

Evaluation of the Relationship between the Mesio Buccal-2 Canal Shape, Associated Root Length, and Vertucci's Classification in Permanent Maxillary First Molar Teeth with Cone Beam Topography Data

Shivani Mittal¹, Aishwarya Gandhewar¹, Aditya Patel², Priyanka Paul Madhu^{1*}, Amit Reche¹

¹Department of Public Health Dentistry, Sharad Pawar Dental College and Hospital, Datta Meghe Institute of Higher Education and Education (Deemed to be university), Sawangi (Meghe), Wardha, Maharashtra, India

²Department of Conservative Dentistry and Endodontics, Sharad Pawar Dental College and Hospital, Datta Meghe Institute of Higher Education and Education (Deemed to be university), Sawangi (Meghe), Wardha, Maharashtra, India

ABSTRACT

Background: For effective endodontic therapy, a thorough understanding of root canal morphology and variations is required. The final effectiveness of therapy is influenced by the detection and appropriate clearance of all channels in the root canal system. It is critical to understand and use in order to aid in the diagnosis of MB2 canal identification. Recent investigations have revealed that CBCT imaging has high accuracy values.

Objective: From the data collected of CBCT; Measurement of mesial root length, Detection of presence of MB 2 canal, determining the canal configuration using Vertucci's classification and Evaluation of correlation ship of mentioned parameters; in maxillary first permanent molar.

Methodology: After collecting, Retrospective CBCT data from January 2020 to January 2022, from department of Oral Medicine and Radiology, Sharad Pawar Dental College, Wardha. On a CBCT scan, the MB2 canal will be evaluated. The photographs were evaluated on a 14-inch monitor with a resolution of 1920x1080 pixels using 8 Care stream 9300 software in a calm, poorly lit environment. The MB root will be analyzed in all multi planar reconstruction (MPR) with free use of enhancing techniques as images are reoriented. Any inconsistencies will be noticed and discussed in order to reach an agreement.

Conclusion: This study will help to examine the link between the MB-2 canal architecture, associated root length, and Vertucci's classification in permanent maxillary first molar teeth using CBCT data.

Keywords: CBCT, Maxillary first permanent molar, MB2 canal, Vertucci's classification, Root Canal Configuration (RCC)S

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Corresponding author: Priyanka Paul Madhu

e-mail: Drpriyanka0690@gmail.com

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INTRODUCTION

The root canal's anatomy is complex. The primary goals of root canal therapy are to eliminate the infection and achieve a satisfactory apical and coronal closure with the use of the proper filling [1]. For the aforementioned objectives to be accomplished, the doctor must have a firm understanding of the Root Canal Configuration

(RCC). The challenging root canal system must be meticulously three-dimensionally obturated and chemically and mechanically prepared for nonsurgical endodontic treatment. The efficacy of root canal therapy depends on thoroughly cleaning and disinfecting every root canal in a tooth [2,3].

Finding the source of the ongoing infection is the first step in managing the failing root canal filling. If the infection is found within the root canal system, such as if a canal was overlooked, orthograde retreatment is the recommended course of action [4]. The most common reasons for failure were shown to be insufficient obturation (45%), missing canals (32%), and fractured or dislodged restorations (14%) [5]. If the infection is found within the root canal system, such as if a canal was overlooked, orthograde retreatment is the recommended

course of action.

Root canals are missed and insufficiently cleaned due to a lack of understanding of root canal anatomy. The intricacies of root canal anatomy are to blame for the majority of root canal treatment failures, including missed root canals.

Cone-Beam Computed Tomography (CBCT) is a widely used technique and most effective for examining and visualizing a tooth's ambiguous morphology [6]. For successful root canal therapy, CBCT might give the doctor more knowledge about the various root canal configurations. It provides a great noninvasive model that makes it possible to evaluate dental and maxillofacial structures in three dimensions, making it essential for studying root and canal anatomies [7]. The presence of the MB2 in the mesiobuccally roots of maxillary molars is a common finding during root canal therapy. A high frequency of maxillary molar treatments that are unsuccessful is associated with failure to detect these canals [8]. CBCT is more precise than the dental microscope and can be used in a clinical context to determine the MB2 of maxillary first molars [9].

Clinicians must be aware of the location and likelihood of discovering the mesio-buccal 2 (MB2) canal in the permanent teeth of maxilla. Knowing the length of the Mesio Buccal (MB) root in a permanent first maxillary molar tooth before chemo-mechanical preparation can help the physician predict the sort of root canal configuration they could face. The dimension of the MB root is known to be a crucial anatomical characteristic in determining the kind of RCC [10].

