

Root Canal Morphology of Mesio Buccal Root of Permanent Maxillary First Molar Teeth in Himachal Pradesh (India) Population, Using A - Tooth Clearing Technique

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I. INTRODUCTION

Those who have dissected or inspected many [bodies] have at least learnt to doubt; while others who are ignorant of anatomy and do not take the trouble to attend it are in no doubt at all". (Giovanni Battista Morgagni) .

Since prehistoric times, when people have had issues with their teeth, there have been other people there to help. How we care for our teeth has changed over the past several thousand years, and today we call the professionals who care for our teeth dentists. Evidence of dental decay has been found in teeth from skulls that are 25,000 years old and archaeologists have evidence of the first dental fillings in teeth from people who lived around 8000 BC.¹ Determining the racial affinity of an unknown individual from dentition for identification is indeed a difficult endeavor. However, there are certain dental characteristics which are predominant in certain racial groups and these contribute important indicators in the identification process. Inherited dental characteristics are modified by prenatal and postnatal environmental and nutritional conditions. They can also become less discernible due to admixture of the various races.² Recognition of variations in root canal anatomy is an essential prerequisite for successful endodontic diagnosis and treatment. The complexities of internal anatomy are often masked by the external surfaces, which have a relatively simple and uniform anatomy. Internal complexities of the root canal are genetically determined and have definitive importance in anthropology, thereby necessitating the identification of root canal morphologies of different ethnic populations.³ Dental caries, because of its ubiquitous nature, remains one of the most prevalent afflictions of mankind. This disease can aptly be termed as a scourge of modern civilization. No nation or continent has escaped the ill effects of this deadly malady.⁴ Permanent first molar teeth are frequently affected by caries at an early age and may require root canal treatment for long-term retention. The morphology of both permanent first molars has been studied and it is accepted that the mesial root of maxillary first molars and the distal roots of mandibular first molars often have more than one canal. In general, the second canal of the

distal roots of mandibular first molars is more easily located and treated than the second canal in the mesio buccal root of maxillary first molars which tends to be elusive.⁵ The maxillary permanent first molar tooth has been described as "possibly the most treated least understood posterior tooth". The form and number of root canals in the mesio buccal root is principally determined by the deposition of secondary dentine. Generally an important aid in detection of extra root canals is careful study of radiographs. However when dealing with maxillary first molars an extra mesio buccal canal is rarely seen on the original examination film, due to its small size and close relationship to the main mesio buccal canal.⁶ Various researches concluded that failure to find and treat existing MB2^{6,7} .canals would decrease the long-term prognosis. If the initial treatment was completed by the same operator, it would be very challenging to detect a missed MB2 canal in retreatment without new technology.⁸ False assumptions about the root canal anatomy of teeth may lead to misdiagnosis, improper debridement, step formation and breakage of instrument during root canal treatment. Problems faced during endodontic treatment of permanent molar teeth indicate the need for increased knowledge of the anatomy of root canal systems.⁹

II. AIM

To investigate the root canal morphology of mesio buccal root of maxillary first permanent molar teeth collected from various dental clinics in Himachal Pradesh (India) population.

III. OBJECTIVES

- To study
- (i) The morphology of Mesio buccal root.
 - (ii) To determine the frequency of Mesio buccal 2 canal in the mesio buccal root.
 - (iii) Root canal configuration using Vertucci's classification.
 - (iv) Presence and location of lateral canals and intercanal communications.
 - (v) Presence and location of apical Foramen.

