Original Article

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COMPARATIVE EVALUATION OF 17% EDTA, 15% EDTAC, 5% CHLORINE DIOXIDE, 5.25% NAOCL ; IN REMOVAL OF SMEAR LAYER IN VITRO: A SEM STUDY

Gangamwar Neha[1], Chandak Manoj[2], Pradnya Nikhade[3], Saxena Ajay[4], Patel Aditya[5], Sawant Supriya[6]
1.PG student, SPDC,Wardha
2.Prof.,HOD.,SPDC,Wardha
3.Prof, SPDC,Wardha
4.Prof, SPDC,Wardha
5.Asso.Prof., SPDC,Wardha
6.PG student, SPDC,Wardha

ABSTRACT:

AIM:- The purpose of study is to compare the efficacy of smear layer removal by 17%EDTA,15% EDTAC, 5% Chlorine dioxide,5.25% NaOCl from root canal dentin.

Method:- 65 single rooted mandibular single rooted premolars were taken. After access cavity preparation, all sampls were prepared upto f3 with protaper universal system. Samples were divided into five groups. After final irrigation with 17%EDTA,15% EDTAC, 5% Chlorine dioxide,5.25% NaOCl and saline; samples were sectioned longitudinally with diamond disc. Scanning electron microscopic examination dine with five scale grading.

Statistical Analysis: one way ANOVA

All the groups were stasistically significant when campared with each other at coronal, middle and apical third

Result : On comparison, all EDTA,15%EDTAC, 5% chlorine dioxide , 5.25%NaOCl and saline the efficiency of 15% EDTAC was more than rest of all other irrigating solutions.

Key words: smear layer,EDTAC,ClO_2,EDTA.

INTRODUCTION:

The success of the root canal therapy depends on various factors; proper case selection, accurate diagnosis, proper cleaning and shaping, proper irrigation, quality root canal filling and good final restoration. Although many factors affect the success of the root canal treatment. Presence or absence of the infection is the main etiologic factor for pulp and periradicular pathologic processes. Schilder (1974)[1] defined cleaning and shaping as the removal of all contents of the root canal system that could possibly serve as substrate for bacterial growth, or as a source of periapical inflammation and the establishment of a specific cavity form that will facilitate root canal filling.

The component of the smear layer has been listed by Schulein TM (1988)[2] based on his SEM studies. It contains both organic and inorganic components. The organic components may

*Corresponding Author Address:Dr.Neha GangamwarEmail: nehagangamwar@gmail.com

consist of heated coagulated proteins (gelatin formed by the deterioration of collagen heated by cutting temperatures), necrotic or viable pulp tissue, odontoblastic processes, saliva, blood cells and micro organisms and inorganic portion of the smear layer contains minerals from the dentinal structures and some non specific inorganic contaminants.[3]

The smear layer associated with the endodontic instrumentation is currently thought to be a thin layer that occludes the orifices of the dentinal tubules and covers the intertubular dentin of the prepared canal wall. Whether it is beneficial or detrimental to a successful root canal therapy is still controversial.[4]

The purpose of this study is to compare and contrast the efficacy of 17%EDTA, 15% EDTAC, 5% chlorine dioxide and 5.25% NaOCl in removal of smear layer from the prepared root canal with the help of scanning electron microscope.

MATERIALS AND METHODS:

Sixty five freshly extracted human mandibular premolar with straight roots and single canals were used in study. Selected samples were randomly divided into fifteen samples in each group and five samples in control group.

Access opening was done with the help of high speed airotor and round bur no. 4(Mani, Japan) and the orifice were flared using gates glidden drills #2-4(Mani co. India). Canal patency was established through the apex and the working length was determined at 1 mm short from the apical foramen with K-file (Mani co. India) and confirmed by radiograph.

Two layers of utility wax was applied over the root tips to prevent irrigating solution from passing through apical foramina.

