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RESEARCH ARTICLE
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FREQUENCY AND CONFIGURATION OF BIFID MANDIBULAR CANAL USING CONE BEAM COMPUTED TOMOGRAPHY: A CROSS-SECTIONAL STUDY AT KHYBER COLLEGE OF DENTISTRY, PESHAWAR

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Abstract

The bifid mandibular canal is a common variation in the lower jaw. It has important effects during oral surgery. Cone Beam Computed Tomography (CBCT) helps to see these canals clearly. It also helps in finding and classifying them correctly. **Objectives:** To find out how often bifid mandibular canals are seen in patients using CBCT at Khyber College of Dentistry, Peshawar. **Materials and Methods:** This cross-sectional study was done in the Oral and Maxillofacial Surgery Department. It took place at Khyber College of Dentistry from April to September 2023. A total of 141 CBCT scans were studied (81 male, 60 female). The scans were analyzed using Planmeca Romexis ProMax 3D Mid software [3]. Naitoh's system was used to classify the canals. Data were analyzed using SPSS 22.0 by age, gender, and side. **Results:** Out of 141 patients, 33 (23.41%) had bifid canals. On the right side, 9.93% showed this feature. On the left side, 9.22% showed it. On both sides, 4.26% had it. The retromolar canal was the most common type (36%). Next came the forward canal (24%), buccolingual canal (21%), and dental canal (18%). **Conclusion:** The study showed a 23.41% rate of bifid canals. The retromolar canal was most frequent. No clear link was found between gender or age. CBCT is advised to detect these variations early. This helps avoid problems during surgery.

Introduction

Mandibular canals are small tunnels inside the lower jawbone. Each side of the jaw usually has one canal. These canals begin at the mandibular foramen. This foramen is located on the inner side of the ramus. The canal runs downward and forward in the ramus. Then it moves straight forward in the body of the mandible. It ends at the mental foramen, near the premolars. The canal carries a bundle of nerves and blood vessels. These supply the teeth and nearby tissues. On X-rays, the canal looks like a dark line. It has thin white lines above and below it (10). A bifid mandibular canal is a variation. It means the main canal splits into two branches. Chavez et al. explained that this may happen when three nerve branches fail to fuse during early development. This process occurs around the seventh week of pregnancy (1). Knowing about these variations is important in dental surgeries. These include placing implants, removing wisdom teeth, cutting bone with drills, Orthognathic surgeries, taking ramal bone grafts, or fixation of mandibular angle fractures. In some cases, extra nerves may be in a different position. Bifid canals can also reduce the effect of local anesthesia. If the variation is missed, it can cause nerve injury. This can lead to problems like numbness, pain, bleeding, or neuroma. Researchers have used many methods to study these canals. Older studies using panoramic X-rays showed a low rate of bifid canals—around 0.3% to 1.89%. But newer studies using CBCT report much higher rates—from 10.2% to 66.5%. Panoramic X-rays are not very reliable for detecting these canals. Ghost images and overlapping soft tissues can hide the bifid canals (9). So, many of them go unnoticed. CBCT is better for this purpose. It gives clear 3D images. It also avoids overlapping issues found in panoramic X-rays. CBCT helps identify the exact shape, location, and number of these canals. This makes it very helpful in planning surgeries, especially for implants, extractions, jaw operations, and trauma care. This study aims to find out how often bifid mandibular canals occur. It also looks at their types and patterns. CBCT will be used to study a group of patients. The goal is to provide accurate data about this variation in our population. Improving preoperative planning accuracy, increasing clinical awareness, and lowering the frequency of complications linked with unknown anatomical differences during mandibular operations depend on this study. This study aims to deepen our knowledge of mandibular canal anatomy and provide evidence-based recommendations for best patient care by means of thorough CBCT [8]. needing surgical procedures on the mandible. The results will provide a basis for future studies and therapeutic approaches meant to maximize patient outcomes and safety in oral and maxillofacial surgery.

Materials and Methods

Cross-sectional research carried out at the Department of Oral and Maxillofacial Surgery, Khyber College of Dentistry (KCD), Peshawar, Pakistan. The period Six months, from 1st April 2023 to 30th September 2023, constituted ethical approval from the Institutional Ethical Committee. Technical approval was also granted by the research board before data collection. Informed consent was not required because anonymized CBCT records were used retrospectively. The study population included patients who had CBCT scans at the Oral and Maxillofacial Surgery Department, KCD. A total of 141 scans were reviewed: 81 males and 60 females. Sampling was done through non-probability consecutive sampling. Only patients aged 18 years or older were included. Scans had to be of good quality, showing both mandibles. Excluded scans were those of poor quality, incomplete, or belonging to patients with mandibular trauma, pathology, or prior surgery. CBCT images were acquired using Planmeca Romexis ProMax 3D Mid (Planmeca, Helsinki, Finland). All scans were analyzed with Romexis software. The presence and type of bifid mandibular canal (BMC) were identified. Naitoh's classification was used, which includes four types: forward canal, buccolingual canal, dental canal, and retromolar canal. Each image was assessed for side (right, left, or both), canal type, and distribution across age groups and genders. The variables were demographic and research-related. Demographic variables were age (years) and gender. Research variables were side of canal (nominal), canal type (nominal), age group (ordinal), and presence or absence of BMC (nominal). Data analysis was performed in IBM SPSS version 22.0. Categorical variables were presented as frequency and percentage. Descriptive analysis was done to determine prevalence and distribution of

BMC by gender, side, and type. The 95% confidence interval (CI) was calculated for the observed proportion.

