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Case Report

Anatomical Variations in Mandibular Second Molar: A Case Series

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ABSTRACT

Anatomic variations may be present in any tooth. Knowing the typical morphology and their variations helps in better prognosis of the treatment performed. The result of successful endodontics revolves around knowledge, respect, and appreciation for root canal anatomy, and careful, thoughtful, meticulously performed cleaning and shaping procedures. Knowledge of pulpal anatomy, it's possible variations is critical for success in endodontic and lack of such knowledge may lead to treatment failure. The most typical anatomy of a mandibular second molar is the presence of two roots and three root canals, but variations in the number of roots as well as canal morphology are not uncommon. This includes single canal, two canals, three and four canals, five canals and C-shaped canal system. Because proper cleaning, shaping, and three dimensional obturation of the entire root canal system is regarded as an important determinant to good prognosis, the variations in root canal system, thus, represents a challenge to its proper diagnosis, debridement and obturation.

Key words: Mandibular second molar, Root canal anatomy, Endodontic treatment.

INTRODUCTION

A general trend towards the retention of teeth rather than extraction is evident today, the scope of endodontics is to render the affected tooth biologically acceptable, symptom free and functional. [1] Consequently mandibular second molars are now more frequently involved in root canal treatment. [2] Consistently high levels of success in endodontic treatment require a thorough understanding of root canal anatomy and morphology. [3] Successful root canal treatment depends on adequate debridement and filling of the entire root canal system, but the relative simplicity and uniformity of external surfaces of roots often masks their internal complexicity. [4] The clinician should anticipate and identify the normality as well as the anatomical alterations that may be present because therapeutic failure may result from failure to identify alterations, such as supplementary roots or canals. [5]

According to Vertucci, the mandibular second molar is similar to the first, except that the roots are shorter, the canals more curved, and the range of the variations broader. Very often (64%) the mesial root has two canals, approximately 38% incidence for type II and 26% incidence for type IV. In the distal root, there is almost always only one independent canal (92%) (type I), rarely type II (3%) or type IV (4%). When type I is a single canal extends from the pulp chamber to the apex; type II are two separate canals leave the pulp chamber and join short of the apex to form one canal and the type IV are two separate and distinct canals extend from the pulp chamber to the apex. [3]

Mandibular second molars usually have two roots and three root canals but

variations in the number of roots as well as canal morphology are not uncommon. Which includes single canal, two canals, three and four canals, five canals. [6] More recently, C-shaped (gutter-shaped) root and canal configurations have been reported in different populations. Although seldom found in Caucasians, these variations have a relatively high prevalence in mandibular second molars of Chinese and other northern and eastern Asian populations. However, there are variations that endodontics should be aware of to obtain good treatment results. Unusual root and root canal morphologies associated with the mandibular second molar have been recorded in several studies in the literature. [7,8]

Cleaning and shaping root canal systems are essential steps in root-canal treatment. The goal of root canal treatment is to clean the root canal systems as thoroughly as possible and to fill it in all its dimensions. In depth knowledge of the root canal anatomy of each tooth is crucial in order to reach this goal. Thus, it is necessary for the clinician to have knowledge of dental anatomy and its variations. [9]

CASE SERIES

Although, root canal therapy has been a practice trend to save teeth since ages, nature till date does not stop mystifying the dentist with the various root canal morphologies. In all the presented cases, teeth had been planned for routine root canal treatment after their detailed history and clinical as well as radiographic examination.

Case 1: Single Canal:

Patient named M. Madhavi, aged 39 yrs reported to Department of conservative dentistry and endodontics, with a complaint of pain in lower left back tooth region. Upon clinical and radiographic examination, case was diagnosed as symptomatic apical periodontitis i.r.t 37. After thorough debridement of the pulp tissue from the pulp chamber, a single but considerably large opening was found in the center of the pulp chamber floor, which was confirming the presence of a single root and single canal. Working length was measured (Fig 1 a)and cleaning and shaping of the canal was done with K- file of No.50 , mastercone selected size 50(Fig 1b) and followed by obturation with corresponding gutta purcha cones with lateral condensation technique(Fig1c).

Figure : 1 a

1b

1c

Case 2: Two Canals:

Patient named K. Reshma, aged 34 yrs reported to Department conservative dentistry and endodontics, with a complaint of pain in lower left back tooth region. Upon clinical and radiographic examination, case was diagnosed as symptomatic apical periodontitis in relation to 37. While getting access to the pulp chamber, two canal orifices representing one mesial and one distal canal were seen periapical radiograph showed two canals with wider canal configuration at apical region (fig 2a). After determination of correct working length (fig 2b), cleaning and shaping was done with the help of K-files and obturation done with thermoplasticized gutta percha technique (fig 2c).

