EVALUATION OF MESIOBUCCAL ROOT CANAL ANATOMY IN THE FIRST AND SECOND MAXILLARY MOLARS AMONG MALES AND FEMALES USING CBCT

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ABSTRACT

Research Title: Evaluation of Mesiobuccal root canal anatomy in first and second molars among males and females
Introduction: The objective of successful endodontic therapy is thorough mechanical and chemical cleansing of the entire root-canal system and its complete obturation with an inert filling material. Therefore, the ability to locate all the canals in this system is an important factor in determining the eventual success of the case. If a canal is not detected, it cannot be cleansed and filled and is a potential cause of failure of endodontic therapy. It has been known that maxillary molars often have two canals in the mesiobuccal root. Inability to locate, instrument, and obturate the second mesiobuccal canal (MB2) could lead to endodontic failure in these teeth. The challenge for the clinician in successfully treating maxillary molars is locating the MB2 canal.

Aim: The aim of this study was to investigate the prevalence and anatomy of the MB2 that may vary between male and female patients which can be challenging for root canal treatment

Materials and methods: 100 CBCT's of Patient attending Saveetha Dental College were considered in which 50 were males and 50 female. The presence or absence of MB2 canal was determined in the study group.

Results: The present study was mainly aimed at determination of the frequency of MB2 canals and their configuration types according to the classification of Vertucci [19] in the first and second molar teeth of the maxilla. According to this study MB2 canal was seen among 82% males and 58% females in maxillary first molars. Among which 2-1 Type- II configuration (Vertucci'sclassification) was seen in 80% of the males and the remaining 14% had 2-2 Type -IV configuration, 5% had 3-1 type configuration and 1% had 3-2 Type configuration. females with 2-1 configuration were 92% and 2-2 configuration was seen in 6%, 2% showed 3-1Type configuration . In maxillary second molars MB2 canal was seen in 72% of the males and 42% females. Among 72% males , 94% had 2-1 configuration and 6% had 2-2 configuration, whereas among 42% females 98% has 2-1 configuration 2% had 2-2 configuration.

Conclusion: It is evident that most of the molars have fourth canal in the mesial root . So it is important to detect the canals for the success of root canal treatment. These data are of great importance, and endodontists must be aware of it, since not only the fact that the second canal is of small volume, its anatomy can be responsible for the failure of endodontic treatment, and once when it is not obturated, leaves the apical foramen open and the canal exposed at the treatment ending. Therefore, professionals are encouraged to request high-resolution CBCT before performing endodontic treatment in maxillary first molars, given that this examination is able to highlight this channel, and reveal its anatomy in detail.

Keywords: Mesiobuccal , CBCT, Maxillary molars, Root Canal morphology ,Endodontics

INTRODUCTION

Successful root-canal treatment depends on adequate cleaning, shaping and filling of the root canal system. It is mandatory and most essential that the operator should have a through and detailed knowledge of root canal morphology of each tooth which is intended to be treated.[1] Slowey[2] stated that the root canal anatomy of teeth has certain common characteristics and numerous atypical ones, which can indicate the actions necessary for successful endodontics. Root canal anatomy determines the exact location of initial access for the root canal treatment and dictates the first file size to be used and gives a analytical approach to breaking down any problems that may be encountered during therapy. Maxillary first molars are the most frequently endodontically treated teeth in the permanent dentition. The problems arising during endodontic treatment of permanent maxillary molars indicate that more knowledge is required of the anatomy of root canal systems.

Traditionally, most endodontic canal detection procedures have relied on the doctor's tactile dexterity and mental image of the canal system, because the ability to visualise the canal orifices was severely limited. This has changed with the utilisation of enhanced vision systems in endodontics. The use of surgical headlamps and dental loupes has evolved into the use of the surgical operating

microscope (SOM). The SOM provides the clinician with superior lighting and magnification and the ability to treat cases that previously have been deemed untreatable or resulted in a com- promised prognosis [3]