Root canal preparation was performed using K-file (Mani co. India) rotary ProTaper files (Densply, Tulsa Dent, India) at 240 rpm & 3 torque(X-smart, Dentsply with LCD display) 5 ml of 3% NaOCl and EDTA gel (RC Prep, primier Dental products, USA) in crown down technique master apical file #3o, i.e. F3 and flush the root canals with 5ml of 3% NaOCl by 30-gauge needle positioned in apical third.

At the end of the preparation all the samples were divided into four groups. Each group containing fifteen samples (n=15) and five samples in control group. Each sample was irrigated with 5ml solution of respective irrigant of each group for 1 min by 30 gauge needle.

SEM Evaluation:

Debris are defined as dentin chips, pulp remnants, and particles loosely attached to the root canal wall. The removal of smear layer and cleanliness of dentinal wall was graded using a 5 grade scale which was given by M. Hulsmann, M. Heckendorff& A. Lennon (1997).

Statistical Formulas:

Statistical test used for the analysis were Krushkal Wallis One way ANOVA Test,Mann Whitney U Test,Reliability Analysis.

RESULT:

Mean smear layer in coronal third group I was 1.26±0.59, in group II it was 1.13±0.35 , in group III it was 1.26±0.45, in group IV it was 2.33±0.72 and in group V it was 4.20±0.44. By using one way ANOVA Krushkall Wallis Chisquare test statistically significant variation was found in smear layer of all groups(א2-value=37.35,p-value=0.0001, S,p<0.05).

Mean smear layer at Middle Third in group I was 2.20±0.41, in group II it was 1.26±0.45 , in group III it was 2.33±0.48, in group IV it was 3.13±0.35 and in group V it was 4.20±0.44. By using one way ANOVA Krushkall Wallis Chisquare test statistically significant variation was found in smear layer of all groups(א2-value=59.17,p-value=0.0001, S,p<0.05).

Mean smear layer at Apical Third in group I was 2.46±0.74, in group II it was 1.20±0.41 , in group III it was 3.13±0.35, in group IV it was 4.13±0.35 and in group V it was 5.00±0.00. By using one way ANOVA Krushkall Wallis Chisquare test statistically significant variation was found in smear layer of all groups(א2-value=58.22,p-value=0.0001, S,p<0.05).

DISCUSSION:

Evolution of mankind from generation to generation, holds true even to the field of dentistry. Concept of concerning the role and purpose of this biomechanical preparation , however, have differed remarkably at different times in the development of endodontics and in the hands of different practioners and teachers.

Root canal irrigation plays an important role in the debridement and disinfection of the root canal system and is an integral part of root canal preparation procedures. It is generally believed that mechanical enlargement of canals must be accompanied by copious irrigation in order to facilitate maximum removal of microorganisms so that the prepared canal becomes as bacteria free as possible and should provide a mechanical flushing action. [5]

JeeraphatJantarat and KallayaYanpiset(2005)suggested that the formula contains 17%EDTA, cetrimide and a special surfactant. The surfactant is claimed to reduce the contact angle of the EDTA solution when placed on dentin surface and enhance cleaning efficacy.[6]

MuraliNath Reddy Jupalle , Ravi Kumar P, Srilatha V, Pallavi Reddy Y, Vishnuvardhan, Y5 Ramakrishna Ganta, (2013) suggested possible reason may be due to increased penetration of irrigant into the apical third of root canal and dentinal tubules . Surfactants reduce the surface tension and fluid viscosity, thus enabling the chelating solution to be carried more easily to the full depth of the canal. Smear clear which contain surfactants, cetrimide and two additional surfactants namely,

polyoxyethylene and iso-octylcyclohexyl ether.