Results

A total of 141 CBCT scans were evaluated in the study, including 81 males and 60 females. No participant was lost to follow-up, dropped out, or excluded after selection, and there were no missing data. Bifid mandibular canals (BMC) were found in 33 patients, giving a frequency of 23.41%.

Table 1: Frequency and Percentage of Bifid Mandibular Canal (BMC) Presence

BMC Presence	Frequency	Percentage
Present	33	23.41%
Absent	108	76.59%
Total	141	100%

Mandibular canal variations were observed in 9.93% of patients on the right side, 9.22% on the left side, and 4.26% bilaterally.

Table 2: Laterality of Bifid Mandibular Canals (n = 33)

Side	Frequency	Percentage
Right	14	9.93%
Left	13	9.22%
Bilateral	6	4.26%
Total	33	23.41%

The retromolar canal was the most common type, accounting for 36% of the identified variations, followed by the forward canal at 24%, the bucco-lingual canal at 21%, and the dental canal at 18%.

Table 3: Types of Bifid Mandibular Canal (n = 33)

Type of BMC	Frequency	Percentage
Retromolar	12	36.36%
Forward Canal	8	24.24%
Buccolingual	7	21.21%
Dental Canal	6	18.18%
Total	33	100%

These findings were further analyzed according to age and gender, but no significant differences were found in the incidence of BMC with respect to these demographic variables.

Table 4: Gender-wise Distribution of Bifid Mandibular Canal

Gender	Frequency of BMC	Total Cases	Percentage
Male	20	81	24.69%
Female	13	60	21.67%
Total	33	141	23.41%

Discussion

The accurate identification of bifid mandibular canals is crucial during mandibular surgical procedures, as it can significantly impact surgical outcomes and patient safety; however, despite prevalence rates being reported to vary widely from 0.08% to 64.8%, there remains considerable disagreement within the scientific literature regarding the true prevalence. The aim of this study was to find how often bifid mandibular canals (BMCs) appear and what types are most common in a group of Pakistani patients using CBCT. Usually, the mandibular canal is seen as a single structure. But Patterson and Funke reported the first case of a bifid canal in 1973 (2). Many tools have been used to study BMCs. These include panoramic X-rays, CT scans, and CBCT. Studies show that the rate, shape, size, and angle of BMCs vary among different populations (11). On panoramic X-rays, the rate of BMCs ranges from 0.08% to 0.95%. But this may be too low. That's because soft and hard tissues can cause ghost images and overlaps, which make it hard to see BMCs clearly (12). Also, the mylohyoid muscle insertion may show a false image that looks like a bifid canal. Naitoh et al. (3) found that panoramic X-rays only showed 2 out of 5 BMCs. But CT scans showed all 5. Klinge et al. (4) noted that X-rays missed the mandibular canal in 36.1% of cases. In another study, Bogdan et al. (5) found that only 0.2% of BMCs were visible on panoramic X-rays, while 19.6% were seen in real mandibles. Tantanapornkul et al. (6) compared panoramic X-rays with CBCT. CBCT had better results in detecting the mandibular canal. So, they said CBCT is more accurate. Neves et al. (7) also found that CBCT showed more BMCs than panoramic images (13). CBCT provides 3D images without overlaps or ghost effects (15). This makes it ideal for studying mandibular canals. Studies using CBCT have reported BMC rates between 10.2% and 65%. Many researchers have also suggested different ways to classify BMCs based on panoramic and CBCT images. CBCT was employed in this investigation to analyze BMCs. We discovered a 23.41% frequency. Males had more cases than women. The retromolar canal was The most often occurring kind then came, followed by buccolingual and dental varieties (14). These results align with international data and reaffirm the superior diagnostic value of CBCT in assessing mandibular canal abnormalities [15]. This research adds to the expanding body of evidence on the anatomical diversity of Highlights the need of including high-resolution imaging techniques in regular dental practice, especially in surgical preparation, mandibular canals. The results of this study Suggest that preventing surgical problems and raising clinical outcomes in oral and maxillofacial operations depends on thorough analysis of CBCT scans for bifid mandibular canal identification.

Conclusion

This study found that the bifid mandibular canal (BMC) is a common anatomical variation. CBCT scans showed it in 23.41% of cases. The most frequent type was the retromolar canal. Other forms included forward, buccolingual, and dental canals. The results stress the role of CBCT in detecting such variations before surgery. Careful assessment before treatment can lower risks during procedures like implant placement, wisdom tooth removal, and nerve blocks.

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