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Original Research Article

Determination of Accessory and Lateral Canals through Dye Method, Decalcification and Histological Sectioning in Permanent Mandibular First Molar

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Abstract: The aim of this study is to compare the efficiency of radiopaque dye, decalcification, and histological sectioning in detection of accessory canals in mandibular 1st molars. 30 Extracted mandibular 1st molars were selected. The teeth selected for the study were stored in normal saline. Endodontic access openings were made using a round bur and pulp tissue was removed from the pulp chamber using a standard spoon excavator. Root canal contents were extirpated using barbed broach. Complete debridement of root canals was done using files No. 8 to 25, with copious irrigation using 3% sodium hypochlorite. The teeth were placed in separate bottles containing normal saline and were labeled. Three different methods were used to study the accessory canals, viz, Radiopaque dye, decalcification, and histologic sectioning. According to this study, The incidence of lateral and accessory canals for the mandibular first molar is 46.6%. Results showed that Histological sectioning was significantly ($P = 0.048$) better than dye method , but the difference between the Histological sectioning and decalcification was not significant.

Keywords: Lateral canals, Sodium diatrizoate, decalcification , histological sectioning, Permanent mandibular 1st Molar

INTRODUCTION

Accessory or lateral canals are part of a complicated root canal anatomy that may have been undetected in the first procedure. Root canals, which house the contents of the pulp of a tooth (blood vessels, nerves and connective tissues), can be quite elaborate. Like the root system of a tree or plant, the root canal system of a tooth may have tiny branches coming off the main canals. These accessory canals are usually located in areas where the roots of multi-rooted teeth join, or around the last third of the root, but can also be found anywhere along the length of a main root canal. Accessory canals can sometimes be quite difficult to detect, clean and fill. If tissue is trapped inside one of them, it can become infected and die. If accessory canals open into the periodontal membrane (the attachment mechanism between the tooth and bone) they can give rise to periodontal (gum) problems in addition to endodontic (root canal) problems [1, 2]. Accessory canals result due to a localized failure in the formation of Hertwig's sheath during the embryonic stages of tooth formation. This defect is probably due to the persistence of abnormally placed blood vessels reaching the pulp, which is more common in the furcation region. This often requires the skills of an endodontist, a specialist in the diagnosis and treatment of root canal disorders, who will use advanced technologies such as microscopes and specialized filling techniques to treat these minute canals.

Although the terms accessory and lateral canals are often used interchangeably, they do mean different things. A lateral canal extends from the main, central canal to the periodontal ligament. Although the path may be somewhat tortuous, anatomically it is a direct route. Most frequently, it is perpendicular to the main canal. The lateral canal is generally found in the main body of the tooth and might be quite near to the gingival margin the accessory canal, on the other hand, is found in the apical regions of the tooth and goes from apical secondary branching of the canal to the periodontal ligament.

A variety of techniques have been used to study the anatomy of the root canal system However, the documentation of accessory canals in the furcation

areas of mandibular molars is scanty [3-6] and the reports are contradictory. Hence, an *in vitro* study was planned to know the prevalence of accessory canals in molars and to compare the efficiency of sodium diatrizoate, decalcification, and histological sectioning in detection.

METHODOLOGY

The present study was conducted on 30 extracted mandibular molar 1st molars. Only teeth with root resorption not involving more than one third of the apical aspect of any root were included in the study. The teeth selected for the study were stored in normal saline. Endodontic access openings were made using a round bur and pulp tissue was removed from the pulp chamber using a standard spoon excavator. Root canal contents were extirpated using barbed broach. Complete debridement of root canals was done using files No. 8 to 25, with copious irrigation using 3% sodium hypochlorite. The teeth were placed in separate bottles containing normal saline and were labeled.

Three different methods were used to study the accessory canals, viz, dye method, decalcification, and histologic sectioning.

Dye method

Sodium diatrizoate was injected into teeth and examined through RVG. All the teeth were imaged buccolingually with digital radiography. In this method the dye used was diatrizoate which is a radiopaque contrast media, This chemical is used in Angiographic indication, Urography, Computed Tomography.