Sandeep Singh , Vimal Arora , InderpalMajithia, Rakesh Dhiman, Dinesh Kumar, Amber Ather (2013) compared the efficacy of smear layer removal by 5% chlorine dioxide and 15%ethylenediamine tetra acetic acid plus cetavlon (EDTAC) from the human root canal dentin. . At the coronal third, no statistically significant difference was found between 15% EDTAC and 5% Chlorine dioxide in removing smear layer. In the middle and apical third region 15% EDTAC showed better smear layer removal ability than 5% chlorine dioxide. The capacity or smear layer removal or chlorine dioxide could be because of its low pH. i.e. 3.97 as studies confirm that pH of an irrigant is indirectly proportional to the amount of demineralization of root canal dentin. [7]

Salgado R et al. (2009) showed that worst results of smear layer removal were seen with NaOCl. Authors suggested that although sodium hypochlorite appears to be the most desirable single endodontic irrigant, it cannot dissolve inorganic particles. Hence, demineralizing agents such as EDTA and Citric acid have been recommended as adjuvant in root canal therapy.[8]

The present in vitro study suggest that although none of the irrigant are able to remove smear layer completely from root canal, EDTAC can satisfactory results as compared to all the other ingredient (i.e. 15% EDTA , 5% Chlorine Dioxide and 5.25% Sodium hypochlorite).

CONCLUSION:

Within the limitation, the study concludes that,

1. Minimum amount of debris and smear layer was observed with EDTAC irrigating solution in all the coronal, middle and apical third of canal.

2. Amount of debris observed with EDTA irrigating solution was similar with Chlorine Dioxide in coronal but lesser in middle and apical third.

3. Amount of debris observed with Chlorine Dioxide was lesser compared with Sodium Hypochlorite at all coronal, middle and apical third.

Limitations: This is an in vitro study therefore it is possible that the inferences from the study might not co-relate completely with the similar situations clinically, which needs to be evaluated.All the teeth were extracted from young patients undergoing orthodontic treatment. The physical properties of enamel and dentin may be different in other age group.

Scope: There is scope for research with an aim to remove smear layer completely in shortest time and in a safest way using different irrigants and combinations of these irrigating solutions with mechanical agitation provided by Sonic, Ultrasonic

instrumentation or a rotary file, may also performed to enhance smear layer removal from the root canal system.

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TABLES:

Table: 1 Division of Samples into Groups

Sr. No	No of Samples	Irrigating Solutions Used	Time
Group I	15	17% EDTA	1min
Group II	15	15% EDTAC	1min
Group III	15	5% Chlorine dioxide	1min
Group IV	15	5.25% Sodium Hypochlorite	1min
Group V	5	Saline	1min

Table 2:

Score	Criteria
Score 1	Clean root canal wall, only few small debris and particles
Score 2	Few small agglomerations of debris
Score 3	Many agglomerations of debris covering less than 50% of root canal wall
Score 4	More than50% of the root canal wall covered by debris
Score 5	Complete or nearly complete root canal wall covered by debris

Table 3: Comparison of Smear Layer at coronal third in five group

Group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Group I	15	1.26	0.59	0.15	0.93	1.59	1.00	3.00
Group II	15	1.13	0.35	0.09	0.93	1.32	1.00	2.00
Group III	15	1.26	0.45	0.11	1.01	1.52	1.00	2.00
Group IV	15	2.33	0.72	0.18	1.93	2.73	1.00	3.00
Group V	5	4.20	0.44	0.20	3.64	4.75	4.00	5.00