Till date scanty literature has been published which researches the co-relationship of the MB-2 canal configuration, the corresponding root length and its correlation with Vertucci's classification in maxillary first permanent molar tooth in central Indian Population?

Therefore, the goal of the current study is to, using retrospective CBCT data, ascertain the relationship between the MB-2 canal configuration, the corresponding root length, and its correlation with Vertucci's classification in permanent maxillary first molar teeth.

Aim

To examine the relationship between the MB-2 canal architecture associated root length, and Vertucci's classification in permanent maxillary first molar teeth using CBCT data.

Objectives

From the data collected of CBCT, following parameter will be calculated

Detection of presence of MB 2 canal in maxillary first permanent molar.

Determining the canal configuration of maxillary first permanent molar using Vertucci's classification.

Measuring mesial root length of maxillary first

permanent molar.

Evaluation of corelationship of above-mentioned parameters

MATERIAL AND METHODS

Sample collection

After receiving clearance from the Institutional Ethical Committee for the retrospective study. The CBCT scans between January 2020 and January 2022 were retrieved and analyzed in Department of Oral Medicine and Radiology from the institute's computerized data.

Inclusion criteria for the sample of the study comprises of CBCT scans

of people of the ages of 30 and 65 of either of gender from the population, in which the maxillary first permanent molar tooth is clearly visible; whereas Exclusion criteria comprises of a tooth that has had resorption, restoration, or endodontic therapy before.

Total number of 145 scans were retrieved that had permanent first maxillary molar present in it which 48 scans of female patients was present and 97 were male patients. Total number of teeth evaluated was 248, in which 86 molars were of female patients and 162 molars were of male patient.

Image assessment

The MB2 canal will be examined on a CBCT scan. The images were assessed using dental software from Planmeca Romexis on a 22-inch display in a subdued setting. All Multi-Planar Reconstructions (MPR) will analyze the MB root while allowing the user to freely employ boosting techniques as the pictures are rotated. Any discrepancies will be identified and discussed in order to come to a consensus. The two observers got training and calibration before the evaluation process. For observer training and calibration, a sample of CBCT scans from maxillary first molars that displayed all 8 categories of root canal morphology according to Vertucci's Categorization (VC) was used.

RESULT

As predicted, the left and right maxillary first molars were the main focus of the two observers' separate reviews of the 290 CBCT scans. The patients' ages ranged from 30 to 65 years, and 66.9% of them (194 patients) were men and 33.1% of them (96 patients) were women. Among the total number of CBCT scans studied; the mesiobuccal second canal was seen in 46 patients out of 290 patients; that is 15.86% patients (Table 1) of which 10 were female patients and 36 were

Table 1: Prevalence of MB-2 canal

	Total Number Of Evaluated Data	Mb-2 Canal Present	Percentage Of Mb-2 Canal Present
Scans	290	46	15.86%
Teeth	496	70	14.11%

male patients. Since only CBCT scans of patients with maxillary first molars were included in the study, a total of 496 Molars were analyzed. Only 0.5% and 0.3% of the 496 maxillary permanent first molars in the study had 2 or more roots, while the majority of teeth had 3 roots (99.2%). Among the total number of molars studied; the mesiobuccal second canal was seen 35 molars out of 496 molars; that is 14.11% of molars (table 1); of which 14 molars were of female patients and 56 molars of male patients. Among the female patients' total number of CBCT evaluated were 96 scans, in which 172 maxillary first molars were present. MB-2 canal was seen in 10 scans out of 96; that is 10.41% of female patients. And MB-2 canal was seen 14 molars out of 172 molars; that is 8.13% of female patients' molars (table 2). Among the male patients' total number of CBCT evaluated were 194 scans, in which 324 maxillary first molars were present. MB-2 canal was seen in 36 scans out of 194; that is 18.5% of male patients and MB-2 canal was seen 70 molars out of 324 molars that is 17.28% of male patients molars (table 3). The mesiobuccal roots of teeth with second mesiobuccal canals showed two distinct canals leaving the pulp chamber and combining just before the apex to form a single canal configuration (Type II) in 30 molars, or 44.4% of the total number of molars, while two separate and distinct canals extending from the pulp chamber to the apex were seen in 40 molars, or 55.6% of the total number of molar. The mesiobuccal root included no further types. An examination of bilateral symmetry in canal configuration revealed that 58.3% of the mesiobuccal roots of the right and left maxillary first molars were bilaterally symmetrical, whereas 41.7% were asymmetrical. The length of mesiobuccal root in the molars with MB-2 canal is present ranges from 9.4 mm -13.1mm. Thus, the mean value of root length is 10.5mm, the mode value is 10.3mm and the median is 10.6 mm of molars in which MB-2 canal seen. It is appreciated that males have longer root length than that in females. It is also observed that Types IV canal configuration in molars with MB-2 canal is seen in the molars with root length more than 10 mm, on contrary Type II is appreciated in shorter roots. Therefore, the prevalence of MB-2 canal in male is more than that in female patients in the central Indian population. Also, the type IV is more commonly seen. We can also appreciate that it not important that there will be a bilateral symmetry in the configuration seen in molars of right and left side. We can also conclude that Types IV canal configuration is appreciated in male more than in female and thus it is

