Original Research Paper

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COMPARISON OF THE EFFECTIVENESS OF CONVENTIONAL, ULTRASONIC AND LASER ACTIVATED IRRIGATION TECHNIQUES IN REDUCING INTRACANAL ENTEROCOCCUS FAECALIS POPULATIONS: AN IN VIVO STUDY

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ABSTRACT

AIM: To determine the root canal irrigation technique that is most efficient at reduction of Enterococcus faecalis in persistent periradicular disease.

MATERIALS AND METHODS: 60 healthy adult patients presenting with symptomatic and radiographic evidence of chronic apical periodontitis were selected as study subjects and divided into 3 equal groups based on irrigation technique used. During and after canal preparation Group (Gp) 1 samples were irrigated with 3% NaOCl and 17 % EDTA using Max-i-probe side vented needle, which was used as control, Gp 2 & 3 samples were supplemented with ultrasonic & Diode laser activation of irrigants used in Gp 1, respectively. Pre and post intervention samples were collected using sterile paper points and transported in thioglycolate medium to the microbiological lab for incubation. The colony-forming units (CFUs) grown were counted by using Open CFU software. The value obtained was then transformed into actual counts based on the known dilution factors.

RESULTS: The percentage decrease in the E. faecalis was around 98.46%, 92.91% and 76.79% in Gp 3, Gp 2 and Gp 1 samples. The decrease in pre & post test microbial count was statistically significant under all three groups

CONCLUSION: Laser activation of 3% NaOCl and 17% EDTA is better than ultrasonic activation and conventional syringe irrigation of root canals in vivo. Laser disinfection is a viable option for incorporation in routine clinical practice to reduce E. faecalis in root canals prior to intracanal medication/obturation.

KEYWORDS :

INTRODUCTION:

Since the dawn of the modern endodontic era, meticulous effort has been put in towards achievement of the quintessential treatment outcome utilizing solid biomechanical principles. The past decade has seen a plethora of new developments and potential additions to the endodontists' armamentaria. Yet, it is the responsibility of all clinicians to make a fair assessment and decide the technique that is best suited to the individual patient's case.

Contemporary endodontic therapy places a premium on the meticulous cleaning of radicular spaces. For endodontic success, thorough removal of vital and necrotic remnants of pulp tissues, microorganisms, and microbial toxins from the root canal system is essential.[1] Therefore, chemomechanical debridement is an important part of endodontic treatment.[2,3] Elimination of pulpal tissue, microbiota and their by-products, and debris removal by using instruments and intracanal irrigants are objectives of this important phase of treatment.[3] Irrigation is an essential part of root canal debridement and several new agitation devices have been introduced to enhance the flushing action of the irrigant with the main objective of improving disinfection[4,5].

In the category of primary endodontic infections, E. faecalis has been found to be associated with asymptomatic chronic periradicular lesions significantly more than in acute infections. Enterococcus fecalis is a facultative anaerobic Gram positive coccus shown to be associated with failed endodontic treatment owing to the property of forming biofilms which are difficult to eradicate entirely.[6]

Endeavors have continuously been made to develop more effective irrigant delivery and agitation systems for root canal irrigation.[7] In addition to manual hand filing and irrigation with side vented needles, utilization of ultrasonic & laser devices assisted cleaning of root canals were utilized since recent decade. This study intends to find the effective methodology of irrigation system along with mechanical debridement of root canals.

METHODOLOGY:

Healthy adult patients presenting to Dental OPD with symptomatic and radiographic evidence of chronic apical periodontitis were selected as study subjects with following inclusion and exclusion criteria

Inclusion criteria: (a) Teeth with radiographic evidence of chronic periapical pathology. (b) Teeth with completely formed roots.

Exclusion criteria were: (a) Teeth requiring endodontic retreatment. (b) Teeth presenting with canal calcifications or severe canal curvatures.

Informed written consent was taken according to an exhaustive proforma explained to each patient. Ethical committee approval was obtained from Government Medical College & Hospital, Jammu. Sixty patients were randomly distributed into 3 experimental groups of 20 teeth each.

Group 1: conventional irrigation with 3% NaOCl and 17% EDTA using Max-i-probe side vented needles;
Group 2: irrigation with 3% NaOCl and 17% EDTA using Max-i-probe side vented needles supplemented with ultrasonic activation of the irrigant;
Group 3: irrigation with 3% NaOCl and 17% EDTA using Max-i-probe side vented needles supplemented with diode laser activation of the irrigant.