Fig 2a **2b** **2c**

Case 3: Two Roots with Three Canals:

Patient named S. Deepa, aged 21 yrs reported to Department conservative dentistry and endodontics, with a complaint of pain in lower left back tooth region. Upon clinical and radiographic examination, case was diagnosed as chronic irreversible pulpitis in relation to 37. After the access cavity preparation four separate orifices 2 on mesial root and 2 on distal root were located. Working length was determined, which showed that distal canals were in type II configuration (joining at the apex) (3 b). Cleaning and shaping was done with the help of K-files, after which the distal canals were merged into one, which was showed in master cone radiograph (fig 3c) and obturation done with lateral condensation technique (fig 3d).

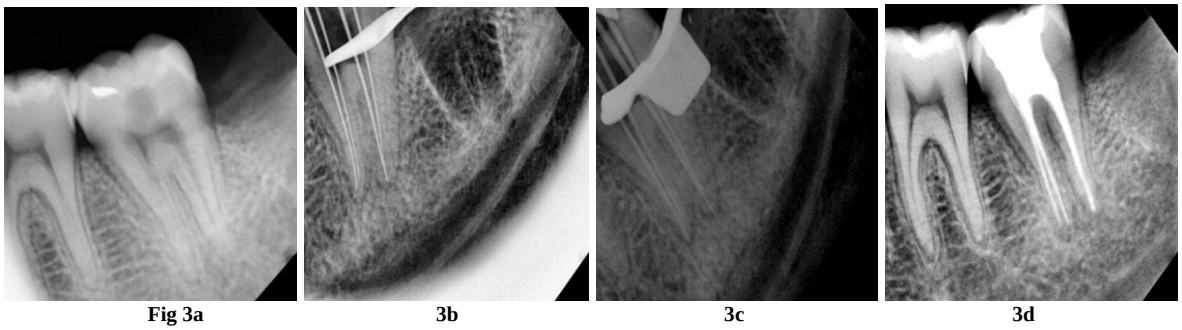

Fig 3a **3b** **3c** **3d**

Case 4: Three Roots with Four Canals (Radix Enteromolaris):

Patient named N. Vanaja, aged 46 yrs reported to Department of conservative dentistry and endodontics with a complaint of pain in lower right back tooth region. Upon clinical and radiographic examination, case was diagnosed as symptomatic apical periodontitis in relation to 47. Periapical radiograph showed another root margin on distal root which was confirming the presence of third root (fig 4a). After the access cavity preparation four separate orifices were located, two on mesial aspect and one on distal aspect, another orifice located slightly buccal and mesial to distal orifice suggested radix enteromolaris and confirmed by working length radiograph (4b). Cleaning and shaping was done with the help of K-files and master cone selected (fig 4c) and obturation done with lateral condensation technique (fig 4d).

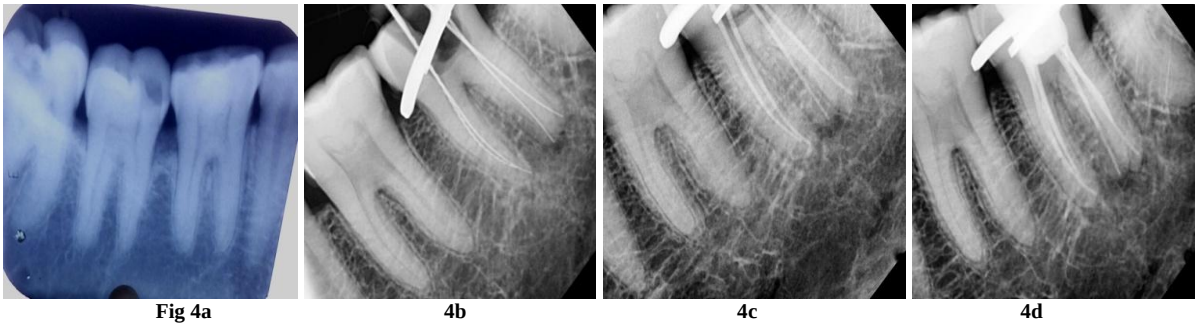

Fig 4a **4b** **4c** **4d**

Case 5: C - Shaped Canal:

Patient named K. Nagamani, aged 37 yrs reported to Department of conservative dentistry and endodontics, with a complaint of pain in lower left back tooth region. Upon clinical and radiographic examination, case was diagnosed as chronic irreversible pulpitis in relation to 37. After the preparation of access cavity, thorough debridement with 5.25% sodium hypochlorite, the pulpal floor showed a single C configuration a semicolon configuration on mesio lingual canal and another canal extends from mesio buccal aspect to disto buccal aspect. Working length was determined (fig 5a), Cleaning and shaping was done with k files and obturation done with thermoplasticized gutta percha technique (fig 5b).

