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Review Article

Review of literature of studies referreing Mandibular molar's root canal morphology

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ABSTRACT:
Mandibular first molar is the first posterior tooth that erupts in the oral cavity and is the tooth that most often requires root canal treatment. This tooth usually has two roots but occasionally, it has three with two or three canals in the mesial root and one, two, or three canals in the distal root2. Over the years, there have been numerous reports regarding aberrant canal morphology associated with mandibular molars with multiple canals in both mesial and distal. Root canal system can be studied extra root as radix entomolaris, radix paramolaris, C shaped canal anatomy etc which can act as an obstacle in rendering successful endodontic therapy.
Key words: Mandibular, Molar

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INTRODUCTION

Success is the expected outcome after root canal treatment (RCT), regardless of the clinical conditions. However, predicting success usually requires adopting a referential or criteria, and presupposes that the patient is healthy. It is estimated that RCT should be considered completed when the tooth is permanently restored and in function. RCT clinical success can be analyzed based on different points of view, with specific values that involve the dentist, the patient or the tooth itself. References for the dentist are the value of symptom (clinical silence - absence of pain), the value of image (root canal space completely filled with no evidence of periapical inflammation), and the value of clinical condition (a well-restored and functioning tooth). The dentist's skills are crucial to interpret correctly the radiographic features and establish a diagnostic hypothesis. For the patient, the value of symptom (no pain) is essential. Apart from this, RCT success is associated with predictive aspects that eliminate the need of interventions and establishes treatment conclusion. The success for the tooth itself is associated with absence of disease (root canal infection or periapical inflammation). The result of successful endodontic treatment depends on knowledge, correct sight and awareness of root canal anatomy and careful, conservative and meticulously performed cleaning and shaping procedures. Lack of knowledge about root canal anatomy and its variations in configuration may lead to many root canal treatment failures such as perforation.[1-4]

REVIEW OF LITERATURE

Zhang X et al (2015) conduct a cone-beam computed tomographic (CBCT) investigation on the root and canal configuration of the mandibular first molars, especially the morphology of the disto-lingual (DL) root, in a Chinese subpopulation. A total of 910 CBCT images of the mandibular first molars were collected from 455 patients who underwent CBCT examinations as a preoperative assessment for implants or orthodontic treatment. The following

information was analyzed and evaluated: tooth position, gender, root and root canal number per tooth, root canal type of the mesial root(s) and distal root(s), angle of the DL root canal curvature, distance between two distal canal orifices in the teeth with DL root, and angle of disto-buccal canal orifice–disto-lingual canal orifice–mesio-lingual canal orifice (DB-DL-ML). Most of the mandibular first molars (64.9%, n = 591) had two roots with three root canals, and most of the mesial root canals (87.7%, n = 798) were type VI. The prevalence of the DL root was 22.1% (n = 201). The right side had a higher prevalence of DL root than the left side ($p<0.05$). Additionally, the curvature of the DL root canal were greater in the bucco-lingual (BL) orientation (30.10°±14.02°) than in the mesio-distal (MD) orientation (14.03°± 8.56°) ($p<0.05$). Overall there was a high prevalence of DL root in the mandibular first molars, and most of the DL roots were curved in different degrees. This study provided detailed information about the root canal morphology of the mandibular first molars in a Chinese subpopulation.[5]

HadiAssadian et al (2016) evaluated the accuracy of CBCT, digital radiograph and tooth sectioning in evaluating root canal morphology of mandibular incisors. They found that majority of samples had type I canal configuration (Vertucci's classification) when digital radiography and tooth sectioning was used, but when CBCT was used type III was the most common canal configuration. Finally, they concluded that none of the used imaging techniques per se could adequately show the exact internal anatomical configuration in mandibular incisors.[6]

Mokhtari H et al (2016) conducted a study in which CBCT images were taken from 96 extracted human mandibular first molars and the teeth were then evaluated based on Vertucci's classification to determine the root canal morphology. Afterwards, access cavities were prepared and India ink was injected into the canals with an insulin syringe. The teeth were demineralized with 5% nitric acid. Finally, the cleared teeth were evaluated under a magnifying glass at 5× magnification to determine the root canal morphology. The Kappa coefficient for agreement between the two methods evaluating canal types was 0.346 (95% CI: 0.247-0.445), which is considered a fair level of agreement based on classification of Koch and Landis. The agreement between CBCT and Vertucci's classification was 52.6% (95% CI: 45.54-59.66%), with a significantly higher agreement rate in the mesial canals (28.1%) compared to the distal canals (77.1%).[7]

Sherwani OA et al (2017) in their study on 863 mandibular first molars found that majority had two roots (85%) with three (61%) and four (30%) canals. Three roots were present in 15% of the specimens. Type IV (49%) and type I (48%) were the most common configurations in mesial and distal roots, respectively. First molars with two roots and three canals are a common feature in North Indian patients. Both roots showed wide variations in canal anatomy with type IV and type I configurations predominating in mesial and distal roots, respectively.[8]

