Original Research Paper
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MB1–MB2 Canal Orifice Distance in Maxillary First and Second Molars: A CBCT Study in a Rajasthan Population.

Abstract:

Aim: To evaluate the distance between the mesiobuccal canal orifices (MB1 and MB2) in maxillary first and second molars in a Rajasthan population using cone beam computed tomography (CBCT).

Materials and Methods: CBCT scans of maxillary first and second molars were evaluated in the axial plane at the level of the pulpal floor. The linear distance between the centers of the MB1 and MB2 canal orifices was measured using dedicated CBCT software. Measurements were statistically analyzed and comparisons were made between first and second molars and between genders.

Results: The mean MB1–MB2 distance was 1.58 ± 0.72 mm in maxillary first molars and 1.97 ± 0.74 mm in maxillary second molars. The difference between first and second molars was statistically significant (p = 0.001). No statistically significant difference was observed between males and females (p = 0.923).

Conclusion: Knowledge of MB1–MB2 inter-orifice distances in maxillary molars may assist clinicians in more predictable location of the MB2 canal and improve endodontic treatment outcomes.

Keywords: Maxillary molars, MB2 canal, CBCT, root canal anatomy

Introduction:

Successful endodontic treatment depends on accurate access cavity preparation, effective cleaning and shaping, and three-dimensional obturation of the root canal system. A thorough understanding of root canal anatomy and its variations is essential, particularly in multi-rooted teeth such as maxillary molars. Missed canals remain a leading cause of endodontic failure, with the second mesiobuccal canal (MB2) being one of the most frequently overlooked canals in maxillary molars.

Several methods have been used to study root canal morphology, including clinical exploration, conventional radiography, staining and clearing techniques, and sectioning. With advances in imaging technology, cone beam computed tomography (CBCT) has emerged as a reliable, non-invasive tool for evaluating root canal anatomy in three dimensions. CBCT enables accurate detection of additional canals and allows precise morphometric measurements.

Failure to locate and treat the MB2 canal can result in persistent infection and compromised long-term

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prognosis of endodontically treated teeth. Understanding the spatial relationship between MB1 and MB2 canal orifices may provide clinicians with valuable guidance during access cavity preparation and canal location. Therefore, this study aimed to evaluate the distance between MB1 and MB2 canal orifices in maxillary first and second molars in a Rajasthan population using CBCT imaging.

Materials and Methods:

This observational study analyzed CBCT scans obtained from private radiology centers. Previously acquired CBCT images taken for diagnostic purposes were screened and selected based on predefined criteria.

Inclusion Criteria:

- CBCT scans of maxillary first and second molars showing the presence of an MB2 canal orifice
- Images with a small field of view (6 × 6 cm)
- High-resolution images with adequate diagnostic quality
- Patients aged between 18 and 70 years

Exclusion Criteria:

- Maxillary molars without evidence of an MB2 canal orifice
- Images with artifacts, poor resolution, or distortion

Based on a 95% confidence interval, 2% margin of error, and an estimated prevalence of 4.5%, the final sample size was calculated to be 1100 teeth.

CBCT images were evaluated in the axial plane at the level of the pulpal floor. The centers of the MB1 and MB2 canal orifices were identified, and a straight-line distance between them was measured using the built-in measurement tools of the CBCT software. Measurements were recorded in millimeters to the nearest tenth.

Data were tabulated and statistically analyzed using SPSS software (version 23.0). Descriptive statistics were calculated, and intergroup comparisons were performed using the independent t-test. The level of statistical significance was set at $p < 0.05$.

Results:

Table 2 presents the comparison of MB1–MB2 distances between maxillary first and second molars. The mean distance was significantly greater in second molars compared to first molars ($p = 0.001$).

No statistically significant difference in MB1–MB2 distance was observed between males and females ($p = 0.923$).

Figure 1 (composite figure) illustrates the gender distribution and intergroup comparison of MB1–MB2 distances.\

Discussion:

The mesiobuccal root of maxillary molars is known for its complex and variable canal anatomy. The presence of an MB2 canal has been widely reported, and failure to identify this canal is a major contributor to endodontic failure. CBCT has proven to be a valuable diagnostic tool for identifying additional canals and evaluating canal morphology with greater accuracy than conventional radiographic techniques.

In the present study, the mean MB1–MB2 distance was 1.58 mm in maxillary first molars and 1.97 mm in second molars. These findings are consistent with previously published CBCT-based studies conducted in different populations, which have reported inter-orifice distances ranging between 2 and 3 mm. Minor variations among studies may be attributed to ethnic differences, sample size, and methodological variations.

The absence of a statistically significant gender difference in MB1–MB2 distance aligns with findings from earlier studies, suggesting that gender does not influence the spatial relationship between mesiobuccal canal orifices.

Clinically, awareness of average MB1–MB2 distances can aid clinicians in directed troughing and conservative dentin removal during access cavity preparation. Combined with magnification and CBCT imaging when indicated, such anatomical knowledge can improve the detection rate of MB2 canals and enhance treatment success.

The limitations of this study include its retrospective design and the use of CBCT scans obtained for diagnostic purposes, which may not fully represent the general population. Additionally, CBCT should not be routinely prescribed solely for canal detection due to radiation exposure considerations.

Conclusion:

Within the limitations of this CBCT-based observational study, it can be concluded that the MB1–MB2 inter-orifice distance is significantly greater in maxillary second molars than in first molars, with no significant gender-related differences. Knowledge of these anatomical relationships may assist clinicians in locating the MB2 canal more predictably and improving endodontic treatment outcomes.

Plagiarism Statement:

The manuscript was screened for plagiarism using standard plagiarism detection software, and the similarity index was within acceptable limits.

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