

Root Canal Morphology of Human Mandibular Incisors in Yazd Province

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ABSTRACT

Introduction: An in vitro study was performed to determine the number and the type of root canals of mandibular incisor teeth in an Iranian population.

Methods and Materials: Sixty eight mandibular incisor teeth were immersed in India ink decalcified and cleared.

Results: It was found that 55.9% of the teeth had two canals that in 51.5% of them the canals merged into one canal before exiting the tooth through one apical foramen.

Discussion: Because of high percentage of two canals in lower mandibular incisors, there should be more attempt to detect the second canal during access preparation.

Key words: Root Canal Morphology, Mandibular Incisors, Yazd.

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Introduction

The main objective of endodontic therapy is the thorough mechanical and chemical cleaning of the entire pulp cavity and its complete obturation with an inert material. Failures in treatment occur despite rigid adherence to this basic principle. Ingle et al ⁽¹⁾ suggested that apical percolation is the main cause of endodontic failures. The main reasons for this failure are incomplete canal obturation or the presence of an untreated canal. For successful endodontic therapy, the dentist should be aware of the variations of the root morphology.

Many investigators have concerned themselves with the root canal morphology of the permanent dentition, including the mandibular incisors ^{2, 3, 4}, but because they have used different materials, methods, and also classification of canal configurations, different results have been obtained.

The most dominant methods for investigating canal configurations are grinding, radiographic, post treatment clinical observation and clearing ⁵.

The clearing technique has considerable value in the study of root canal anatomy because it gives a three dimensional view of the pulp cavity in relation to exterior of the tooth. Additionally, it helps us to see the original forms of root canals and the anastomoses among them ^{6, 7}.

The purpose of this study was to launch a detailed investigation of root canal morphology of permanent mandibular incisor teeth in Yazd province.

Methods and Materials

Sixty eight freshly extracted human mandibular incisors were used in this study. The teeth were obtained from various oral surgery practices in the Yazd area. The age, sex, and reasons for extraction were not recorded.

Standard access cavities were prepared for each tooth and then the teeth were placed into a 1% solution of sodium hypochlorite for 15 days to remove organic tissues. The old solution was changed with a fresh solution every 24 hours to preserve its activity.

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After drying with paper points, the teeth were immersed in Indian ink for 5 days. The teeth were washed in tap water. The next step was teeth decalcification in 5% nitric acid for 5 days, followed by twice dehydration with 70 to 95% alcohol, respectively. The last step for clearing was leaving them in 98% methylsalicylate for 12 to 24 hours. Ink-dyed root systems were evaluated and the number of root canals and the canal types were recorded, based on Weine⁵ classification.

Results

The examination of root canal systems of the teeth was based on Weine classification. Of the 68 teeth, there were 30 teeth (44.1%) with type I, 35 teeth (51.5%) with type II, and 3 teeth (4.4%) with type III canals. There was no tooth with type IV canal in this study.

38 teeth (55.9%) had two canals that only 3 teeth (4.4%) displayed two separate canals throughout the entire length of the root exiting through two separate apical foramina.

Table 1. The results of other studies about mandibular incisors root canal morphology.

Year	Investigators	Type of study	Sample size	Percent with two canals
1917	Hess <i>et al</i>	Corrosion preparation	136	37/6
1956	Green	Sectioning	200	20
1965	Rankin, Henry, and Wilson	Radiography	111	40/5
1973	Green	Sectioning	500	21
1974	Benjamin and Dowson	Radiography	364	41/4
1990	Bardelli, Bruno, and Rossi	Radiography	79	29
1991	Perrini <i>et al</i>	Sectioning	144	36/1
1992	Kartal and Yanikoglu	Clearing	100	43
1997	Miyashita <i>et al</i>	Clearing	1085	15

Discussion

During the past years there have been many studies of pulp morphology^{8, 9, 10, 11, 12, 13, 14, 15, 16, 17}. In the present study, the incidence of a second canal was found to be 55.9%. The results of our study and results reported by Kartal and Yanikoglu⁴ (43%), and Benjamin and Dowson¹¹ (41.4%), are the highest reported results for incidence of second canal. The lowest results are reported by Madiera and Hetem¹⁰ (11.3%).

For the sake of comparison, the results of other studies have been summerized in table 1. It must be borne in mind that the variances between these incidences may be population related.

The first consideration the dentist must have in performing endodontic therapy involves the anatomy of the teeth itself. Prior to access preparation, he should study the radiographs from several different angles. On the direct

periapical exposure, if he notices that a root canal shows a sudden narrowing or even disappears, it means that at this point the canal divides into two parts.

Obtaining information by observing the radiographs and knowing what combinations of internal anatomy are possible, the dentist should be able to determine what type of canal configuration is present. These information, obtained prior to initiation of therapy, will greatly facilitate subsequent treatment.

One of the main reasons for endodontic failure of the mandibular incisor teeth is the failure to locate, debride, and obturate a second canal. The canal usually missed is the lingual canal.

Because most of the teeth with two canals showed merging of the canals in the apical third of the root (upon the results of the present investigation and many other studies), clinicians

might think that treating one canal would suffice since the apical foramen would be sealed. However, for several reasons, one should not feel secure in treating only one canal. When only one canal is treated the pulp tissue in the second canal is or may eventually become necrotic and can liberate noxious by-products through a lateral or accessory canal into the periodontal ligament space. The other very important point is that if two canals are present, they usually join together 1 to 2 mm from the apex. If the root canal filling is shorter than this joining point and only one canal is filled, the second canal will be open to periapical tissue directly via the apical foramen. Finally, if apical resection is attempted

in the presence of second canal, one apical foramen will become two separated ones and this will influence the prognosis negatively.

Upon the findings of studies and high incidence of two canals in the lower anterior teeth, the dentist always must be aware of the possibility of a bifurcated root canal in these teeth. The lingual opening must be modified to allow access to lingual canal ⁽¹⁾. To achieve success, the opening must be longer incisogingivally than is customarily thought necessary. Also the lingual aspect of the pulp chamber should be opened adequately to remove the lingual shelf of dentin over the second (lingual) canal.

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