more commonly longer roots.

DISCUSSION

In order for patients to keep their natural teeth in both function and aesthetics, endodontic therapy involves treating vital and necrotic dental pulps [11]. For predictable endodontic success, the root canal contents must be completely removed [12]. Additionally, dentists should be knowledgeable about the anatomy of teeth, respect it, and be aware of the typical range of variation associated with each tooth type [13]. The identification and adequate closure of all root canal system channels affects the therapy's final effectiveness [14]. Root canal preparation is one of the key stages in root canal therapy and one of the key factors in the process' effectiveness [15]. When treating infected teeth with apical periodontitis, the clinician's ability to effectively eliminate bacteria, their metabolites, and necrotic tissue that can serve as a substrate for bacterial regrowth is crucial to the treatment's effectiveness [16]. Correctly identifying the total number of canals may enable a clinician to provide standard care. Using an extra oral imaging scanner made specifically for head and neck imaging, CBCT scans the maxillofacial bones in three dimensions [17]. Large databases of CBCT images were previously collected for a variety of therapeutic purposes, but they may still offer useful information on the typical root shape of a population [18]. The root canal morphology was validated by examination of the CBCT pictures, and the doctor carried out more efficient cleaning, obturation, and therapy [19]. One or more canals may exist in the MB root of the permanent first maxillary molar. CBCT is helpful in identifying and mapping the mesiobuccal root canal system, which may improve the effectiveness of root canal therapy [20]. Navas Moidu, et al stated that the length of the MB root was a crucial anatomical factor for predicting the kind of RCC. For the purpose of correctly detecting root canal morphology, Vertucci proposed an eight-type categorization.

Additionally, using current CBCT volumes, measurements and consequently quantitative analysis of the dimensions of the roots, root canals, and particularly the thickness of the root walls, may be feasible. CBCT image measurements were accepted as a method for determining the size of anatomical landmarks because it was demonstrated that they were comparable to the

Table 2: Prevalence of MB-2 canal in females.

	Total Number Of Female Patient Evaluated Data	Mb-2 Canal Present	Percentage Of Mb-2 Canal Present In Female
Scans	96	10	10.41%
Teeth	172	14	8.13%

Table 3: Prevalence of MB-2 canal in males.

	Total Number Of Male Patients Evaluated	Mb-2 Canal Present	Percentage Of Mb-2 Canal Present In Male
Scans	194	36	18.55%
Teeth	324	56	17.28%

gold standard (cadaver specimen measurements).

According to a study by Heredia et al, the mesiobuccal root of first molars had a Vertucci type II configuration (2-1) in 56.5% of cases and a Vertucci type IV configuration (2-2) in 23.2%. Most frequently, first molars have two Vertucci type II canals [21]. The Emirati subpopulation has a relatively high prevalence of MB2 (80.1%). According to Martins et al., maxillary first molars had a significantly higher MB2 canal prevalence (69.6%; 64.5%–74.8%). Compared to women, men had higher odds of having an MB2 canal. The prevalence of MB2 appeared to vary depending on the geographic area [22]. Various authors have studied in different population. As we have studied in central Indian population, which showed that MB-2 canal prevalence is about 14.11%. it is also seen that it is more prevalent in male gender than that in female. Also Types IV RCC is seen more prevalent in maxillary first molar.

CONCLUSION

Understanding root canal morphology is crucial for providing patients with standard care. In order to achieve this, it is crucial to detect all canals. Doing so will improve the standards of root canal therapy for maxillary first molars and reduce the likelihood of errors because MB2 canals may go undetected. According to this study, the prevalence of MB-2 canals is 14.11%. Vertucci's classification research will also be used to identify the root canal configuration in the same teeth. Additionally, the clinician will be assisted in identifying root canals by the correlation with Vertucci's classification.

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