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Comparative Evaluation of Different Irrigation Techniques with Conventional Irrigation Technique for the Removal of Double Antibiotic Paste from Root Canal-An in vitro study

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ABSTRACT

Complete removal of infection, rendering root canal free of an organism is the prime aim of endodontic treatment. It cannot be achieved alone by biomechanical preparation due to the complexity of root canal treatment. Therefore the use of intracanal medicament is a must. The antibiotic paste is frequently used intracanal medicament, usually in regenerative cases. Hence the aim of the is to compare different irrigation technique for removal of double antibiotic paste from root canal through a stereomicroscope. 36 single-rooted were standardized to root length of 12mm then instrumented by Protaper rotary file up to size F4. Irrigation was done using sodium hypochlorite in between instrument change. The root canal was dried using paper point and filled by DAP and then randomly allocated to 3 groups (n=12) according to irrigation system used: conventional syringe irrigation (CSI), Passive ultrasonic irrigation (PUI), EndoVac (EV). Roots were then longitudinally sectioned using the diamond disk and studied under a stereomicroscope using a scoring scale. Data were evaluated using one way ANOVA and Tukey test. Among all experimental group CSI was least efficient. PUI and EV showed greater efficiency but no significant difference between PUI and EV, but a significant difference between CSI and PUI, EV ($p < 0.05$). Use of irrigation activation system results in efficient removal of DAP compared to CSI.

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INTRODUCTION

Endodontic regeneration has proved to be a boon in the treatment of immature permanent teeth. (Diogenes *et al.*, 2013; Kriplani *et al.*, 2013) The prime protocol of this procedure is the complete canal disinfection, which is achieved by intracanal medicament. (Kamble *et al.*, 2017; Khatod *et al.*, 2020) TAP formulated by Hoshino *et al.* (1996) is most commonly used medicament for a regenerative procedure. (Hoshino *et al.*, 1996) Use of TAP has been discontinued because of its property of discolouring the tooth structure. (Trope, 2010) Thus use DAP can be done. After complete canal disinfection removal of medicament followed by placement of MTA plugin root canal (Thibodeau and Trope,

2007; Tawfik *et al.*, 2013). Ruparel *et al.* (2012); Kim *et al.* (2010) founded that antibiotic paste has a detrimental effect on stem cell in the apical papilla. Therefore, complete removal of medicament is must to avoid detrimental effect on stem cells. And to inhibit its result on sealer penetration and discolouration. (Zhu *et al.*, 2013; Villas-Bôas *et al.*, 2011) Conventional syringe irrigation is the most commonly practised method for removal of medicament but is not efficient enough for complete removal of it. (Mukherjee *et al.*, 2017; Reddy *et al.*, 2019) Therefore use of different irrigation activation system for efficient supply of irrigating solution and removal from the canal. (Khubchandani *et al.*, 2017; Patni *et al.*, 2016) EndoVac (EV) is based on apical negative pressure. (Chandak *et al.*, 2018; Schoeffel, 2008) Developed for delivering irrigants at the apical third of canal, for cleaning of the root canal. (Ahmad *et al.*, 1987) Passive ultrasonic irrigation (PUI) uses U file for irrigant actuation in the root. And allow removal of biofilm, permitting efficacious penetration of irritants in canal walls. (Schoeffel, 2008; Van Der Sluis *et al.*, 2007) Therefore the aim of to "evaluate the efficacy of different irrigation activation system for removal of Double Antibiotic Paste from root canal".

MATERIALS AND METHODS

36 single-rooted teeth were collected at decoronated to simulate 12mm root length of each tooth (Figure 1). Then instrumented up to F4 using pro taper rotary files (Figure 2). 1ml of 3% sodium hypochlorite was used in between every change of file. The double antibiotic paste was prepared by mixing metronidazole and ciprofloxacin in 1:1 ratio in distilled water to make a slurry-like paste (Figure 3). Using leptospiral medicament was placed in canal up to orifice and sealed using cavit for seven days and stored at 100% humidity for 7 days. Randomly teeth were allocated in each group such that 12 in each group

Group 1(CSI)

24 gauge needle was used and placed as apically as possible such that it does not adhere to the canal wall. 10 ml/min of 3% NaOCl was used as an irrigating solution (Figure 4).

Group 2 (PUI)

#15 U file was placed 1mm short of working length without adhering canal wall. The file was activated with a power setting of 6 and 10ml/min 3% NaOCl was agitated using it (Figure 5).

