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Association of Gender to Mandibular Second Molars with Single Fused Canal: A Retrospective study

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Abstract: The occurrence of aberrant anatomy is one of the causes of endodontic failures when they are not detected accurately. Hence understanding these anomalies is highly important for a dental practitioner. The present retrospective study was conducted to analyse the incidence of a single fused canal in mandibular second molars and its association with gender . Data was obtained from the database of the institute and the preoperative and obturation radiographs were evaluated. The details were entered in an excel sheet and a descriptive statistical analysis and a chi square test by SPSS. The results of the present study showed a 1.6% chance of occurance of a single fused root with a single canal in a mandibular second molar with a higher predilection for females. These results are statistically significant with a p value of 0.012. From a clinical point of application, a complete examination from multiple angled radiographs and three dimensional assessment must be conducted when an unusual anatomic form is encountered. This will reveal accurate details and will help in preventing iatrogenic errors which often lead to the failure of endodontic treatment.

Keywords: defense Aberrant Anatomy; C Shaped Canal; Canal Morphology; Mandibular Second Molar; Single Fused Canal, innovative

INTRODUCTION

The success of a root canal therapy is primarily dependent on the accurate diagnosis and the complete elimination of bacteria from all the canals. This is possible only when one is able to accurately locate all the canals and negotiate its morphology from the coronal to the apical third. Variation in the anatomy of these canals is an occurrence that can be noticed in all groups of teeth. Multi-rooted teeth pose a persistent challenge for accurate diagnosis during endodontic therapy by way of its variation in root canal anatomy.(Malagnino, Gallottini and Passariello, 1997) While focusing on locating extra canals, apical ramifications, lateral canals, a clinician must not ignore the possibility of a single fused canal. A thorough knowledge of such variations is highly imperative, particularly in relation to the location, number and shape of the canals.

The general anatomic configuration of a mandibular second molar is that of two roots, one mesial and one distal. According to Weine, the mandibular second molar exhibits greater anatomical variations when compared to all the other molar teeth. (Weine, Pasiewicz and Ted Rice, 1988; Weine, 1998)The most common anomaly noticed in the mandibular second molar is that where the roots get fused to form a single root with varying internal anatomy which is often in C shape configuration.(Fan *et al.*, 2008) When one root is present, the root canal system may present a broad root canal, two canals that may or may not join or a c-shaped canal.(Weine, 1998)

The difference in the morphological variance in the root and the root canal system among the mandibular molars is a challenge for the practitioners during the endodontic treatment, particularly in the diagnosis so that no canal is missed. Vertucci type I canal configuration where there is a single canal can often be observed in mandibular second molars as reported in a study by Weine et al who found 13% chance of a single canal configuration in mandibular second molars; there by highlighting the importance of studying the probability of occurrence of various root canal morphology.(Weine, Pasiewicz and Ted Rice, 1988; Cimilli *et al.*, 2005)

Our department is passionate about research we have published numerous high quality articles in this domain over the past years ((Kavitha *et al.*, 2014) , (Praveen *et al.*, 2001),(Devi and Gnanavel, 2014), (Putchala *et al.*, 2013), (Vijayakumar *et al.*, 2010), (Lekha *et al.*, 2014a, 2014b) (Danda, 2010) (Danda, 2010) (Parthasarathy *et al.*, 2016) (Gopalakannan, Senthilvelan and Ranganathan, 2012), (Rajendran *et al.*, 2019), (Govindaraju, Neelakantan and Gutmann, 2017), (P. Neelakantan *et al.*, 2015), (PradeepKumar *et al.*, 2016), (Sajan *et al.*, 2011), (Lekha *et al.*, 2014a), (Neelakantan, Grotra and Sharma, 2013), (Patil *et al.*, 2017), (Jeevanandan and Govindaraju, 2018), (Abdul Wahab *et al.*, 2017), (Eapen, Baig and Avinash, 2017), (Menon *et al.*, 2018), (Wahab *et al.*, 2018), (Vishnu Prasad *et al.*, 2018), (Uthrakumar *et al.*, 2010), (Ashok, Ajith and Sivanesan, 2017), (Prasanna Neelakantan *et al.*, 2015). The present retrospective study was conducted with the aim of evaluating the incidence of a single root with a single fused canal in the mandibular second molar and to study its association with gender.