Decalcification

The specimens were decalcified for 3 days in 5% nitric acid at room temperature. The solution was changed daily and agitated by hand three times each day. After completion of decalcification, the teeth were rinsed in running tap water and then the teeth were dehydrated using a series of ethyl alcohol rinses, i.e., 80% solution for 6h, followed by 90% solution for 1 h and, finally, three 100% alcohol rinses for 1 h each. The dehydrated teeth were then placed in xylene (for approximately 6 h) till the teeth became transparent India ink was injected into the pulp chamber, using a 24gauge needle and a LuerLok plastic disposable syringe. The excess ink was removed from the surface of the root with gauze soaked in alcohol and the teeth were returned to the methyl salicylate solution until needed . The teeth were examined under a stereomicroscope under 10× magnification.

Histologic sectioning

All decalcified teeth were mounted in clear acrylic stubs and were sectioned with a hard tissue microtome. A series of sections, each of 100µm thickness, were taken .For one tooth 3 sections are taken in apical, middle and cervical thirds. And were mounted on slides using DPX (mounting media). The specimens were then examined under a stereomicroscope under 10 × magnifications.

RESULTS

Out of the 30 Permanent teeth studied for prevalence of patent accessory canals, 5 teeth showed canals in dye method, 11 teeth in decalcification and 14 in histological sectioning. Multiple canals were best seen by sectioning and decalcification when compared to dye method. Out of three regions examined (apical, middle and cervical) apical 3rd showed more canals followed by cervical and middle 3rd.

Fig-1: Demonstrate RVG image with radiopaque contrast media showing accessory canals in the coronal and apical 3rd of permanent mandibular 1st Molar root canal

Fig-2: Demonstrate stereomicroscopic view demonstrating lateral canals in the middle 3rd of a decalcified permanent mandibular 1st Molar

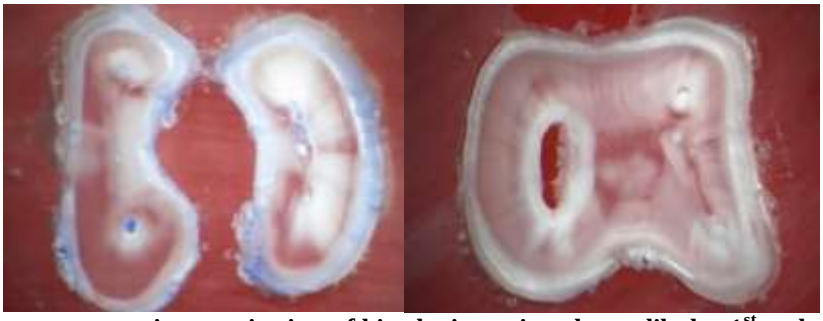


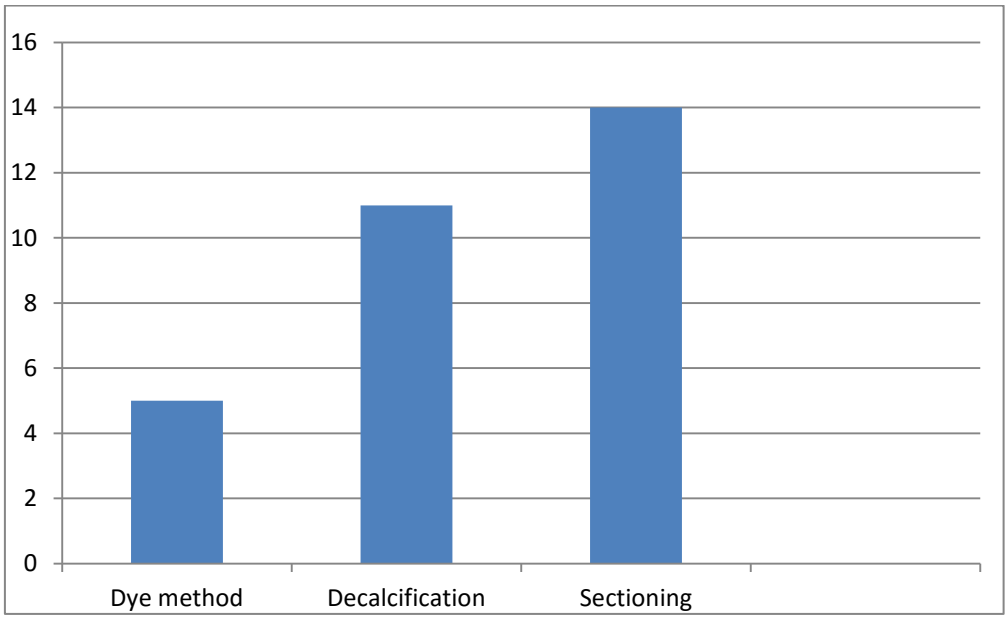
Fig-3 & 4: Demonstrates steromicroscopic view of histologic sectioned mandibular 1st molar showing accesory canals in furcal and in the middle 3rd respectively