CBCT offers significant advantages over X-rays [4] . While X-rays are limited by only being able to form two-dimensional images, computed tomography allows anatomical structures such as teeth and their neighbouring structures to be observed in three planes. This allows for a very precise analysis of the construction of test items[5] . Of course in every situation, the good of the patient should be considered first and care must be taken for his or her safety. According to the principle of "primum no nocere" and "ALARA" ("As Low As Reasonably Achievable") CBCT should be performed only when it is necessary and when it provides information significantly improving the process of diagnosis or treatment of the patient [6] . The CBCT scans used in the present study had been intended for diagnostic reasons, not only for performing scientific work.
However using Cone Beam Computed Tomography (CBCT) provides an higher edge in locating these common morphological variation in maxillary molars. The advent of computed tomography (CT) has started a revolution of information in health studies and has contributed to planning, diagnosis, treatment, and prognosis analysis of several diseases [7] . Computed tomography (CT) images can be formed from planar slices through objects. These can be physical sections, optical sections or CT reconstructions. The development of X-ray computed transaxial micro- tomography, or micro-CT, has gained increasing significance in the study of hard tissues[7].Cone-beam computed tomography (CBCT) is a recently developed technology[8,9] with potential for applications in different areas of research and clinical dentistry[10,11,12].
In Endodontics, images are routinely used before, during, and after root canal treatment. Conventional radiographic images provide a two- dimensional (2D) rendition of a three-dimensional
(3D) structure, which may result in interpretation errors.
Periapical lesions of endodontic origin may be present but not visible on conventional 2D radiographs[13,14]. These lesions are visible more often on CBCT images, and new methods using CBCT scans to investigate apical periodontitis and root resorption have been developed[15,16], as new imaging tools are now used in several endodontic research areas[17,18]. However, CBCT images are affected by high atomic number materials. Artefacts can cause low image quality and poor image contrast leading to limited interpretation of the 3D volumes. There is a concern with artefacts and the search for beam hardening corrections have been the focus of several studies. Cone-beam computerised tomography (CBCT) dedicated to dento-maxillofacial imaging was introduced in response to the high demand for a technique that could provide three-dimensional data at a lower cost and with lower absorbed doses than the conventional CT used in medical radiology. The use of CBCT in clinical practice offers a number of potential advantages over conventional tomography, including easier image acquisition, higher image accuracy, reduced artefacts, lower effective radiation doses, faster scan times and greater cost-effectiveness. Rather than the fan-shaped beam emitted by conventional CT technology, CBCT units, as the name implies, emit a cone- shaped X-ray beam. Because the beam covers the entire region of interest, images can be acquired in only one pass or less around the patient's head. After the X-ray beam passes through the patient, the remnant beam is captured on a 2-D planar detector – either an amorphous silicon flat panel or an image intensifier/CCD detector– and records a cylindrical or spherical volume of data in a field of view ranging from 4 to 30 cm. Voxels are isotropic and typically range in size between 0.08 and 0.4 mm3 .

Complete understanding and Knowledge of entire configuration and anatomy of the root canal system is an important aspect in planning and performing endodontic treatments.[19] The key motive or purpose of root canal treatments is to ensure a complete mechanical and chemical debridement of the root canal throughout their length and replace it with biocompatible materials.[20] The clinical importance to this could be , if the clinician is unable to properly identify, debride, and fill all canals of a tooth is likely to be the cause of endodontic treatment failure.[21] .[22,23,24] Several studies have shown that tortuous anatomy and common morphological variations , like presence of second mesiobuccal canal (MB2) and its various forms. The high incidence of endodontic treatment failure in Maxillary first molars is probably due to the inability to find and fill the MB2 canal. Finding the location of MB2 is therefore the most important aspect of treatment of these canals.[25] Several factors including the race and age as well as variations in the research methods are responsible for the widespread variations in the frequencies reported for MB2 in maxillary molars.[20] Methods of root canal morphology evaluation include tooth clearing and staining, analog radiography, digital radiography, micro-computed tomography (CT), cone beam CT (CBCT), CT, and modified tooth clearing and staining.[20] Lack of anatomical superimpositions provides higher diagnostic accuracy for CBCT compared to digital and conventional periapical radiographies. In addition, in comparison with the conventional CT, CBCT has higher accuracy, higher resolution, less scan time, and low absorption dose. Multiple demographic studies have used CBCT for evaluation of the root shape and root canals in different teeth[20,21,25] Furthermore, several studies have been carried out on the root canal morphology of the Iranian population using CBCT images.Results of the mentioned researches are fairly inconsistent possibly due to the variations in the racial characteristics of different populations even in the same country. Hence, the present study was aimed at evaluating the MB root canal(s) anatomy in the maxillary first and second molar teeth of a northern Iranian population as well as determining the frequency of MB2 canals' association with the patients' sex and the buccopalatal dimension of the roots.

MATERIAL AND METHODS

100 CBCT's of Patient attending Saveetha Dental College were considered in which 50 were males and 50 female. Presence or absence of MB2 canal was tabulated
The inclusion criteria taken into consideration for the study were;AGE- 18-45 Years ,GENDER- Male and females , Bilateral presence of maxillary molar teeth . The exclusion criteria for the study were AGE- below 18 and above 45 ,Pateints with Missing molars, Presence of periapical pathology.