Group 3 (EV)

Initially 5ml of 3%NaOCl for 30 sec using microcannula was delivered in canal (Figure 6) followed by 5ml of 3%NaOCl for 30 sec using microcannula (Figure 7).

After this final wash using 1 ml of NS to remove remaining NaOCl, the canal was dried using paper point, and longitudinal cuts were placed on root using diamond disk deep enough but not penetrating the canal. Using chisel root was split into two halves (Figure 8). And then evaluated under stereomicroscope 25X (Zeiss) using scoring scale by Van Der Sluis *et al.* (2007). (Shin *et al.*, 2010) score 0 - the canal was empty; score 1- DAP was present in less than half of the canal; score 2 -DAP covered more than half of the canal, and score 3 - the canal was filled with DAP (Figure 9, Figure 10, Figure 11).

"Statistical analysis was done by descriptive, inferential statistics using one way ANOVA and multiple comparisons Tukey test and software used in the analysis were SPSS 24.0 version and EPI-INFO 7.0 version, $p<0.05$ is considered as the level of significance".

RESULTS AND DISCUSSION

Mean intracanal medicament left in conventional syringe irrigation was 2.41 ± 0.51, in passive ultrasonic irrigation it was 1.25 ± 0.45, and in EndoVac it was 1.41 ± 0.51 (Table 1). By using one way ANOVA statistically significant variation was found in mean intracanal medicament removal in three groups ($F=16.60, p=0.0001$). By using multiple comparisons, Tukey Test statistically significant difference was found in mean intracanal medicament removal between conventional syringe irrigation and passive ultrasonic irrigation ($p=0.001$) and between traditional irrigation of syringe and Endovac ($p=0.0001$) and no significant difference was found between passive ultrasonic irrigation and Endovac ($p=0.690$) (Table 2).

Figure 1: Single rooted specimen collected

It resulted that PUI was efficient enough for removal of DAP. A similar effect was seen by EV. conventional syringe irrigation is most frequently used for removal. However oval extensions of the canal in the apical area of the canal and inadequate deliv-

Table 1: Descriptive Statistics

Removal techniques	Sample size	Mean	Std. deviation	Std. error	95% confidence interval for mean-lower bound	95% confidence interval for mean-upper bound	Minim	Maximum
Conventional syringe irrigation	12	2.41	0.51	0.14	2.08	2.74	2.00	3.00
Passive ultrasonic irrigation	12	1.25	0.45	0.13	0.96	1.53	1.00	2.00
EndoVac	12	1.41	0.51	0.14	1.08	1.74	1.00	2.00

Table 2: Comparison between different group

Removal technique	Mean difference	Std.error	p-value	95% confidence level lower bound	95% confidence level upper bound
Conventional syringe irrigation compared to passive ultrasonic irrigation	1.16	0.20	0.0001 (significant)	0.67	1.66
Conventional syringe irrigation compared to EndoVac	1.00	0,20	0.0001 (significant)	0.50	1.49
Passive ultrasonic irrigation compared to EndoVac	-0.16	0.20	0.690 (not significant)	-0.66	0.32

Figure 2: Specimen instrumented upto F4

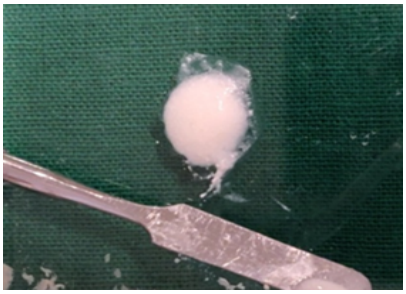

Figure 3: Freshly prepared double antibiotic paste

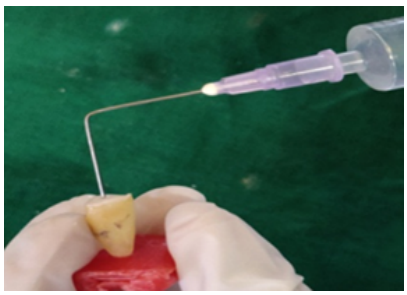

Figure 4: Specimen irrigated by syringe irrigation

Figure 5: Specimen irrigated by passive ultrasonic irrigation

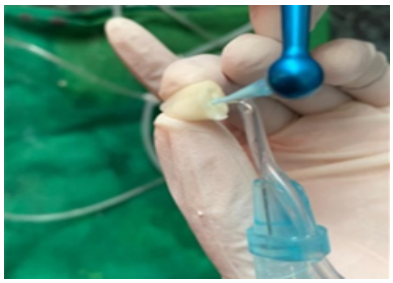

Figure 6: Specimen irrigated by EndoVac (macrocannula)

