

Operating microscope improves ability to locate and negotiate second canal in mandibular incisors

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ABSTRACT

Objective: The purpose of this study was to locate and negotiate second canal in mandibular incisors with/without magnification and to characterize the lingual canals with regard to prevalence locate and negotiability.

Materials and methods: Mixed populations of 50 human first and second incisors were mounted in acrylic dento-form blocks. Conventional access cavities were completed without operation microscope, while attempting to locate and subsequently negotiate the second canals. The teeth in which second canal was not located or could not be negotiated were then submitted under Operating Microscope. The results (present/absent) were recorded.

Results: A total of 50 teeth, 15 of which were detected in a second canal (30%). Without OM, second canal was located in 3 teeth (20%) in the 15 teeth with second canal, but we were not able to negotiate in 2 teeth (13.3%) located. With OM, 8 (53.3%) additional second canals were located and 8 (53.3%) additional second canal were negotiated of those 15 teeth.

Conclusion: Operating microscope remarkably improves location and negotiation of second canals in mandibular incisors.

Key Words: Mandibular incisors, Magnification, Operating Microscope, Second canal

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Introduction

The knowledge of root canal morphology and its frequent variations is a basic requirement for endodontic success.¹ The root canal system and access cavity for the two mandibular incisors are very complex and also similar. Most mandibular incisors have a single root with radiographically appears to be a long and narrow canal. However, it is a broad canal labiolingually and often a dentinal bridge is present in the pulp chamber that divides the root into two canals. The two canals usually join and exit through a single apical foramen but they may exit as two separate canals. Frequently mandibular incisors have two canals that are buccolingually oriented and the lingual canal most often is missed when the lingual shoulder is not completely removal or in case not provided a good view in the access cavity.¹ The clinician should search for the second canal immediately upon completing the access cavity and should use the magnification devices for the success of endodontic therapy. Endodontic failures in mandibular incisors usually arise from uncleaned and skipped canals, most commonly toward lingual access.¹ Many studies have shown that the significance of root canal anatomy had a greater effect in cleaning and shaping procedures hence the success of endodontic therapy.^{2,3} These studies demonstrated that magnification and

illumination greatly enhance endodontic therapy. The use of magnification devices in endodontics is becoming more and more common, with the aim of improving the quality of treatment. The common magnification systems used in modern endodontics, the surgical operation microscope (OM), fiber-optic endoscope, and surgical loupes, are also associated with advantages for the patient, in terms of improvement of clinical and radiographic outcomes.⁴ The introduction of the OM has been widely accepted as a magnification device for the quality of endodontic diagnosis and therapy.⁵ Because the OM has become more widely used in non-surgical treatment procedures, clinicians have indicated that it facilitates treatment of very fine canals, particularly the MB-2 canals of maxillary molars and second (lingual) canal in mandibular incisors.^{6,7}

The purpose of this in vitro study was to locate and negotiate second (lingual) canal in mandibular incisors with/without magnification and to characterize the lingual canals with regard to prevalence locate and negotiability.

Materials and Methods

The 50 mandibular first and second incisors were collected from Oral Surgery Clinic in Hacettepe University, Turkey. They were stored in 0.1% thymol solution until used. The teeth were embedded in dentaforms to

simulate clinical conditions as best as possible. Conventional endodontic access cavities were completed in all teeth with the aid of 4.5X magnification loupes without operation microscope, while attempting to locate and subsequently negotiate the second canals. Slow speed Mueller burs (Brasseler Savannah, GA) and SP-1 ultrasonic tips (Analytic Tech, Orance, CA) were then used to uncover the second canal orifice. Dentin was selectively removed from the pulp horn towards lingual and as much as necessary from the pulp chamber. Irrigation with 2.5% NaOCl and a Stropko air irrigator (Sybron Endo) were used intermittently to optimize visibility. Initially location and negotiation of second canal was attempted and then the results were recorded without magnification. Then the teeth in which second canal was not located or could not be negotiated were then submitted under OM (Zeiss, Germany). The results (present/absent) were recorded and calculated. The radiographs were then exposed of each tooth from the proximal side to demonstrate the pathway of second canals; later the roots were sectioned to verify the absence or presence of the second canal (Figure 1).