Table 4: Comparison of Smear Layer at middle third in five groups

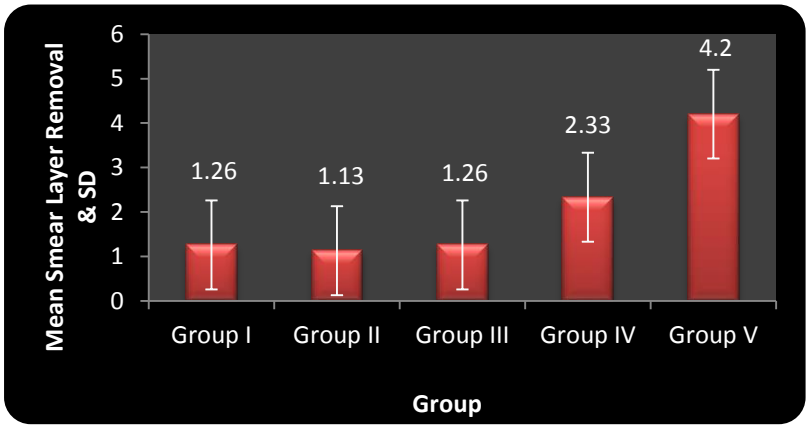
Group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Group I	15	2.20	0.41	0.10	1.97	2.42	2.00	3.00
Group II	15	1.26	0.45	0.11	1.01	1.52	1.00	2.00
Group III	15	2.33	0.48	0.12	2.06	2.60	2.00	3.00
Group IV	15	3.13	0.35	0.09	2.93	3.32	3.00	4.00
Group V	5	4.20	0.44	0.20	3.64	4.75	4.00	5.00

Table 5: Comparison of Smear Layer at apical third in five groups

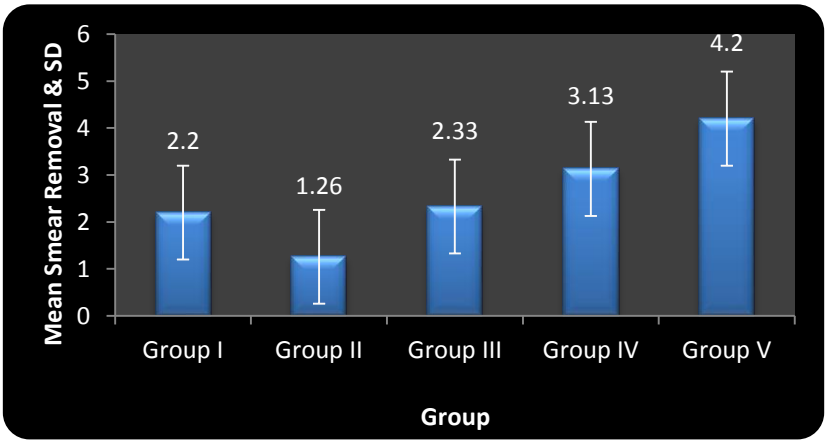
Group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		

Group I	15	2.46	0.51	0.13	2.18	2.75	2.00	3.00
Group II	15	1.20	0.41	0.10	0.97	1.42	1.00	2.00
Group III	15	3.13	0.35	0.09	2.93	3.32	3.00	4.00
Group IV	15	4.13	0.35	0.09	3.93	4.32	4.00	5.00
Group V	5	5.00	0.00	0.00	5.00	5.00	5.00	5.00

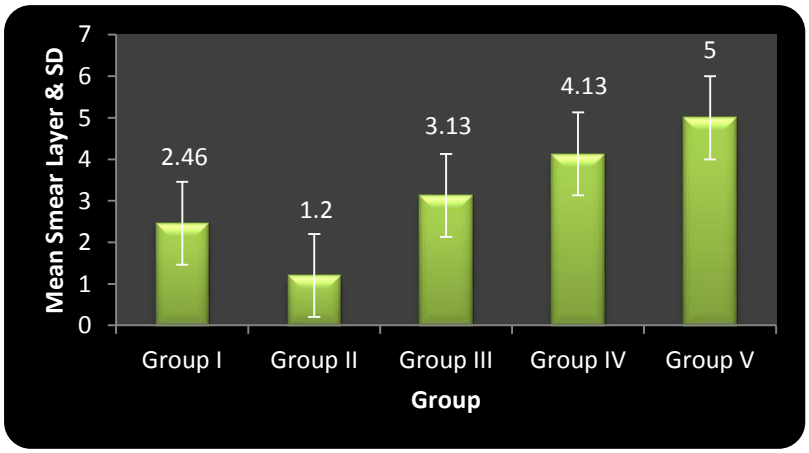
GRAPHS:



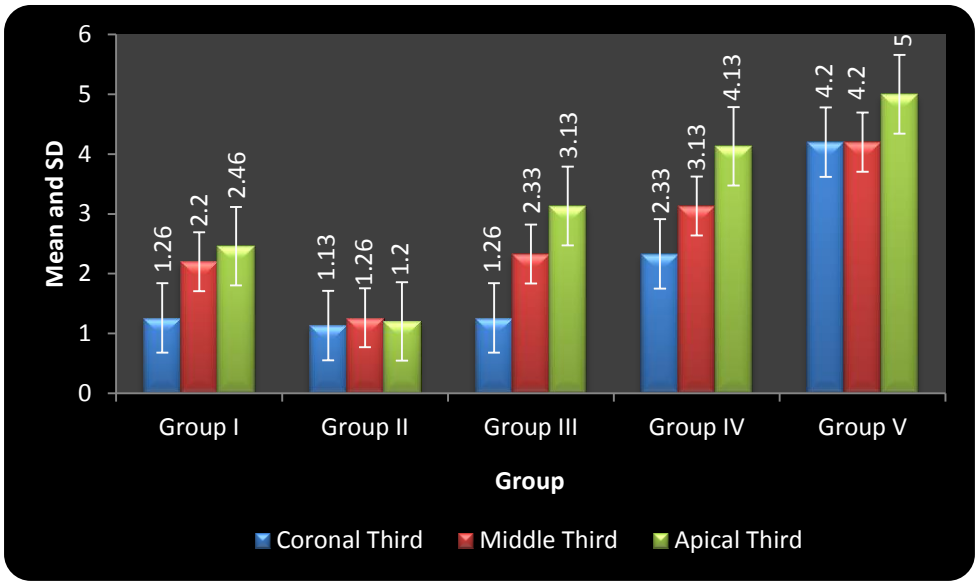
Graph 1: Comparison of Smear Layer at coronal third in five groups



Graph 2: Comparison of Smear Layer at middle third in five groups



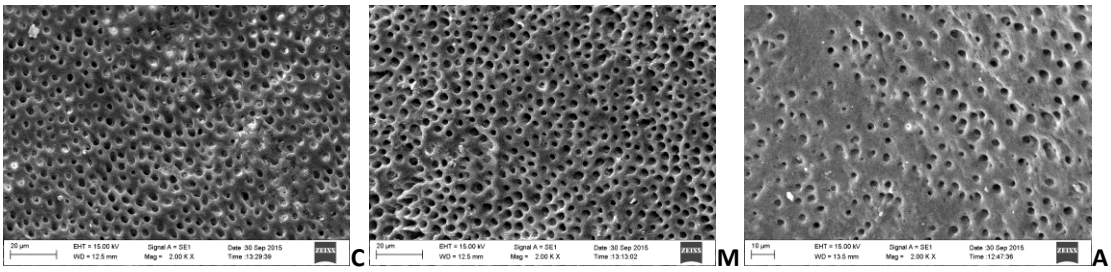
Graph 3: Comparison of Smear Layer at apical third in five groups



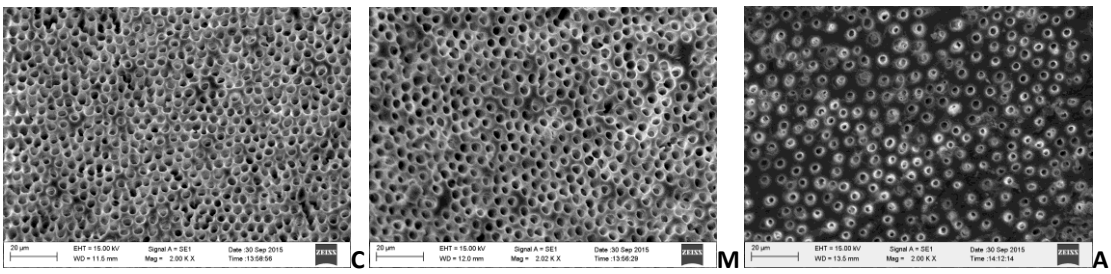
Graph 4: Comparison of Smear Layer in five groups at coronal, middle and apical third