Figure 7: Specimen irrigated by EndoVac (microcannula)

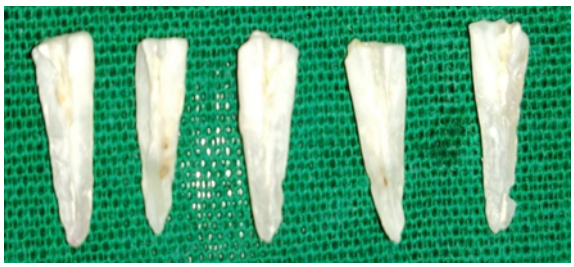

Figure 8: Longitudinally splitted root specimen

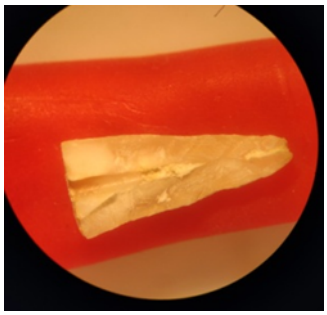

Figure 9: Stereo microscopic evaluation showing score 1

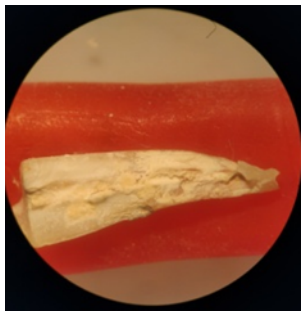

Figure 10: Stereo microscopic evaluation showing score 2

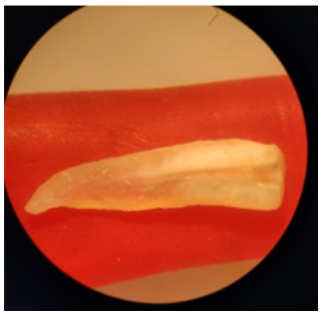

Figure 11: Stereo microscopic evaluation showing score 0

ery of irrigant might render it as failure and medicament may be left in canal. For adequate removal of medicament, there must be adequate delivery of irrigant up to WL. (Nielsen and Baumgartner, 2007; Taşdemir *et al.*, 2011) During PUI, acoustic microstreaming and cavitation resulting in efficient removal of debris or medication from canal compared to CSI and EV. But no significant difference compared to EV. Transmission of energy from ultrasonically oscillating file to irrigant in the canal is a principle of PUI. (Shin *et al.*, 2010; Kenee *et al.*, 2006) PUI was found to be efficient enough for removal of medicament in many studies, and suggestive of improved cleanliness of canal walls. (Ricucci and Langeland, 1997; Jiang *et al.*, 2011) PUI leads to increased velocity of irrigant flow which might result in its efficiency. Results of the current study for PUI group are the same as that of other studies in which maximum of Ca(OH)2 was removed but not totally. It can be because of lowest power intensity of the ultrasonic device. Jiang *et al.* (2011); Desai and Van Himel (2009) have seen cleaning efficiency increases following the output of the ultrasonic device. In future studies, a positive result might be gained using the increased output of ultrasonic activation. EV offer safe delivery of irrigant up to the apex of root and effective cleansing, especially in the apical region of the root canal. (Ahmetoglu *et al.*, 2013; Gu *et al.*, 2009) The EndoVac System showed efficient cleaning of the canal compared to CSI but no significant difference between PUI. Other studies were also following the above result.EV comprises of macro and microcannula. Cannula connected to a high-speed suction produces negative pressure which drags irrigant up to the apex of the cannula and evacuates the irrigant with debris through small holes. However, in our study, total success for removal of DAP was not attained. It might be because microcannulas and microcannulas might get obstructed by particles of DAP paste, which could have caused less irrigation solution to reach the apical region. (Gu *et al.*, 2009)

CONCLUSION

Within confinement of study, it can be stated that the use of irrigation activation system results in meliorate removal of medicament compared to CSI. Use of Passive ultrasonic irrigation showed promising results in removal of intracanal remedy compared to routinely followed syringe irrigation. Thus, the use of irrigation activation system might result in improved seal post obturation.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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