IV. METHOD

Extracted teeth were collected from various government run and private clinics of Himachal Pradesh and then were stored in Chloramine T solution (HEZE Kingvolte chemical co.ltd. China). Hard and soft tissue deposits were removed with the help of ultrasonic scaler and scrubbed under running tap water. Samples were then kept in 5.25% Sodium Hypochlorite (Dentpro, Amrit chemicals Ltd, Mohali, Punjab, India) for 30 minutes for removal of organic debris. The pulp chamber was accessed using round bur (Mani) and Endo Z bur (Dentsply) in a high speed Air rotor hand piece (NSK Japan). Teeth were kept in 5.25% Sodium Hypochlorite (Dentpro, Amrit chemicals Ltd, Mohali, Punjab, India) for 30 min for the dissolution of the pulp remnants. After this the teeth were then washed under running tap water and kept overnight to dry. India ink (Himedia Laboratories Pvt. Ltd., Mumbai, India) was then injected into the root canals using syringe with 27 gauze needle (Sterican, Braun Medical India Pvt. Ltd., Mumbai, India) under negative pressure at the apical end using suction apparatus till the ink crossed the apex. After injecting the ink the teeth were kept to dry overnight. Samples were then kept in freshly prepared 5% Nitric Acid solution (Aries Laboratories, Ahmedabad, India) for 3 days for decalcification, the solution was changed daily, and manually agitated threetimes daily. Demineralisation was assessed with the help of radiovisiography. The decalcified teeth were then rinsed under running tap water for 4 hours and dehydrated in solution of 70%, 80%, 95% ethyl alcohol (Changshu Yanguan Chemicals, China) successively for 24 hours.

V. MATERIALS AND METHOD

Dehydrated samples were then placed in Methyl Salicylate (Vikas Pharma, Mumbai, India) to enhance translucency for 3 days and then observed under

Steriomicroscope for:

- (i) The morphology of mesiobuccal root.
- (ii) To determine the frequency of mesiobuccal 2 canal in the mesiobuccal root.
- (iii) Root canal configuration using Vertucci's classification.
- (iv) Presence and location of lateral canals and intercanal communications.
- (v) Presence and location of apical foramen.

VI. RESULT

1. The morphology of mesiobuccal root

The mesiobuccal root is broad bucco-lingually and slender mesio-distally.

ROOTS PRESENT:

Out of 600 permanent maxillary first molars 593 teeth had 3 roots (98.83%) 1 tooth had 4 roots (.16%)

6 teeth had 2 roots (1%) which had mesiobuccal and distobuccal roots fused but all had 3 separate canals.

VII. NUMBER OF APICAL FORAMEN:

Out of 600 mesiobuccal roots 312 roots have single apex. (52%)

Out of 600 mesiobuccal roots 288 roots have two or more canals (48%)

VIII. DISCUSSION

The clinical impact of missed anatomy can be clearly demonstrated with the large number of re-treatment case reports available in the literature; in the majority of these cases, failure of endodontic therapy is associated with untreated canal space. Localization and treatment of the missed anatomy typically leads to complete clinical and radiographic healing. Finally, untreated canal space may be associated with a remarkable variety of symptoms ranging from a symptomatic teeth to acute responses to hot and cold stimuli and from slight sensitivity to percussion and/or palpation to acute abscesses. The variability of symptoms and diagnostic and therapeutic difficulties make the treatment of missed anatomy a challenge for the general dentist.² Thorough knowledge of tooth anatomy and the incidence of aberrancy in regional population being treated by the dentist can thus be helpful. Tooth clearing technique has been used by various researchers since over 100 years to study the human dental pulp morphology. It is easy to perform, inexpensive and has considerable value in the study of root canal anatomy, for it gives a three dimensional view of the pulp cavity in relation to the exterior of the tooth. Combination of nitric acid and methyl salicylate was used in the present study as was found to be the best (Gupta et al 2014)¹⁴ for three dimensional view of root canal morphology. Regarding three separate root anatomy Cleghorn et al¹¹ analysed data from four anatomical studies and found that the maxillary molar normally has three roots (96.2% of 416 teeth) which is in coincidence with the results of our study that is, 1 tooth (16%) was found with four roots. The fourth root was conical in shape and about half the length of mesiobuccal and distobuccal roots and present between the distobuccal and mesiobuccal root. In the samples six teeth (33%) were found with fused roots (distobuccal and Mesiobuccal roots) and all of them had separate root canals¹. The result of study conducted by Yang et al⁹ found 2% maxillary molars with distobuccal and palatal root fused in Chinese population. No tooth was found with single root, rest 593 teeth had three roots which is in coincidence with our study³³. According to Cleghorn et al³⁵ two roots were found in 16 (3.8%) of the teeth studied, the incidence of one root or four roots is very rare and cannot be evaluated from case reports which support the results of the present study. Prevalence of MB2 in permanent maxillary first molar teeth of Himachal Pradesh population was found to be 65.16% which is supported by the study conducted by Gupta Vishesh et al¹⁹ in 2016, they reported the occurrence of 69.2%. Heeresh Shetty et al¹⁵ also reported the prevalence of MB2 in South Indian population to be 86.36%, also Kishore Gopalakrishna Naik et al (2016)²² by clearing method found 84% MB2, the higher incidence can be due to regional difference between north Indian and south Indian population. Wasti et al reported (2001)²¹ found the presence of 53% four root canals in three rooted 30 maxillary molars of South Asian Pakistani's by tooth clearing. Alavi et al(2002)¹⁷ reported incidence of 65% two root canals in mesiobuccal root of indigenous Thai population. The two separate canals till the apex 2-2 Vertucci's Class IV had the second largest prevalence 19% after Vertucci's Class I 34.84%

