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COMPARATIVE VITRO STUDY- REMOVAL OF TRIPLE ANTIBIOTIC PASTE USING BY THREE DIFFERENT IRRIGATION METHODS IN STEREOMICROSCOPE EVOLUTION

Clinical Research

Dr. Monu Yadav Associate Professor, Department of Dentistry, Rajkiya Medical College Jalaun (Orai) UP.

Dr. Madan Mohan Niranjan SR, Department of Dentistry, Rajkiya Medical College Jalaun (Orai) UP.

Dr. Manoj Verma Associate Professor, Department of Orthopedics, Rajkiya Medical College Jalaun (Orai) UP.

Dr. Hena Rahman Assistant Professor, Department of Dentistry, Rajkiya Medical College Jalaun (Orai) UP.

Dr. Madhulika chandel JR, Department of Dentistry, Rajkiya Medical College Jalaun (Orai) UP.

Dr. Afreena Nasir* Assistant Professor, Department of Biochemistry , Rajkiya Medical College Jalaun (Orai) UP *Corresponding Author

ABSTRACT

AIM: To evaluate the efficacy of three different irrigations, Syringe irrigation with normal saline, with sodium hypochlorite and Passive ultrasonic irrigation with sodium hypochlorite methods in removal of Triple antibiotic paste.

MATERIALS AND METHODS: Comparative evolutionary study conducted Dept. Of Dentistry, Rajikiye medical college Jalaun (Orai) with 75 extracted single rooted mandibular first Premolar were selected. The working length was established and canal prepared by Pro-taper then irrigation was done with 2ml of 2.5% sodium hypochlorite after instrumentation and a final flush of 2ml of 17% ethylene diamine tetracetic acid was used. The roots were dried and fixed in eppendorf vials. Triple antibiotic paste was prepared by using with propylene glycol in the ratio 3:1 to obtain a paste form. The paste applied into the canals using until excess was visible at the apex and closed with ZOE, prepared stored in incubator at 37°C and 100% humidity for 7 days. All sample divided into three groups equally and irrigation was performed. Group I irrigated with normal saline, group II irrigated with Sodium Hypochlorite and group III, irrigated sodium hypochlorite continuously delivered into the root canal and the solution was agitated using ultrasonic file inserted. All the samples were observed under stereomicroscope of magnification 25x for the remaining triple antibiotic paste present in the canal followed by A scoring system used as proposed by Aksel et al score.

RESULTS: The results show that there is significant difference among the groups in terms of removal of TAP from the root canal ($p<0.001$). Group III had the least percentage of remaining TAP in the root canal followed by group II and group I. Pair wise comparison was made among the groups which showed that there was significant difference between group III and group I whereas there was no significant difference between group I and group II and group II and group III respectively.

CONCLUSION: Within the limitations of this study it could be concluded that none of the proposed irrigation methods removed TAP completely from the root canal. However 3% Sodium hypochlorite with passive ultrasonic irrigation resulted in better removal.

KEYWORDS

Intracanal medicament, Irrigation, Passive Ultrasonic Irrigation, Triple Antibiotic Paste, Endodontic therapy

INTRODUCTION:

The main goal of endodontic treatment in dentistry is the complete elimination of bacteria or infection from the root canal system. With the routine endodontic procedures followed, it is impossible to shape and clean the root canal completely[1]. This could be because of the complex root canal anatomy that includes the presence of apical deltas, oval extensions and isthmus [2,3]. The geometry of the instruments and the movement kinematics of the instruments inside the root canal space also make it impossible for complete debridement of the root canal system. So many factors involved for the success of root canal therapy in which the complete elimination of these diverse varieties of pathologic micro-organisms one of the most common. While mechanical preparation of the root canal serves as a primary mechanism for the elimination of the bacteria, irrigants and intra canal medicaments serve as a valuable adjunct. The irrigants can enhance the mechanical debridement by aiding in removal of smear layer, manual flushing of the debris out of the root canal, dissolving the necrotic and vital pulp tissues which serve as a harbour of microorganisms and by having an effective anti-microbial activity.

AIMS & OBJECTIVE:

To evaluate the efficacy and compare of three different irrigation methods in the removal of Triple antibiotic paste by Syringe irrigation with normal saline, sodium hypochlorite and Passive ultrasonic irrigation with sodium hypochlorite.

MATERIAL & METHODS:

In our study, included 75 single rooted extracted mandibular canine with mature apices. The selected teeth were ultrasonically cleaned to remove any soft tissue or calculus present on the root surface. The samples were stored in saline until use. The teeth were de-coronated at the level of CEJ with diamond disc attached to the micro-motor under water coolant. A standard root length of 18mm was obtained in all samples.