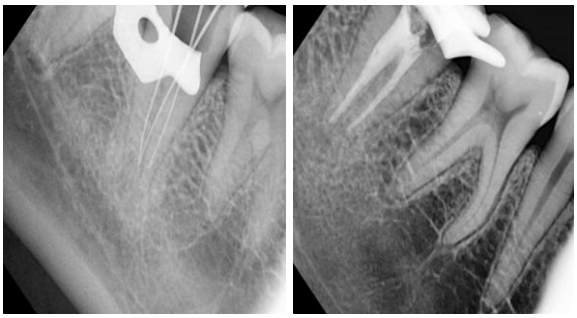

Fig 5a **5b**

DISCUSSION

The root canal anatomy of mandibular second molars has been described by a number of investigators (Hess 1925, Pederson 1949, Tratman 1950, Ainamo & Loe 1968, Pineda & Kuttler 1972, Green 1973, Tamse & KaflFe 1981, Vertucci 1984, Kotoku 1985, Yingetal. 1988, Walker 1988, Weine *et al.* 1988). Conflicting results have been obtained, which may be due to differing methods of study, or due to variations in the population from which the teeth were collected with regard to racial group, age, sex and the side of the mouth from which the tooth originated. The main areas of dispute are the number of roots possessed by mandibular second molars, and the type and shape of canals. A higher number of mandibular second molars with single roots have been found in Mongoloid populations (Kotoku 1985, Walker 1988b); and C-shaped canals have also been found more frequently in the same populations (Kotoku 1985, Yang *et al.* 1988, Walker 1988). [2]

Recently a study was conducted on south Indian population using computed tomography to known the canal configuration of mandibular second molars, which revealed that predominance of two roots and three canals in south Indian population is similar to the observation of vertucci. However, a proportion was three rooted, majority of the teeth had two roots (91.91%). In general, two rooted mandibular second molars had a single distal canal (82.81%) and two mesial canals (74.62%) that existed through apical foramina (48.23%). Single canal in mesial roots (24.53%) and two distal canals in distal roots were seen in (16.04%) of the teeth. Neeelakantan et al in their study on Indian mandibular second molar, found incidence of one mesial root to be 8.4% and two canal in distal roots to be 17.9% and the prevalence of c shaped canals was 4.55% with canal system were complex and variable (type I and type II). Neelakantan et al, however found the prevalence of c shaped canals was 7.5 % in over all Indian population. [4]

Endodontic success in teeth with a number and morphology of canals above than normally found requires a correct diagnosis and careful clinical radiographic inspection. Morphological variations in pulpal anatomy must be always considered of the beginning of treatment. When anatomic variations are detected clinically, treatment can be performed with conventional or rotary instrumentation and root canal system filling techniques respecting technical and biological principles. Radiographic interpretation is overall more effective when based on film combinations ("preoperative and working length radiographs" or "preoperative and final radiographs" or "all three radiographs") than on single radiographs. Among the latter, working length radiographs are more helpful than the

preoperative and final ones, whereas preoperative radiographs are the least effective in diagnosing the C shaped cases. [3]

While preparation of access cavity, dental operating microscope and dental loupes, offer magnification and illumination of the operating field and substantially improve the visualization of root canal orifices which enhance the quality of vision and make the correct identification of the root canal system easier. The use of apex locator can be important to determine the working length. Additional anatomic information about the root canals can be obtained by angulated radiography, R.V.G, CT-scan and 3D reconstruction particularly in c shaped canals. The obturation of simple tubular or tapered canals may be achieved satisfactorily with cold lateral condensation of gutta percha points. However, irregular canals or those with complex ramifications are more satisfactorily obturated using thermoplasticized gutta percha technique. [7]

CONCLUSION

When root canal treatment is to be performed the clinician should be aware that both external and internal anatomy may be abnormal. Knowledge of possible variations in internal anatomy of human teeth is important for successful endodontic treatment. Based on the various studies describing the canal anatomy for second mandibular molar it is difficult to determine configuration of canal system. The early recognition of these configurations facilitates cleaning, shaping, and obturation of the root-canal system. Every attempt should be made to find and treat all root canals to ensure successful endodontic treatment.

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