RESULTS

Prevalence	Male	Female
Maxillary 1st molar	82%	58%
Maxillary 2nd molar	72%	42%

	Male 2-1	Male 2-2	Male 3-1	Male 3-2	Female 2-1	Female 2-2	Female 3-1	Female 3-2
Maxillary 1st molar	80%	14%	5%	1%	92%	6%	2%	-
Maxillary 2nd molar	88%	11%	-	-	98%	2%	-	-

DISCUSSION

The present study was mainly aimed at determination of the frequency of MB2 canals and their configuration types according to the classification of Vertucci [19] in the first and second molar teeth of the maxilla. According to this study MB2 canal was seen among 82% males and 58% females in maxillary first molars. Among which 2-1 Type- (II)configuration (Vertucci's classification) was seen in 80% of the males and the remaining 14% had 2-2 Type (-IV) configuration, 5% had 3-1 type configuration and 1% had 3-2 Type configuration. females with 2-1 configuration were 92% and 2-2 configuration was seen in 6%, 2% showed 3-1Type configuration .
In maxillary second molars MB2 canal was seen in 72% of the males and 42% females . Among 72% males , 94% had 2-1 configuration and 6% had 2-2 configuration, whereas among 42% females 98% has 2-1 configuration 2% had 2-2 configuration.

In the study of Baratto Filho et al.,[19] which was aimed at investigating the internal morphology of the maxillary first molars, 54 teeth were examined using CBCT. It was shown that 37.05% of three-rooted teeth had four canals. In 90.90% of the teeth with four root canals, only one apical foramen was seen which could be considered analogous to the Type I of Weine's classification.

Lin et al.[22] estimated the frequency of MB2 canals to be 56% in the first molar and 7.7% in the second molar teeth of a Taiwanese population using CBCT images. Another study performed by Celikten et al.[24] on the CBCT images of a Turkish population revealed that the frequency of MB2 canals was 50.6% and 22.8% in the maxillary first and second molar teeth, respectively, which is approximately close to the results of our study. They also reported that on the basis of Vertucci classification, Type I in the first molars and Type II in the second molars were the most frequent varieties. The similarity with our study is the the prevalence of MB2 canal is more in Maxillary first molars than maxillary second molars.

Zheng et al.[26] evaluated the root form and root canal anatomy of maxillary first molar teeth using CBCT images in a Chinese population. They reported that the frequency of MB2 canals was 52.24%. The frequency of MB2 canals in this study was highly consistent with the findings of the studies performed on a selected population of Greece (53.4%)[27]and the Asian populations of Thailand (65%) and Japan (58%),[21] but obviously lower than the frequencies reported for a Turkish (93.5%) and a Pakistani (70.6%) population.[28]

Silva et al.[29] reported that the frequency of MB2 canals was 42.63% in the maxillary first molar and 34.32% in the maxillary second molar teeth using CBCT images in a Brazilian population. Furthermore, regarding the root canal types based on the [30] Weine's classification, they claimed that Type I and Type III were the most frequently detected varieties, a finding in complete agreement with the results of our study as well as the study of Neelakantan et al. that investigated the root canal morphology of maxillary first and second molar teeth in an Indian population via CBCT images.

Mohammadzadeh Akhlaghi et al.[18] assessed the thickness of the MB roots in the maxillary first molar teeth and arrived at the conclusion that in the roots with a single canal, the mesial and distal aspects of the root have the least thickness and in the roots containing two root canals, the thinnest parts are the distobuccal and the distopalatal sides. According to the findings of the present study, a significant relationship was found between the presence of MB2 canals in the maxillary first and second molars and the buccopalatal dimension of the MB roots measured at the orifice level. The mean buccopalatal dimension of the MB roots at the onset of the canal orifices tends to be greater in roots having two root canals.

CONCLUSION:

It is evident that most of the molars have fourth canal in the mesial root . So it is important to detect the canals for the success of root canal treatment. These data are of great importance, and endodontists must be aware of it, since not only the fact that the second canal is of small volume, its anatomy can be responsible for the failure of endodontic treatment, and once when it is not obturated, leaves the apical foramen open and the canal exposed at the treatment ending. Therefore, professionals are encouraged to request

high-resolution CBCT before performing endodontic treatment in maxillary first molars, given that this examination is able to highlight this channel, and reveal its anatomy in detail.

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