After proper cleaning and appropriate length, vitro shaping the canal with the help of pro-taper universal rotator system up to master file size F4. Irrigation was done with 2ml of 2.5% sodium hypochlorite solution between each instrument and a final flush was done with 2ml of 17% EDTA solution. The canals were dried with paper points. The samples were fixed in Eppendorf vials with silicone material Triple antibiotic paste was prepared in the ratio of 1:1:1 by using commercially available tablets (Amoxicilline 500mg, Metrogyl 400mg. Cyanomycin 100). The enteric coating of the tablets were removed and pulverised into a powder using motor and pestle. The powder was then transferred to a dapen dish and mixed with propylene glycol in the ratio 3:1 to obtain the paste form. Lentulo spiral was selected that does not bind with the canal walls. It was fixed to the slow speed contra-angle hand-piece and was inserted into the root canal 2mm short of the working length. The paste was carried into the root canal and applied until excess was seen at the apex. The orifice of the canal was sealed temporarily by placing a cotton pellet and closed with ZOE. The samples were stored in incubator in 37°C at 100% humidity for a period of 7days in the department of biochemistry.

Stored sample was divided into three groups each group content 25 samples and removed temporary seal and irrigation was done. Group I in which irrigation was done by using 30G side vented needle inserted 1mm short of working length. 10ml of normal saline was flushed into the canal for a time period of 1min, Group II in which irrigation was done by using 30G side vented needle inserted 1mm short of working length. 10ml of 3% sodium hypochlorite solution was flushed into the canal for a time period of 1min and Group III samples was irrigated by 10ml of 3% NaOCl (Sodium Hypochorite) was activated with the

irrisafe tip was attached to the scaler unit. The tip was inserted into the root canal 1mm short of the working length and activated at a power setting of 6 for a period of 1min all the samples were dried with paper points.

Evaluation of the remaning TAP in the canal: The samples were sectioned bucco-lingually using a diamond disc with copious water avoiding penetration into the root canal lumen and was split into two halves with a chisel. A total of 75 samples were obtained for each group and all the samples were analysed for the remaining TAP using stereomicroscope at 25x magnification. Final observation was done under the microscope by single observer. The amount of TAP remaining in the canal was measured by two methods,

1. The remaining TAP was measured in mm2 and was recorded as a percentage of overall surface area of the root canal space.
2. A scoring system as proposed by **Aksel et al** [4] was used to score the obtained percentage of remaining TAP in the canals:

Score 1 – less than 25% of the root canal filled with TAP,
Score 2 – 25-50% of the root canal filled with TAP,
Score 3 – 50-75% of the root canal filled with TAP,
Score 4 – 75-100% of the root canal filled with TAP.

The data were tabulated and statistical analysis was done.

RESULTS & STATISTICALANALYSIS:

The results were statistically analysed using one way ANOVA using High Significance Difference (HSD) test. In this study each group content 25 samples and mean values found in group I, II and III respectively 36.65, 31.98 and 24.54 as showed table 1. So group III has less mean value compare to Group I & II and group I has higher compare to group II and III. After statistical analysis results found as below in which p value was 0.019096 that's less than 0.05 so results is significant. When compare to each other group then found group I and III significant compare to others group combination as showed in table 3.

Table 1: Summary of data after statistical calculation

SUMMARY OF DATA				
	Group I	Group II	Group III	Total
N	25	25	25	75
∑X	916.37	799.5	613.5	2329.37
Mean	36.65	31.98	24.54	31.058
$\sum X^2$	37391.4549	30458.29	22422.05	90271.7949
Std. Dev	12.5865	14.2745	17.5199	15.564

Table 2: Showed difference between and within observation

RESULTS DETAILS				
Source	**SS**	**Df**	**MS**	$F = 4.18408$
Between-observation	1866.4645	2	933.2322	
Within-observation	16059.1358	72	223.0436	
Total	17925.6003	74		
The p-value is .019096. The result is significant at p < .05.				

Table 3: Pair wise comparisons among the all three groups and showed p value

Pair wise Comparisons		$HSD_{.05} = 10.1090$ $HSD_{.01} = 12.7079$	$Q_{.05} = 3.3844$ $Q_{.01} = 4.2545$
G_I:G_{II}	$M_1 = 36.65$ $M_2 = 31.98$	4.67	Q = 1.57 (*p* = .51310)
G_I:G_{III}	$M_1 = 36.65$ $M_3 = 24.54$	12.11	Q = 4.06 (*p* = .01480)
G_{II}:G_{III}	$M_2 = 31.98$ $M_3 = 24.54$	7.44	Q = 2.49 (*p* = .18998)

DISCUSSION & CONCLUSION

The success of the endodontic therapy is dependent on various factors that mainly govern the complete debridement of the root canal system of the pathological microorganisms. Though there is no general agreement defining the term "success" in endodontics, various studies have been carried out regarding the cause for the failure of the endodontic treatment.