Results:

A total of 50 teeth, 15 of which were detected a second canal (30%) with/without

OM (Table 1). Without OM, second canal was located in 3 teeth (20%) in the 15 teeth with second canal, but we were not able to negotiate in 2 teeth (13.3%) located. When we submit the samples under OM, 8 (53.3%) additional second canal were located and 8 (53.3%) additional second canal were negotiated of those 15 teeth with second canal teeth. Even radiographically and sectionally proven the existence of the second canal in those 15 teeth in 4 teeth the second canal never been located and in 5 teeth never been negotiated.

Discussion

The magnification devices are becoming more and more common, with the aim of improving the quality of conventional endodontic treatment. The benefits of these devices such as surgical operation microscope, fiber-optic endoscope, and surgical loupes are to increased visualization of the treatment field, enhanced possibilities in locating canals, aid in the removal of separated instruments, diagnosis of root and tooth fractures and, perforation repair.⁸ In endodontics, the use of magnification improves the detection and negotiation of accessory canal, clean, and fills the root canal system, thus achieving a satisfactory outcome.

This in vitro study investigated the prevalence, location, and pathway of the

second canal in 50 first and second mandibular incisors with/without OM. Without magnification an apparent second canal orifice was located only 3 (20%) teeth in 15 teeth with second canal and the canal negotiated in 2 teeth (13.3%). These results may seem very good, when the previous study demonstrated that the second canal rates very low.⁹ Xu *et. al.*⁹ demonstrated that the mandibular central incisor with one canal was 73.53% and multiple canals was 26.47% in treated teeth. The mandibular lateral incisor with one canal was 70.67% and multiple canals were 29.33% in treated teeth. However, with OM result showed that the 8 (53.3%) additional second canal orifice was located, and 8 (53.3%)

previously identified canals were negotiated in our study. Thus, previous studies have demonstrated that the obvious need of a microscope for optimum vision in endodontics^{4,10} as shown in the results of our study.

It was concluded that the type of magnification devices (microscope, endoscope, magnifying loupes) used for many purposes only minimally affect the treatment outcome.¹¹ In this study, we only used OM to detect the mandibular second canal. In the literature, the study comparing endodontic therapy performed with/without magnification devices also have been discussed that the use of different magnification devices and visual



The radiographs exposed of each tooth from the proximal side to demonstrate the pathway of second canal



The roots were sectioned to verify the absence or presence of the second canal

Figure 1: The radiographs and the sectioned roots to demonstrate the pathway of second canals.

	Without OM	With OM	Total	With radiographic/sectionally	Total two canal number
Located teeth number	3 (20%)	8 (53.3%)	11 (73.3%) located of total 15 teeth	4	15
Negotiated teeth number	2 (13.3%)	8 (53.3%)	10 (66.6%) negotiated of total 15 teeth	5	15

Table 1: The number and percentage of located and negotiated teeth with/without Operation Microscope

visual acuity of dentists may have a significant impact on the success of endodontic procedures. Perrin *et al.* concluded that the visual performance decreased with increasing age under the specific clinical conditions of each dentist's private practice. Magnification aids can compensate for visual deficiencies.¹² In another study have been showed that near visual acuity varies highly between individuals and decreases during the lifetime. Independent of age or natural vision, visual acuity can be significantly improved by using magnification devices.¹³ Also, to use two or more magnification devices can be improves to the success of endodontic therapy.¹¹

This study was undertaken to assess the

potential of operating microscope to facilitate treatment of second or very fine root canals in mandibular incisors. As we see the results of present study, operating microscope facilities the ability of locating and negotiating of those canals tremendously and improves the percentage of success. Within its limitations, this study suggested that use of the operating microscope enhanced both the detection and negotiation of second canal in mandibular incisors.

Conclusion:

As in common knowledge today magnification and illumination provided by the operating microscope enhance the clinician's control in difficult procedures and in conclusion operating microscope remarkably improves location and

negotiation of second canals in mandibular incisors.

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