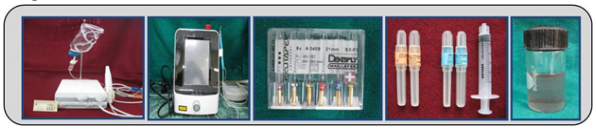

Fig 1a) Ultrasonic system ,b)Laser system, c) Protaper rotary files, d) I- max side vented needles f) Transport media

Rubber dam application and aseptic protocol were followed for each step. Before making access preparation with sterile burs, the teeth were washed with 3% NaOCl and hydrogen peroxide and neutralized with 5% sodium thiosulphate. Root canals were prepared using ProTaper rotary files (Dentsply). Pre and post intervention samples were collected using sterile paper points and transported in thioglycolate medium to the microbiological lab for incubation. Paper points were transferred to tubes containing 10 ml of Thyoglycolate broth (HiMedia Labs) and agitated in vortex for 1 minute. The tubes were preincubated for half an hour at 37ºC. After 10-fold serial dilutions in normal saline, 0.01 ml of broth was pipetted on to freshly prepared Bile Esculin azuride Agar (HiMedia Labs) and inoculated by spreader. The plate

was aerobically incubated at 37ºC for 48 hours. The purity of the cultures was confirmed by Gram staining, catalase production, colony morphology and using a biochemical identification kit (BacT Alert, bioMeriux, France). The colony-forming units (CFUs) grown were counted by using OpenCFU software. The value obtained was then transformed into actual counts based on the known dilution factors. Data so obtained was subjected to statistical analysis.

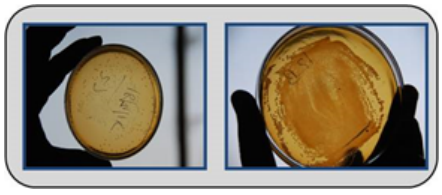

Fig 2. Microbiological analysis

RESULTS:

The Descriptive Statistics of all Pretest & Post Test scores for all three groups is as given below.

Paired Samples Statistics						% Decrease	p value (2-tailed)
		Mean	N	Std. Deviation	Std. Error Mean		
GROUP 1 (Control)	Pretest	59.2500	20	118.21	26.43	76.79%	0.009
	Posttest	13.7500	20	61.49	13.75		
GROUP 2 (Ultrasonic)	Pretest	126.9500	20	143.19	32.02	92.91%	0.002
	Posttest	9.0000	20	40.25	9.00		
GROUP C (Laser)	Pretest	410.4000	20	591.63	132.29	98.46%	0.007
	Posttest	6.3000	20	23.89	5.34		

Since p value is less than 0.05, the level of significance; the difference in Pretest & Posttest is significant on an average for all the three groups. Percentage reduction in microorganisms is the highest in Gp 3 and least in Gp 1.

DISCUSSION :

It has been reported that facultatives, such as enterococci were harder to eliminate than the strictly anaerobic part of the microbiota which was originally predominant.

Kvist et al[8] showed that there was no quantitative or qualitative difference between the two medications with respect to the micro-organisms that survived. So it follows that what survives is what was there before treatment, without much specific selection.

Gorni & Galiani [9] in 2004 indicated that the main problem with re-treatments is not a specifically resistant microbiota but rather anatomy which cannot be reached by disinfectants. Hence this study aimed to distinguish the better disinfection modality for primary endodontic infections.

Nusstein et al[10] in 2007 indicated that addition of ultrasonic irrigation was 7 times more likely to yield a negative culture in vivo than hand/rotary instrumentation. Effect of ultrasound is related to cavitation and acoustic streaming. Theirs was a polymicrobial study whereas the present study is specific to E. faecalis.

Gutknecht et al[11] 2006 reported that irradiation with the 980-nm diode laser can eliminate bacteria that have migrated deep into the dentin up to 500 µm, whereas chemical solutions can only reach 100 µm. According to Schoop et al[12] 2004, in contrast to higher wavelengths like those of the Er:YAG laser, diode lasers are poorly absorbed by dental hard substances themselves and allow the propagation of light through dentin.

In the study by Neelakantan et al[13] in 2015, the use of NaOCl after or in combination with a chelator caused the greatest reduction of E. faecalis. Diode laser and Er:YAG laser activation were superior to ultrasonics in dentinal tubule disinfection in an in vitro model.[13]

CONCLUSIONS:

Laser activation of 3% NaOCl and 17% EDTA is better than ultrasonic activation and conventional syringe irrigation of root canals in vivo.Laser disinfection is a viable option for incorporation in routine clinical practice to reduce E. faecalis in root canals prior to intracanal medication/obturation.

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