So many studies conducted in different years and evaluating the antimicrobial efficacy of TAP and irrigation method that's help to removed of microbes and debris during Root canal. Various irrigation solutions and methods have various effects on the removal of intra-canal medicaments. **Ghivari et al in 2011**[5], they proposed that side vented needles were effective in removing root canal debris. The side vented needle is proposed to improve the hydrodynamic activation of the irrigant and also they reduce the chance of apical extrusion of the irrigants. NaOCl removes significantly more smear layer, bacteria, pulp tissue and dentine debris from the root canal than saline. As same in our study, we found NaOCl was better than normal saline but more effective irrigation method was passive ultrasonic instrumentation NaOCl. Also positive result found as **Cameron 1987, Metzler & Montgomery 1989** related with our study. Hence Passive ultrasonic activated NaOCl mopre effective than normal saline were used in this study. Few studies have been done so far comparing the efficiency of NaOCl when it is agitated with passive ultrasonic irrigation.

The result of this study showed that, there is no significant difference in the removal of TAP from the root canal when normal saline or sodium hypochlorite was used for irrigation with conventional syringe irrigation method. The mean percentage of remaining TAP in the root canal in group I (saline with conventional syringe irrigation) and group II (NaOCl with conventional syringe irrigation).

Though saline and NaOCl with conventional syringe irrigation showed no statistically significant difference, NaOCl efficiently removed TAP from root canal system compared to saline. Sodium hypochlorite as an irrigant removes more debris from the root canal when compared to normal saline. As 40% of the dentinal debris after root canal instrumentation is made up of organic material, the excellent tissue dissolving ability of NaOCl makes it more effective in removing debris from the root canal. But in the present study this tissue dissolving ability of NaOCl has no effective role in the removal of TAP as it is completely as inorganic material without passive ultrasonic method.

The results showed that passive ultrasonic irrigation with 3% sodium hypochlorite was the most effective in removal of TAP from the root canals with a mean residual percentage was statistically significant ($p<0.001$). The results were in accordance with the study done by **Arslan et al, 2014 and Akman et al, 2015.** Passive ultrasonic irrigation depends on the transmission of acoustic energy to the irrigants through the oscillating file or wire placed inside the root canal. After the root canal has been shaped to master apical file size, a smaller size file is introduced into the root canal filled with the irrigating solution and the file is activated. The activated file transmits the energy to the irrigant and induces acoustic micro-streaming and cavitation to the irrigant. Solution as the canal has been already shaped the passive non cutting movement of the freely oscillating file will cause deeper penetration of the irrigant solution in the root canal and also does not cause any aberrant cuts in the dentin walls. The ultrasonic device converts the electrical energy into ultrasonic waves of certain frequency. The property of the ultrasonic material used determines the frequency of the oscillating instrument. A higher frequency results in higher streaming velocity of the irrigant. The streaming resulting thus formed is inversely proportional to the surface area of the file touching the canal. This results in increased shear stress between the irrigant and the canal wall resulting in increased removal of the contents of the canal.

Acoustic streaming is the rapid movement of the liquid around an instrument in a circular or vortex like movement. When this occurs in case of root canal irrigation it is termed acoustic micro-streaming. In acoustic micro-streaming, a frictional force is created between the medium and the file carrying the vibrations. This result in the formation of streaming near the obstacles (nodes and antinodes) placed in the sound field. The streaming pattern of the irrigant from the apical to the coronal part of the canal[6] will improve the removal of debris from the root canal compared to conventional syringe irrigation method. Even though sodium hypochlorite is efficient in removing organic debris, the possible reasons for its improved efficiency in removing intra canal medicaments have been put-forth by **Lee et al in 2004.** The physical properties of NaOCl are different. It is a salt water suspension. Bubbles formed in salt water tend to be more numerous in number and they are smaller in size. These bubbles thus formed are less prone to coalesce[7]. Because of this, the acoustic micro-streaming will be different and could perhaps be more powerful. During PUI, gas will dissolve in the bubbles during cavitation and the oscillations of the bubbles depend upon the concentration of the dissolved gases, the temperature of the liquid used and the presence of small amount of surface impurities that are present on the bubble[8]. When NaOCl is used

as an irrigant for PUI, chlorine gas that is present in them gets dissolved in the bubbles. This will have an increased effect on the oscillation of the bubbles. This could also have led to the increased efficiency of sodium hypochlorite with passive ultrasonic irrigation.

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Within the limitations of the present study it can be concluded that, none of the proposed irrigation methods resulted in complete elimination of TAP from the root canals. 3% Sodium hypochlorite when used with Passive ultrasonic irrigation resulted in better removal of TAP from the root canals compared to 3% sodium hypochlorite used with conventional syringe irrigation and normal saline used with conventional syringe irrigation

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