AMF using cone beam computed tomography (CBCT) scans.

METHODS

Data Collection Procedure: The Institutional Review Board (IRB) gave its approval for this cross-sectional retrospective study that examined hospital data. The research was done in Peshawar. The radiology department of Khyber College of Dentistry (KCD) provided the CBCT pictures. All patients from KPK, regardless of their socioeconomic status, can access health treatments at Peshawar's Khyber College of Dentistry (KCD), a referral hospital. Each CBCT image was interpreted by the same observer. The CBCT radiographs used in this investigation are currently accessible in the Radiology Department of Khyber College of Dentistry (KCD). CBCT pictures were imported onto the computer using Planmeca Romexis software. A senior radiology technician at KCD took the CBCT radiographs in accordance with strict, standardized scanning procedures and the manufacturer's specifications. A cone beam computed tomography scanner was used to create these radiographs, with an exposure time of 9 seconds and a voxel size of around 400 m, depending on the field of view (FOV). The same examiner assessed each cone beam computed tomography image to avoid inter-observer differences. They were also evaluated under typical viewing circumstances, which included adjusting the brightness and opacity settings to improve radiograph clarity. The investigator was trained to recognize the mandibular foramen and other landmarks in the mandible using a series of cone beam computed tomographic images prior to performing the radiography examination. The calibration training approach includes practical discussion sessions, demonstrations of how to identify mandibular CBCT landmarks, and instructions on how to utilize the CBCT software to determine the separations between mandibular landmarks.

The study included CBCT pictures of males and females in the age range of 15–70 years, but it excluded CBCT radiographs of patients with pathological lesions in the mandibular mental region and those with bone loss at the MF level in old patients.

The radiographs were recreated and analyzed using at least three planes. The literature defines an AMF as any smaller foramen that emerges from a mandibular canal branch and is situated in close proximity to the MF[18]. The presence of the MF and any AMF was assessed for every case. The age and sex of AMF patients were noted.

Statistical analysis: The statistical analysis was conducted using IBM SPSS Version 20.

In order to determine the frequency of one or more AMF, frequency analysis was done.

To search for any possible differences between the gender of the patients and the existence of AMF, the chi-square test was employed.

The level of statistical significance was set at 95%.

RESULTS

AMF was found in 78 (7.8%) of the 1,000 CBCT's studied. There were 64 (6.4%) cases of unilateral AMF (37 right, 26 left) and 14 (1.4%) cases of bilateral AMF (11 cases with two right and two left, 2 cases with two right and three left, and 1 case with three right and three left). There was only one case when MF was not present (Table 1).

The AMF sample included 25 females and 53 males. There was no discernible gender difference. The patients with AMF had an average age of 47.0 years (SD: 17.2 years, range: 15-70 years).

Table No. 1: Distribution of gender of patient with AMF

		Distribution of gender of patient with AMF Total								
		Mental Foramen Absent	**2R**	**2 Lt**	**3R**	**3 LT**	**2R, 2Lt**	**2Rt, 3Lt**	**3R, 3Lt**	
Gender	Male	1	26	13	2	1	7	2	1	53
	female	0	8	12	1	0	4	0	0	25
Total		1	34	25	3	1	11	2	1	78

Figure No. 1: Bilateral Accessory mental foramen seen in a CBCT picture that has been surface rendered.

Figure No. 2: CBCT image of patient with Unilateral Accessary mental Foramen on left side of the mandible.

DISCUSSION

AMF is an uncommon mutation linked to mental foramen. It carries a branch of the inferior alveolar nerve that nourishes the same area with the mental nerve and emerges the mandibular canal from a separate foramen. Certain neurovascular problems during procedures like implant implantation and periapical surgery will occur if they go unnoticed. Therefore, the treatment plan is influenced by knowledge about this anatomic variance(10). Planned surgery in the mental region also requires knowledge of the anatomical variances of the MF. It has been proposed that postoperative complications like paralysis or bleeding after implant insertion or dentoalveolar surgical procedures in this area are caused by a failure to recognize and account for the presence of AMF(3). Labio-mandibular paresthesia after endodontic overfilling and surgery has also been connected to it. It is also crucial to be aware of the possibility of multiple mental foramina because an AMF can present as a periapical radiolucency on conventional plain film radiography, potentially misdiagnosing the condition(19).

In this study, AMF was detected in 78 out of the 1,000 CBCT scans, indicating a frequency of 7.8%. This frequency aligns with previous research findings that have reported varying frequencies of AMF in different populations, ranging from 1% to 14%(20,21).The relatively high frequency of AMF observed in this study underscores the importance of considering this anatomical variation in clinical practice.

According to the findings of present study the unilateral presence of AMF was noted in 6.4% of cases, with a slight predilection for the right side (37 cases) compared to the left side (26 cases).

A study by Lam, et.al.2019 found that the most common anatomical difference among the group of people with AMF was unilateral AMF, occurring 7.8% of the time in the whole population(3). According to other research, the range was 2.2-2.2%(22,23). As was noted in earlier investigations, there was no discernible variation in the frequency of incidence of AMF between sides (24).

In the present study Bilateral AMF was observed in 1.4% of cases, with varying patterns of distribution, including cases with two right AMFs, two left AMFs, and combinations of both. According to a study conducted by Lam, et.al.2019 bilateral AMF was found to be 0.3%(3), while other earlier research demonstrates a range of 0.5% to 7.9% as documented in the literature(25).

It is noteworthy that the absence of the mental foramen (MF) was rare, occurring in only one case. Knowledge of such variations is crucial to avoid complications and ensure the safety and success of procedures in the mandibular region (26).

The gender distribution of AMF did not reveal significant differences, with 53 cases in males and 25 cases in females. This lack of gender predilection for AMF is consistent with previous studies(21,22). It is imperative to recognize, nonetheless, that the study's sample size may have limited the capacity to identify minute gender-related differences in the frequency of AMF. To investigate any possible gender-related variations, greater study with bigger and more varied populations is necessary.

The age distribution of the AMF patients in this study showed an average age of 47.0 years, with a range of 15 to 70 years. It's interesting to note that the age group of 15–25 years old had the highest prevalence of AMF, followed by the age group of 26–40 years old. This finding suggests that AMF may not be associated with a specific age group but can be encountered in individuals across various age ranges. This observation challenges previous assumptions that AMF may be more common in older individuals [22].

Furthermore, dental implant placement in the mandibular region must take into account the presence and location of AMF to avoid damage to neurovascular structures. Careful assessment through CBCT imaging can aid in treatment planning and minimize the risk of complications associated with implant placement in the vicinity of AMF [18].

CONCLUSION

With a frequency of 7.8%, understanding and identifying AMF is crucial for optimal clinical practice in oral and maxillofacial surgery.

According to the study's findings, gender does not influence the frequency of AMF, indicating its occurrence irrespective of gender.

The study's findings also suggest that AMF occurrence isn't specific to any particular age group.

Author's Contribution:

Concept & Design of Study:	Asma Sattar
Drafting:	Muhammad Ishfaq, Naheed Imran
Data Analysis:	Bushra mehboob, Nadia ashraf, Fatima Abdul Qaiyum
Revisiting Critically:	Asma Sattar, Muhammad Ishfaq
Final Approval of version:	Asma Sattar

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