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Dr. Ankush Jasrotia
Department of Conservative
Dentistry and Endodontics,
Indira Gandhi Govt. Dental
College and Hospital, Jammu,
Jammu and Kashmir, India

Dr. Ravinder Kumar Bhagat
Department of Conservative
Dentistry and Endodontics,
Indira Gandhi Govt. Dental
College and Hospital, Jammu,
Jammu and Kashmir, India

Dr. Kanchan Bhagat
Department of Conservative
Dentistry and Endodontics,
Indira Gandhi Govt. Dental
College and Hospital, Jammu,
Jammu and Kashmir, India

Assessment of efficacy of two different irrigation techniques in patients undergoing endodontic therapy

Dr. Ankush Jasrotia, Dr. Ravinder Kumar Bhagat and Dr. Kanchan Bhagat

Abstract

The present study was conducted to compare two different irrigation techniques in patients undergoing endodontic therapy. It comprised of 60 freshly extracted mandibular premolars. Teeth were divided into 3 groups of 20 each. In group I (Control), teeth were irrigated with distilled water solution during preparation. In group II teeth were irrigated with 5.25% sodium hypochlorite & 17% EDTA and in group III teeth were irrigated 5.25% sodium hypochlorite and 17% EDTA agitated with Passive Ultrasonic Irrigation. The samples were prepared and observed under a scanning electron microscope (SEM). The photomicrographs were recorded and evaluated with a scoring system. There was significant difference in occurrence of smear layer at different level of tooth surface in group I whereas no significant difference was observed in group II and group III.

Keywords: Smear layer, passive ultrasonic irrigation, scanning electron microscopy

1. Introduction

Bacteria have long been recognized as the primary etiologic factors in the development of pulp and periapical lesions. Successful root canal therapy depends on thorough chemomechanical debridement of pulpal tissue, dentin debris, and infective microorganisms. Irrigants can augment mechanical debridement by flushing out debris, dissolving tissue, and disinfecting the root canal system [1]. Chemical debridement is especially needed for teeth with complex internal anatomy such as fins or other irregularities that might be missed by instrumentation [2]. Ideal requirements of root canal irrigants are that it should have broad antimicrobial spectrum, high efficacy against anaerobic and facultative microorganisms organized in biofilms, ability to dissolve necrotic pulp tissue remnants, ability to inactivate endotoxins and ability to prevent the formation of a smear layer during instrumentation or to dissolve the latter once it has formed [3]. The irrigating process has three objectives as advocated by the Walker: (1) Dissolution of remnant tissue, (2) antimicrobial action, and (3) lubrication of the canal. Many researchers have pointed out that the smear layer is difficult to remove [4]. One of the irrigants should be a chelating agent to remove it more effectively. Earlier, Abbott *et al.* [5] had advocated that irrigation with 17% ethylenediaminetetraacetic acid (EDTA) followed by 5.25% sodium hypochlorite (NaOCl) produced very clean surface of root canals. Passive ultrasonic irrigation should be introduced in the canal once that the root canal system has a final apical size and taper. A fresh solution of irrigant should be introduced and a small file size #15 is ultrasonically activated which moves freely in the root canal without contact the root canal walls [6, 7].

The present study was conducted to compare two different irrigation techniques in patients undergoing endodontic therapy.

2. Materials and Methods

The present study was conducted in the department of Endodontics. It comprised of 60 freshly extracted mandibular premolars. Teeth were divided into 3 groups of 20 each. In group I (Control), teeth were irrigated with distilled water solution during preparation, group II teeth were irrigated with 5.25% NaOCl & 17% EDTA and in group III teeth were irrigated with 5.25% NaOCl and 17% EDTA along with passive ultrasonic irrigation. The samples were prepared and observed under a scanning electron microscope (SEM). The photomicrographs

Correspondence

Dr. Ankush Jasrotia
Department of Conservative
Dentistry and Endodontics,
Indira Gandhi Govt. Dental
College and Hospital, Jammu,
Jammu and Kashmir, India

were recorded and evaluated with a scoring system. The amount of smear layer remained on the surface of the root canal or in the dentinal tubules was scored according to the following criteria: 0 = no smear layer: No smear layer was detected on the surface of the root canals and all tubules were

clean and open; 1 = moderate smear layer: No smear layer was observed on the surface of the root canal, but tubules contained debris; and 2 = heavy smear layer. The smear layer covered the root canal surface and the tubules. Results thus obtained were subjected to statistical analysis.

Table 1: Distribution of teeth

Group	Group I	Group II	Group III
Solution	Distilled water	5.25% NaOCl and 17% EDTA	5.25% NaOCl and 17% EDTA activated with passive ultrasonic irrigation
Number	20	20	20

3. Results

On the basis of the observations made in this study following results were obtained:

There was statistically significant difference between Group I with rest of two groups (Group II and III) with p value of 0.04 (P < 0.05) (Figure 1), (Table 2) (Graph 1) and there was no statistically significant difference between the Group II and Group III (Figure 2 and 3), (Table 2) and (Graph 1).

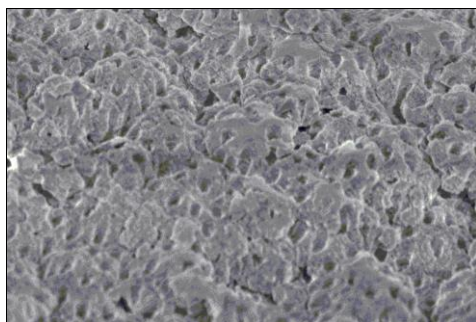


Fig 1: Scanning electron microscope images of group I.