The following were the objectives of the study:

1. To evaluate the incidence of a single root with a single fused canal in mandibular second molars
2. To study if there is any association of the occurrence of a single root with a single fused canal in mandibular second molar with different gender groups

MATERIALS AND METHOD

The present retrospective study was conducted at the department of Conservative Dentistry and Endodontics at Saveetha Dental College in Chennai. For the purpose of data collection, all the preoperative radiographs and obturation radiographs of endodontically treated mandibular second molars between the month of June 2019 and April 2020 were obtained from the college database along with the demographic details of the patient. An excel sheet was tabulated for the same which recorded the age, gender and the canal configuration of the mandibular second molar of the patient. Two reviewers were involved in the evaluation of the radiographs to minimize the bias. The data was evaluated in SPSS 2.0 IBM software and a descriptive statistical analysis was performed to obtain the frequency and percentage. A chi square test was done to find out if there is any association of the occurrence of a single root with a single fused canal in a mandibular second molar with gender. A p value of <0.05 in the chi square test was considered as statistically significant.

RESULTS AND DISCUSSION

A total of 509 mandibular second molars were evaluated. Upon analysis, out of the 509 mandibular second molars, 8 (1.6%) had the configuration of a single fused root with a single canal (Fig 1). When comparing the gender, seven(87.50%) of these eight cases were observed in females and only one (12.50%) was observed in male. The chi square value for the chi square test was 6.239 and the p value was 0.012 which was <0.05 , making it statistically significant. Single fused canals in mandibular second molars had a predilection for females as compared to males (Fig 2).

Previously our team had conducted numerous clinical trials (Ramamoorthi, Nivedhitha and Divyanand, 2015; Nasim *et al.*, 2018; Janani, Palanivelu and Sandhya, 2020), in vitro studies (Ramanathan and Solete, 2015; Nandakumar and Nasim, 2018; Teja, Ramesh and Priya, 2018; Rajendran *et al.*, 2019; Siddique *et al.*, 2019) and surveyed (Manohar and Sharma, 2018; Jose, P. and Subbaiyan, 2020) and reviewed various aspects of endodontics and conservative dentistry (*Website*, no date; Noor, S Syed Shihaab and Pradeep, 2016; Kumar and Delphine Priscilla Antony, 2018; Ravinthar and Jayalakshmi, 2018; R, Rajakeerthi and Ms, 2019)Teja, K.V. and Ramesh, S., 2019(*Website*, no date; Noor, S Syed Shihaab and Pradeep, 2016; Kumar and Delphine Priscilla Antony, 2018; Ravinthar and Jayalakshmi, 2018; R, Rajakeerthi and Ms, 2019) over the past five years. Now we are focusing on retrospective studies, the idea for which has stemmed from the current interest in our community. Acknowledging the importance of studying anomalies in root canal morphology, this retrospective study was conducted to highlight the incidence of a particular anomaly of single root with a single fused canal in mandibular second molars.

It was Cooke and Cox in 1979 who first reported in literature the occurrence of C shaped cross sectional configuration in mandibular second molars.(Cooke, Groves Cooke and Cox, 1979) Though mandibular second molar is the one where C shaped canals are most commonly found, it can also be observed in maxillary molars, mandibular third molars and mandibular premolars. A variation in the location and number of canals present in the C shaped configuration can be observed as the canal courses from the coronal third to the apical third.(Fernandes, de Ataide and Wagle, 2014)

The Hertwig's epithelial sheath determines the shape and number of roots. It bends in a horizontal plane below the cementoenamel junction and fuses in the center leaving openings for roots. (Orban and Mueller, 1929)The main cause for C shaped roots which contain C shaped canal is the failure of the Hertwig's epithelial root sheath to fuse on the lingual or buccal root surface. The coalescence because of deposition of the cementum with time may also be the cause for C shaped roots. (Manning, 1990)