Table-1: Shows the number of mandibular molars showing accessory canals by the three different methods

Lateral Canine	Dye Method	Decalcification	Histological Sectioning
Present	05	11	14
Absent	25	19	16
Total	30	30	30

Table-2: Shows the significance difference between the 3 groups

	Dye method Vs decalcification	Dye method Vs histological sectioning	Decalcification Vs histological sectioning
P value	P = 0.04	P = 0.02	P = 0.60
Significance	Significant	significant	Not sigificant



Graph-1:Graphical representation of number of molars showing lateral and accessory and lateral canals through 3 different methods. (n=30)

Table I shows the number of mandibular molars showing accessory canals by the three different methods. According to this study, The incidence of lateral and accessory canals for the mandibular first molar is 46.6%. Results showed that Histological sectioning was significantly (p = 0.048) better than dye method, but the difference between the Histological sectioning and decalcification was not significant. Table II shows the significance difference between the 3 groups.

DISCUSSION

The presence of patent furcal, lateral and accessory canals are the portals of entry and exit between the root canal space and the periodontal ligament [1, 2]. Although Prevention of missed anatomy starts with good pre-operative radiographs, Studies have shown that radiographs often fail to provide the basic information that is required such as the number of canals within the tooth or the presence of lateral canals

[7]. A method which enhances the appearance of the canals may therefore be considered of value in endodontic therapy.

The technique of introducing a radiopaque contrast medium into the root canal system of extracted permanent teeth was used by Barker et.al to investigate the anatomy of pulp space from radiographs. A newer contrast media is used in the present study. The contrast media used in our study was Sodium diatrizoate, which has not been used in clinical dentistry so far. This chemical is an iodinated radiopaque X – ray contrast media used as a diagnostic aid in angiography, urography and radiography. Angiographic indication, Urography, Computed Tomography and Venography. The use of radiopaque contrast medium in endodontic radiography may be a valuable aid in the diagnosis and evaluation of root canal system. This system would complement rather than replace plain radiography.

According to this study, the incidence of lateral and accessory canals for the mandibular first molar using radio opaque media is 16.6%. In contrast, Lowman *et al* [8] found patent accessory canals in 59% of molars. This variation may be due to the selection of teeth and methodology used. In our study, only mandibular 1st molars are included and radiographs were not taken at different angles.

Decalcification of calcified tissues plays an important part in histological techniques. The goal of decalcification is to remove calcium salts from the mineralized tissues, preparing them for further sectioning of the histologic specimen. The decalcification technique used in the present study was the method advised by Shetty Aditya *et al* [9]. In this study The incidence of lateral and accessory canals for the mandibular first molar is 36%. Vertucci *et al.* [11] using a dissecting microscope found that 46% of teeth studied exhibited lateral canals in the furcation region. In contrast, in our study, where we used a steriomicroscope, only 36% of teeth exhibited accessory canals.

The third method we studied was histological sectioning. This showed accessory canals in 46% of teeth. Many studies had been done on primary teeth. Paras *et al* . did a study by perfusing low viscosity latex using positive and negative vacuum pressure and demonstrated accessory canals in only one tooth out of 20 [10]. On the other hand, Moss found accessory canals in 20% of the specimens. Our study showed 46% of permanent mandibular molars with accessory canals[11].

CONCLUSION

The prevalence of accessory canals in the was seen to be more in histological sectioning followed by decalcification and radiography. On comparing the three methods, decalcification was found to be significantly better than sodium diatrizoate. The difference between sodium diatrizoate and sectioning was highly significant. There was no significant difference between decalcification and sectioning according to this study.

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