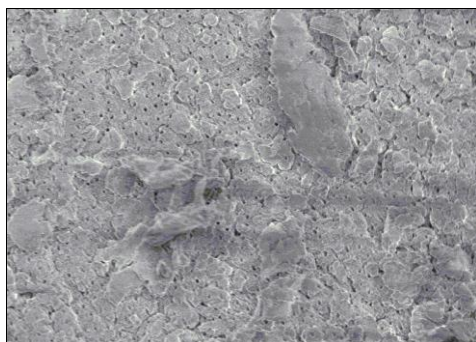


Fig 2: Scanning electron microscope images of group II.

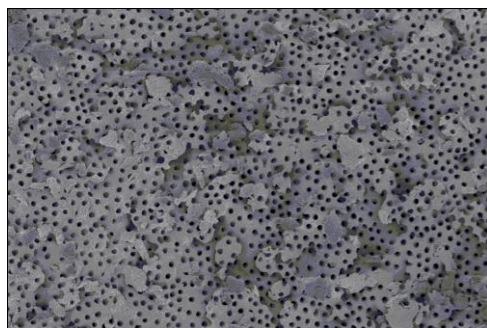
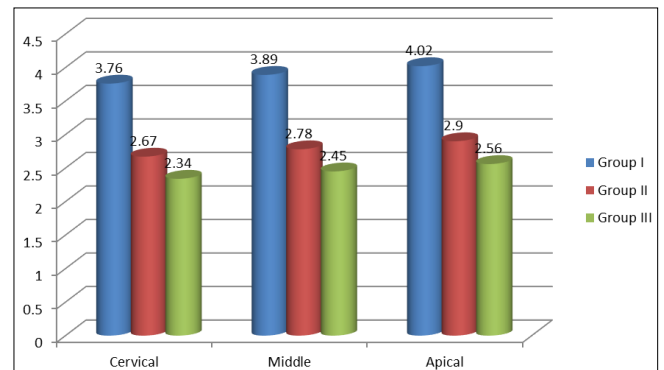


Fig 3: Scanning electron microscope images of group III.

Table 2: Comparison of smear layer score in all groups

Surface	Group I	Group II	Group III
Cervical	3.76	2.67	2.34
Middle	3.89	2.78	2.45
Apical	4.02	2.90	2.56
P value	0.04	0.21	0.32



Graph 1: Comparison of smear layer score in all groups

4. Discussion

The first researchers to describe the smear layer on the surface of instrumented root canals were McComb and Smith [8]. They suggested that the smear layer consisted not only of dentin as in the coronal smear layer, but also the remnants of odontoblastic processes, pulp tissue, and bacteria. Mader *et al.* [9] reported that the smear layer thickness was generally 1-2 μm. They discussed the smear material in two parts: First, superficial smear layer and second, the material packed into the dentinal tubules. Packing of smear debris was present in the tubules to a depth of 40 μm.

The purpose of this study was to evaluate effectiveness of two different irrigation systems in removing dentin smear layer in roots of mandibular premolar teeth. Scanning electron microscopy was chosen because it has been used to determine the effectiveness of various irrigants to remove the smear layer. Plenty of studies have been presented the removal of the smear layer in the single rooted teeth.

After shaping the root canal, cleaning can be completed with passive sonic/ultrasonic or a final flush of syringe irrigation [10]. PUI was first described by Weller *et al.* [11] The term "passive" does not adequately describe the process, as it is, in fact, active; however, when it was first introduced the term "passive" related to the "noncutting" action of the ultrasonically activated file. PUI relies on the transmission of acoustic energy from an oscillating file or smooth wire to an irrigant in the root canal. The energy is transmitted by means of ultrasonic waves and can induce acoustic streaming and cavitation of the irrigant [12].

We included 60 mandibular premolars. We found that there was significant difference in occurrence of smear layer at different level of tooth surface in group I whereas no-significant difference was observed in group II and group III. Ciucchi *et al.* [13] in their study compared the efficacy of different irrigants including ethylenediaminetetraacetic acid (EDTA), EDTA along with ultrasonication, citric acid, and mixture of tetracycline isomer, an acid, and a detergent (MTAD) as final irrigants whereas sodium hypochlorite (NaOCl) was used in each experimental group during root

canal preparation with special emphasis on the apical third. Forty-five human upper anterior teeth were selected and divided into one control group (group 1) and four experimental groups (group 2 to group 5), each containing nine teeth. All the four experimental groups were irrigated with 5.25% NaOCl solution during preparation, whereas test irrigants (5 mL) as the final solution used in each experimental group were 17% EDTA, 17% EDTA along with passive ultrasonic irrigation, 25% citric acid, and MTAD, respectively. The samples were prepared and observed under a scanning electron microscope (SEM). The photomicrographs were recorded and evaluated with a scoring system. None of the combined irrigants was found completely effective. All the test irrigants including MTAD worked well in the middle and cervical third, whereas MTAD showed excellent results in the apical third as compared to the other groups.

5. Conclusion

Both of the irrigation techniques found to be equally effective in patients undergoing endodontic therapy.

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