Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies ***NLM ID:*** *101716117*

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Index Copernicus value = 85.10

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Efficacy of various irrigation systems in removal of debris from root canal walls

Sapanpuneet Kaur

House No-1, Greater Mohali, Sunny Enclave, Sector-125, Pincode-140301, Desu Majra, Punjab, India
Current Address- Soraway, Sacramento, California

ABSTRACT:
Background: Success of root canal treatment depends on good biomechanical preparation. The present study was conducted to compare the efficacy of various irrigation systems in removal of debris from root canal walls. **Materials & Methods:** 60 freshly extracted human teeth were divided into 15 each of 4 groups. In group I, conventional irrigation with needle and syringe using saline was done. In group II, irrigation with Max-I-Probe needles using NaOCl and ethylenediaminetetraacetic acid (EDTA) and in group III, irrigant activation with Endo Activator using NaOCl and EDTA, group IV irrigation with Endovac was done. Scoring criteria was compared. **Results:** The mean debris score in group I was 2.7, in group II was 2.2 and in group III was 0.7, group IV was 1.2 The difference was significant (P< 0.05). **Conclusion:** EndoActivator performed much better than other available systems.
Key words: Debris, MAX-I-PROB , EndoActivator, Endovac.

Received: October 20, 2020 Accepted: November 27, 2020

Corresponding author: Dr. Sapanpuneet Kaur, House No-1, Greater Mohali, Sector-125, Pincode-140301, Desu Majra, Punjab, India, Current Address- Soraway, Sacramento, California

This article may be cited as: Kaur S. Efficacy of various irrigation systems in removal of debris from root canal walls. J Adv Med Dent Scie Res 2020;8(12):201-204.

INTRODUCTION

Success of root canal treatment depends on good biomechanical preparation. Despite all efforts, it is evident that bacteria can still survive in certain inaccessible areas.[1] The aim of an endodontic treatment is to eliminate micro-organisms from infected radicular canals using a biomechanical procedure combined with an antibacterial therapy to achieve the periapical tissue healing.1In clinical practice.[2] The goal of instrumentation is to remove some hard tissue from the root canal, facilitate satisfactory delivery of irrigants to the apical anatomy and give the canal system a shape that allows both a predictable and a permanent root filling.[3] Mechanical instrumentation alone or with saline irrigation cannot predictably eliminate the bacteria from infected root canals, whereas instrumentation combined with adequate irrigation is mandatory to complete the cleaning process and reduce the microbial load in the canal system. Byström et al, established that mechanical instrumentation alone is inefficient and supporting actions of disinfectants such as NaOCl are still necessary. Chow[4] showed that the efficacy of apical irrigation is directly related to the depth of insertion of the needle, which at times presents a challenge to the clinician.

The ability of an irrigant to reach the apical portion of the canal depends on the size of mechanical instrumentation, canal anatomy and delivery system; for optimal effective-ness, irrigants must have direct contact with the entire root canal wall. Therefore, different manual and mechanical agitation techniques have been proposed to deliver the irrigant solution into the apical area of the root canal: needle irrigation, hand files, rotary brushes, gutta-percha cones, ultrasonic and sonic devices.[5] The present study was conducted to compare the efficacy of various irrigation systems in removal of debris from root canal walls.

MATERIALS & METHODS

The present invitro study was conducted among freshly extracted 60 mandibular premolar and molars. After cleaning the teeth of calculus and extraneous soft tissue, the teeth were stored in 10% buffered formalin solution. Access opening was done with the help of Endo Access and Endo Z burs. Biomechanical preparation was done in all specimens. Teeth were divided into 4 groups. In group I, conventional irrigation with needle and syringe using saline was done. In group II, irrigation with Max-I-Probe needles using NaOCl and ethylenediamine tetra acetic acid (EDTA) and in group III, irrigant activation with Endo Activator using NaOCl and EDTA and in group IV endovac irrigation technique was done.

Scoring criteria score 0: No smear layer, more than 80% of the dentinal tubules open and free of debris. Score 1: Minor smear layer, more than 50% of the dentinal tubules open and free of debris. Score 2: Heavy smear layer, more than 30% of the dentinal tubules open and free of debris. Score 3: Maximum obliteration of dentinal tubules was present, extremely heavy smear layer was present with no tubule orifice visible. The presence or absence of smear layer was evaluated by using electron microscope of 1000x power. Data thus obtained were clubbed together and were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of teeth

Groups	Group I	Group II	Group III	Group4
Method	Conventional irrigation with needle and syringe	Max-I-Probe needles + NaOCl + EDTA	Endo Activator + NaOCl + EDTA	EndoVac

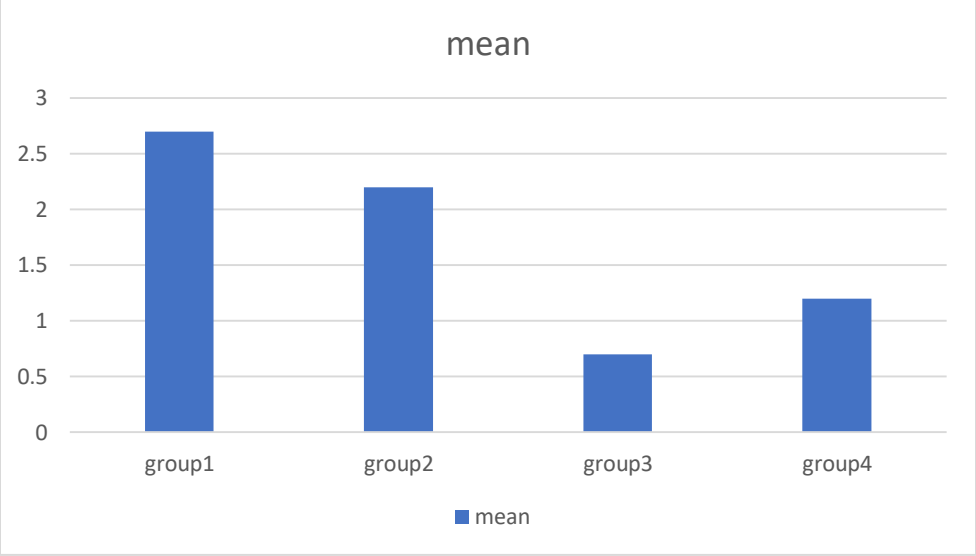
Table I shows that method of irrigation in different groups.