Many different methods have been used to study this specific root canal configuration. Histological sections, clearing and micro computed tomography have been used in ex vivo studies white spiral CT, cone beam CT and

radiographic techniques have been used in in vivo studies. . Previous studies reveal that when compared to western countries, there is a considerably higher prevalence of C-shaped configurations in mandibular second molars in East Asian populations.Further, there was a higher prevalence in females (16.5%) as compared to males (10.4%) which was statistically significant in the global sample ($p<0.05$).(Zuben *et al.*, 2017)

Various classifications were put forth to better understand the variation in the root canal anatomy of C shaped canals which do not have a fixed spatial relation. In one such classification given by Fan et al, Type 4 configuration has been described as cross section showing only one round oval canal.(Fan, Cheung, Fan, Gutmann and Bian, 2004; Fan, Cheung, Fan, Gutmann and Fan, 2004) Fava et al has reported the presence of one single root and one root canal in all second molars of the same patient which is a rare occurrence.(Fava *et al.*, 2000)

A rational approach was developed by Krasner and Rankow to study the relationships of the pulp chamber to the clinical crown and pulp chamber floor. After several observations, they laid down certain laws which have proven to be valuable aids to the clinician searching for elusive canals.(Krasner and Rankow, 2004) The clinician should be aware of the fact that in certain cases there is always a possibility of fused or fewer canals although extra canals are more of a rule than an exception.

In a study conducted by Parsiena and Milan, out of the 102 extracted human mandibular second molars, only six teeth (5.88%) were observed with one root having a single root canal. ((*[No title]*, no date)) Weine et al conducted a study on 75 extracted mandibular second molars of which only one tooth (1.3%) had a single canal configuration and two teeth (2.7%) were C shaped. These results are in accordance with the observations made in the present study.

Various case reports in literature are an evidence for the rare occurrence of a single fused canal in mandibular second molars.(Roy, 2013; Acharya, 2016; Bansal *et al.*, 2019) Sabala et al has stated that the probability of an aberration is higher if it is rare and hence the clinician should suspect its presence on the contralateral pair.(Sabala, Benenati and Neas, 1994) It has been observed that the occurrence of abnormal anatomy can occur in any racial groups and depends on factors like age, sex and ethnicity. This study reports an association of females with presence of a single fused root and a single canal in mandibular second molars.

The incidence of single canal in maxillary first molar tooth is rare and have been reported by very few authors and the incidence of single canal in maxillary second and third molars is extremely rare.(Fava *et al.*, 2000; Torre *et al.*, 2008) Recently a case report of maxillary first molar with a single root and a single canal was reported by Gopi Krishna et al.(Gopikrishna, Bhargavi and Kandaswamy, 2006). Ioannidis et al reported a case of single root with single canal in seven teeth if the same patient which included maxillary and mandibular molars. (Ioannidis *et al.*, 2011)However it has been reported in literature that the chance of occurrence of single canals in the mandibular second molar tooth is comparatively higher than their maxillary counterparts.(Skidmore, 1979)

Some of the most common iatrogenic errors in such anomalies occurs when the extra canals are missed.(Cantatore, Berutti and Castellucci, 2006) These can be minimised if the clinician has a thorough knowledge of the general location and dimensions of the pulp chamber as well as the variations and their probability of occurrence along with good preoperative evaluation using radiographs and CBCT. From a clinical perspective, when the initial radiograph shows the image of an unusual anatomic form, it is recommended that a second radiograph is taken with a mesial or distal angulation and also a radiograph of the contralateral tooth. (Fava and Dummer, 1997)

One of the limitations of the present study is that only the radiographs were assessed which allowed a two dimensional analysis only. Furthermore the sample size was small and was restricted to a particular geographic location. Hence, using three dimensional analysis and studying the population over a larger geographical area will allow the results to be generalised to a larger population. Further, bilateral analysis can be conducted to see their association.