in the mesiobuccal canal. The 3-3 vertucci's class VIII was not found in any MB root canal while only 2 teeth presented with 1-2-1-2 type of root canal. Satoru Matsunaga et al⁶⁵ found that in maxillary first molar palatal roots, none of the canals were completely separated, and most of the canals were Type I, which are single canals. As for the incidence of root canals with ramifications, Type I-a, in which there are no accessory root canals, comprised 65.6 %, while Type I-b, which show apical ramifications, comprised 31.1 %. Type I-c, which shows lateral canals, demonstrated the lowest incidence at 3.3 %. The presence and location of apical foramen have a wide variance, the mesiobuccal root contain the maximum number of foramen. L. Benan Ayranci et al¹² also reported that the morphology of apical foramina in the Turkish population present highly complex anatomical variations. This study found that the mesiobuccal root had a single foramen in 315 (52.5%) teeth while 285 (47.5%) teeth had two or more than two foramen. Thomas et al (1993)⁶⁷ reported an occurrence of 46.3% two or more foramen. In the present study the apical foramen of the mesiobuccal canal did not open at the anatomical apex in 231 (38.5%) teeth in rest 369 (61.5) teeth the apical foramen opened at the anatomic apex. The recognition and management of canal isthmus and accessory root canals is a factor that may improve the success rate of surgical endodontic treatment. These anatomical structures can act as reservoir for bacteria or necrotic pulp tissue and may account for the failure of endodontic treatment. The present study shows intercanal communications in²³ mesiobuccal roots 16% and these isthmuses were present in middle third of the root. Weller et al⁸ presented the concept of a partial isthmus and reported a 100% prevalence of an isthmus at the apical 4 mm level of the MB roots with two canals. Teixeira et al¹² also found the incidence of canal isthmus was greatest at the apical 3 to 5 mm level of the MB root of maxillary first molars. Tam and Yu¹⁵ differentiated between the accessory root canals and canal isthmi and reported that 12.5% of the maxillary first molars have one or more accessory root canals located between the mesiobuccal (MB1) and the mesiolingual (MB2) root canal. It was observed that the mesiobuccal second canal was thinner than the main mesiobuccal canal. These mesiobuccal second canal (MB2) canals then followed a torturous route towards the apex to open at an independent apical opening which is present at a lateral position to the anatomical apex or join the main mesiobuccal canal to open as one apex. The clearing technique revealed that the complex anatomy and the tortuous pathway of the root canal system justify the difficulties in penetrating the entire length of the MB canal, showing that achieve patency in the MB2 canal is much more challenging than locating them. Achieving patency of MB2 canal is much more challenging than locating them. According to Tauby et al¹⁶ it was only possible to achieve patency in 50.9% on MB2 canals in the endodontic treatment of first molars,

IX. CONCLUSION

The result of our study concludes that the incidence of two or more canals in permanent maxillary first molars of Himachal Pradesh (India) population is about 65%. Keeping in view this higher prevalence of the second canal the clinicians should always rule out the presence of mesiobuccal II canal. The

presence of separate apical foramen in more than 48% cases necessitates that the MB II canal should not be left untreated to avoid failure of the endodontic treatment. The second mesiobuccal canal found in most of the cases was thinner and had torturous course with intercanal communications and lateral canals so the role of thorough irrigation protocol is necessary. Further more studies are required to demystify the maxillary molar teeth for a better understanding of the tooth morphology and get best results for its root canal treatments. e MB2 canal.

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