Smear layer removal in scanning electron microscope images

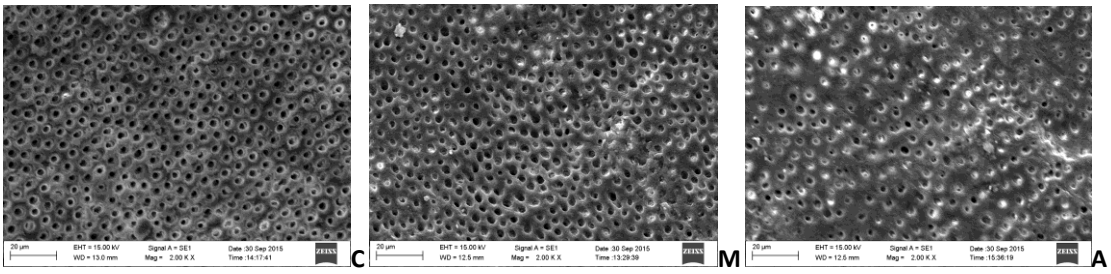
Group I (fig 1)



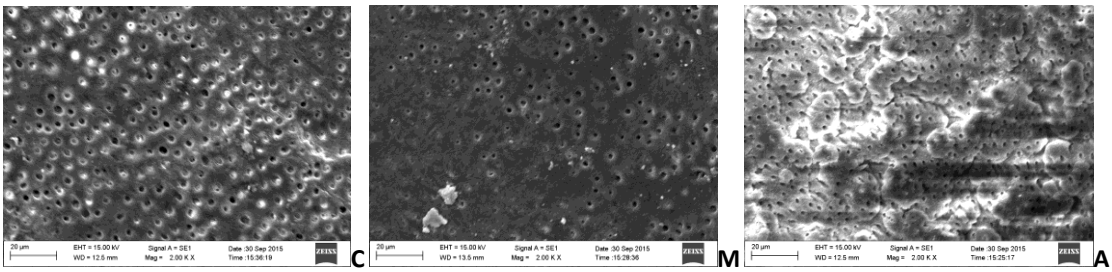
Group II (Fig 2)



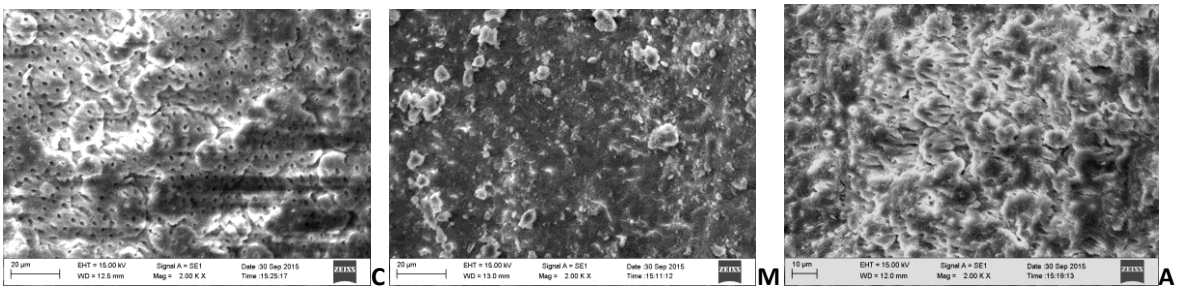
Group III (fig 3)



Group IV (fig 4)



Group V (fig 5)



C: coronal

M: middle

A: apical