CONCLUSION

Under the limitation of present study, out of the 509 mandibular second molars, 8 (1.6%) has the configuration of a single fused root with a single canal. Seven(87.50%) of these eight cases were observed in females and only one(12.50%) was observed in male which is statistically significant. However from a clinical point of application, a complete examination from multiple angled radiographs and three dimensional assessment must be conducted when an unusual anatomic form is encountered. This will reveal accurate details and will help in preventing iatrogenic errors which often lead to the failure of endodontic treatment.

Conflict of Interest

There is no conflict of interest.

Authors Contribution

All authors have contributed equally in bringing out this research work.

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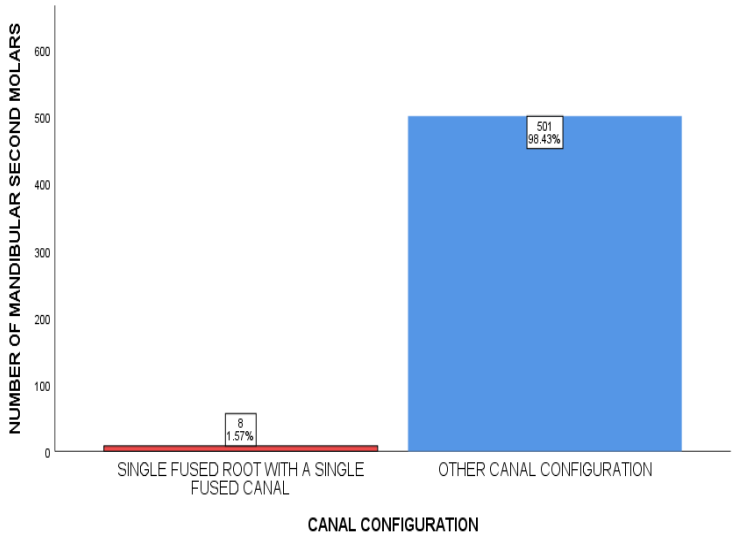

Fig.1: Bar Graph represents the frequency distribution of the occurrence of a single fused canal in mandibular second molars. The X axis represents the type of canal and the Y axis represents the number of mandibular second molars. Out of a total of 509 mandibular second molars, only 8 (1.6%) had a single fused root with a single canal.

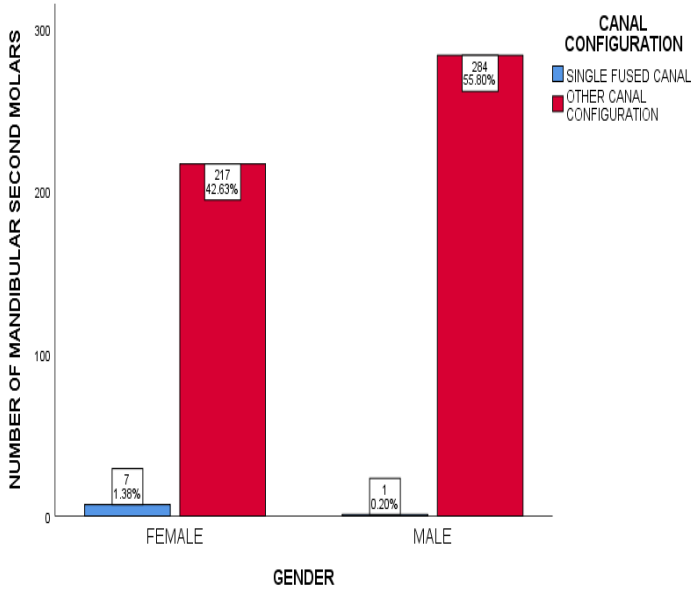

Fig.2: Bar graph represents the association between gender and canal configuration in mandibular second molar. X axis represents the gender and the Y axis represents the number of mandibular second molars. 7 mandibular second molars having a single fused canal were observed in females and 1 in male. Chi square value- 6.239,p = 0.012(<0.05). There is a strong association of a single fused canal in mandibular second molars with female gender.