Madani et al (2017) in their study found that amongst 154 first mandibular molars, 149 (96.7%) had two roots, 3 (1.9%) had three roots and 2 (1.2%) had C-shaped root configuration. Of 147 second mandibular molars, 120 (81.6%) had two roots, 1 (0.6%) had three roots and 26 (17.6%) had C-shaped roots. There was no significant difference in the prevalence of Vertucci's type between two genders. The most common configuration in mesial roots of first and second molars were type IV (57%-42.9%) and type II (31.5%-28%). Mesial and distal walls had the most frequency as the thinnest wall in all levels of root canals with mostly less than 1 mm thickness. In second molars the DB-DL inter orifice distance and in first molars the MB-ML distance were the minimum. MB-D in first molars had the maximum distance while ML-DL, MB-DB and ML-D had the same and maximum distance in second molars.[9]

Somasundaram P et al (2017) in their study CBCT images of 171 mandibular third molars were observed and data regarding number of roots, number of canals, Vertucci's classification in each root, prevalence of C shaped canal, gender and topographical relation of morphology in mandibular third molar was statistically evaluated. Majority of mandibular third molars had two roots (84.2%) and three canals (64.3%). Most mesial root had Vertucci Type II (55.6%) and Vertucci Type IV (22.2%), distal root had Type I canals (87.5%). Over all prevalence of C shaped canals in mandibular third molars was 9.4%.[10]

Pawar AM et al (2017) found that the most common configuration was two-root (79.35%) and three-root canals (53.50%). The incidence of three-rooted molars was 7.53%, whereas 13.12% of the studied teeth studied have fused roots with C-shaped canals. The predominant canal morphology in the mesial roots was Vertucci's type IV (45.17%), followed by type II (32.55%), type I (7.23%), type V (1.02%), and type III (0.91%). The distal root in contrast showed type I (61.14%) as the predominant canal configuration, followed by type II (18.21%) and type IV (7.53%). The incidence of three-rooted molars was higher in males (n = 55; 5.59%) than in females (n = 19; 1.94%) ($p < 0.01$). The canals in the extra roots exhibited type I (100%) root canal morphology. In teeth with C-shaped root canal (13.12%), the variations in the coronal, middle, and apical third ranged from C1 to C4.[11]

Rezaeian M et al (2018) conducted a study in which 80 extracted permanent maxillary first molars from a population in Rafsanjan, Iran were collected. Root canal morphology was evaluated by clearing technique under stereomicroscope under 40 X magnification. A combination of Vertucci's and Sert and Bayirli's classifications was used to determine the root canal types. All palatal roots and almost all disto-buccal roots had type I configuration. Ten different

types of root canal system were found in mesio-buccal roots, among which type I was the most common (38.75%), followed by type II, IV, V, VI, IX, XV, XVI, XIX and VII, respectively.[12]

Kajan ZD et al (2018) in their study found that CBCT accurately detected the number of root canals in 129 (92.1%) of 140 roots and the form of the canals in 119 (85%) of the roots. There was no significant difference between the accuracy of CBCT in the detection of the number (*P*=0.13) and forms (*P*=0.4) of root canals of maxillary and mandibular teeth. The agreement between CBCT, and tooth clearing and staining in detection of the number of root canals was excellent in the maxilla (kappa=0.88±0.05) and good in the mandible (kappa=0.720±0.097). The agreement between the two methods in demonstration of the form of root canals was good in both maxillary (kappa=0.73±0.07) and mandibular (kappa=0.67±0.09) teeth.[13]

Wu YC et al (2018) in their study, a total of 400 patients (800 pairs of PMCIs and PMFMs) were qualified for further analysis. The prevalence of DLRs in PMFMs along with root canal configurations of PMCIs were assessed at subject and tooth levels. Multivariable logistic regression analysis was used to evaluate the correlation between the root canal configurations of PMCIs with the existence of DLRs in PMFMs. The prevalence of PMFMs with DLRs and complicated root canal configurations in PMCIs was 23.0% and 15.6%, respectively. A significant difference in age (<50 years vs>50 years) was found for complicated root canal configurations in PMCIs. The most prevalent root canal system in PMCIs was Vertucci type I (84.4%) followed by type III (13.5%). A positive correlation between the presence of DLRs in PMFMs and complicated root canal configurations in PMCIs was noted. After adjusting for categoric variables including sex, age, and side, the odds ratios for the occurrence of complicated root canal configurations of PMCIs in the unilateral DLR group and the bilateral DLR group compared with the non-DLR group were 2.13 and 2.53, respectively.[14]

Madjapa HS et al (2018) found that all mandibular molars had two separate roots. The mean tooth length for mandibular 1st and 2nd molars were 21.7 mm and 20.5mm, respectively, with no statistically significant difference in mean tooth length between males and females. All the mesial roots 1st and 2nd mandibular molars possessed two root canals, while 40.4% and 54.1% of the distal roots of 1st and 2nd molars, respectively, had two canals. The majority of the examined teeth had their apical foramen located centrally, with an apical delta present in the distal root of one-second molar. Root canal configuration types commonly reported were Type II in the mesial and Type I in the distal roots of the mandibular 1st molar; while the 2nd molar had, respectively, root types II / IV and type I.[15]

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