Table II Comparison of debris score

Groups	Mean	P value
Group I	2.7	0.01
Group II	2.2	
Group III	0.7	
Group IV	1.2	

Table II, graph I shows that mean debris score in group I was 2.7, in group II was 2.2 , in group III was 0.7 and group IV was 1.2 The difference was significant (P< 0.05).

Graph I Comparison of debris score



DISCUSSION

The aim of root canal treatment is to eliminate microorganisms from infected radicular canals using a biomechanical procedure to achieve the healing.[6] In clinical practice, the goal of instrumentation is to remove some hard tissue from the root canal, facilitate satisfactory delivery of irrigants to the apical anatomy and give the canal system a shape that allows both a predictable and a permanent root filling.[7] Mechanical instrumentation alone or with saline irrigation cannot predictably eliminate the bacteria from infected root canals, whereas instrumentation combined with adequate irrigation is mandatory to complete the cleaning process and reduce the microbial load in the canal system. The goal of irrigants is to increase mechanical debridement by flushing out debris, disinfecting the root canal system and dissolving pulp tissue. At present, there is no unique irrigant that meets all the conditions listed above, therefore, the method of choice has been the alternating use of EDTA and sodium hypochlorite solutions.[8] Although this conventional irrigation has been widely used and accepted in contemporary clinical practice, its action is insufficient to completely remove debris from the irregularities of the root canal anatomy. For this reason, numerous alternative irrigation methods have been proposed.[9] The present study was conducted to compare the efficacy of various irrigation systems in removal of debris from root canal walls.

In present study, we observed that mean debris score in group I was 2.7, in group II was 2.2 and in group III was 0.7, group IV was 1.2. Among the three different techniques endoactivator proved better followed by endoVac as compared to other irrigation techniques because very minor smear layer was found in endoactivator and more than 80% dentinal tubules are free from debris as per electron microscope. The EndoActivator system (Advanced Endodontics, Santa Barbara, CA) is a sonically driven canal irrigation device that produces vigorous intracanal fluid agitation. This sonic device seems to be more effective in the removal of bacteria and smear layer from the root canals than conventional irrigation. In addition Endovac has 1.2 mean score lesser as compared to group I and II techniques. Apical negative pressure irrigation technique with the placement of the EndoVac microcannulas to working length resulted in clean instrumented canal spaces. However, normal saline irrigation contains 2.7 mean value,heavy smear layer was found with only 30% dentinal tubules are free and open and rest filled with heavy layer. Max-i-Probe in our study was able to remove significantly more debris as compared to normal saline syringe technique. This may be due to the reason that Max-i-Probe has a laterally perforated needle which develops a laterally directed hydraulic pressure within the root canal. This mechanism allows the removal of the debris from the wall surfaces. Pavlović and Živković[13] in their study found that laterally perforated needles for irrigation allows more efficient cleaning of root canal walls as compared to end vented needles (conventional needles). On the other hand Compared with other study Kumar et al[10] compared the efficacy of different irrigation systems comparing irrigation with syringe and im needle, Max-I-Probe needle, EndoActivator and EndoVac in removing the smear layer generated at apical third. Instrumentation was done in 40 extracted premolars using different irrigation regimes (Group 1, saline and syringe; Group 2, Max-I-Probe needles with NaOCl and ethylenediaminetetraacetic acid (EDTA); Group 3, irrigant activation with EndoActivator using needles NaOCl and EDTA; and Group 4, irrigation with EndoVac using needles NaOCl and EDTA). The results for the Max-I-Probe needle group were 2.3 ± 0.48 with median value of 2.00 (2-3) The mean debris score for EndoActivator group were 0.8 ± 0.42 with median value of 1 (0-1). The mean debris score for EndoVac group were 0.4 ± 0.52 with median value of 1 (0-1).

According to other study Castagnola et al[12] compared the removal of smear layer and organic debris within the tooth canal among conventional needle irrigation, EndoVac and Endoactivator. Eighty single-rooted extracted human teeth were prepared with rotary NiTi instrumentation and randomly separated into 4 groups. Twenty teeth were used as positive control (Group 1), irrigated with only saline. Teeth assigned to Group 2 (n = 20) received irrigation with a conventional syringe and a 30-gauge needle (NaviTip, Ultradent, South Jordan, UT); samples in Group 3 (n = 20) were rinsed with an irrigation device based on apical negative pressure and teeth in Group 4 (n = 20) were treated with a sonic irrigation system. EndoActivator performed the best cleansing for both smear layer and organic debris in all root canal thirds, followed by EndoVac and conventional irrigation ($p > 0.001$). EndoVac and conventional irrigation showed better cleaning in the coronal area, whereas EndoActivator performed an homogeneous cleansing at all levels.

CONCLUSION

It has found that EndoVac and EndoActivator performed much better than other available systems.

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