A COMPARATIVE EVALUATION OF THE EFFECT OF FINAL ALCOHOL RINSE AND 5.25% SODIUM HYPOCHLORITE AS A FINAL IRRIGANT ON SEALER COVERAGE OF ROOT CANALS. AN IN VITRO STUDY

Brave Dexter,* Tyagi (Mrs) P.S, Brave (Mrs) V.R.*****

Tensioactive agents may alter dentinal wettability allowing increased sealer penetration into dentinal tubules. This may improve the apical seal and better entomb remaining bacteria. The purpose of this study was to determine if a final rinse of alcohol or sodium hypochlorite increased sealer coverage of root canal. The samples were randomly divided into four groups according to the method of sealer placement and final irrigant used. Group 1 file and 95% ethanol, group 2 file and 5.25% sodium hypochlorite, group 3 lentulospiral and 95% ethanol, group 4 lentulospiral and 5.25% sodium hypochlorite. The samples were obturated with AH26 as sealer mixed with carbon black powder and gutta percha. All samples were decalcified with 5% nitric acid and dehydrated in alcohol, followed by clearing in methyl salicylate. The cleared samples were measured under dissecting microscopefor sealer penetration with the help of millimeter scale. Although a final rinse of alcohol did not increase sealer coverage, a high variability was found in the middle and apical third portions of the root canals.

Key words: 95% ethanol, 5.25% sodium hypochlorite, nitric acid, methyl salicylate.

Pulpal necrosis and periapical inflammation are largely caused by bacteria. Once established in the root canal , bacteria have been found to invade deep into the dentinal tubules.[1] Canal instrumentation alone may not completely remove all bacteria.[2] During canal instrumentation , a smear layer is produced that prevents sealer penetration into the tubules.[3] Irrigation with 17% ethylene diamine tetra-acetic acid (EDTA) followed by 5.25% sodium hypochlorite (NaOCl) renders the tubules patent and allows sealer penetration during obturation.[4] Various methods have been suggested to increase the adhesion of sealers onto dentin. One of them is the use of alcohol to dehydrate canal walls before sealer placement.[5]

The purpose of this study was to determine if a final rinse with either 95% ethyl alcohol (95% ethanol) or 5.25% sodium hypochlorite (5.25% NaOCl) in instrumented, smear free canals would affect the sealer coverage of root canal , when the sealer is applied using either a file or a lentulospiral.

**Reader, **Professor and Head, Operative Dentistry and Endodontics*

****Professor, Dept. of Oral Pathology and Microbiology, Kothiwal Dental College and Research Centre, Moradabad – 244001, Uttar Pradesh, India.*

METHOD

40 extracted human single rooted mandibular premolars with root canal curvature < 30 degrees were stored in saline. Conventional access cavities were prepared and working length was established by subtracting 1mm from the apex. Cleaning and shaping was done using K files with the step back biomechanical preparation technique till apical size 35. Canals were flared coronally using Gates Glidden drills number 3 and 4. Throughout the cleaning and shaping procedure , the root canals were irrigated with 5.25% NaOCl and 17% EDTA solution. The teeth were randomly divided into four groups of 10 each according to the method of sealer placement and the final irrigant used. Group 1 file and 95% ethanol , group 2 file and 5.25% NaOCl , group 3 lentulospiral and 95% ethanol , group 4 lentulospiral and 5.25% NaOCl.

After canal preparation, final irrigation was done with 1 ml of 5.25% NaOCl for groups 2 and 4 and with

95% ethanol for groups 1 and 3 using 27 gauge needle placed deep in the canal. The canals were dried with fine paper points until no moisture was evident on the paper point.

AH26 sealer was mixed according to manufacturers directions. A small amount of carbon black powder was added to it to produce a gray colour which would be visible after clearing the teeth. The sealer was placed in the root canal in a quantity of 0.04ml which was measured with a tuberculin syringe and applied in the apical 10mm with a 35 sized K file for groups 1 and 2 and with a lentulospiral number 3 for groups 3 and 4. The canals were obturated immediately after sealer placement using the lateral compaction technique with gutta percha. Excess gutta percha and sealer were removed with a heated plugger and vertically condensed with hand pluggers. IRM (zinc oxide strengthened with polymethacrylate) was sealed in the access cavities. Teeth were decalcified using 5% nitric acid for 8 to 10 days. Teeth were dehydrated in an ascending series of graded alcohols (75%, 85%, 95%, 100%, 2 hrs each) and cleared by immersing them in methyl salicylate initially for 6 hrs and were stored permanently in methyl salicylate. After clearing with methyl salicylate each tooth was placed beside millimeter ruler under a dissecting microscope and readings were taken in coronal, middle and apical thirds of each sample.

Statistical evaluation was done by 't' test and analysis of variance.

OBSERVATIONS

Table 1 : Mean and standard deviations of all groups.

	ALCOHOL (mm) n = 10 FILE (Group 1)			SODIUM HYPOCHLORITE (mm) n = 10 FILE (Group 2)			ALCOHOL (mm) n = 10 LENTULOSPIRAL (Group 3)			SODIUM HYPOCHLORITE (mm) n = 10 LENTULOSPIRAL (Group 4)		
	C	M	A	C	M	A	C	M	A	C	M	A
MEAN	5.64	4.66	4.30	5.54	4.90	4.00	5.38	4.57	4.26	5.39	4.90	4.47
STANDARD DEVIATION (T)	0.31	0.74	1.48	0.40	0.69	0.97	0.40	1.23	0.75	0.44	0.59	0.58

C – Coronal third of the canal, M – Middle third of the canal, A – Apical third of the canal, n – sample size of each group.

Table 2 : 't' values and standard error for groups 1 and 2. (Comparison of coronal and middle third, coronal and apical third)

FILE and ALCOHOL (Group 1)			
Comparison	Mean changes (+/- S E)	't' value	Significance
C v/s M	0.98 (+/- 0.27)	3.69	P < 0.002 Significant
C v/s A	1.34 (+/- 0.50)	2.66	P < 0.05 Significant
FILE and SODIUM HYPOCHLORITE (Group 2)			
C v/s M	0.64 (+/- 0.27)	2.42	P < 0.05 Significant
C v/s A	1.54 (+/ 0.35)	4.39	P < 0.001 (Significant

Table 3 : 't' values and standard error for groups 3 and 4. (Comparison of coronal and middle third, coronal and apical third)

LENTULOSPIRAL and ALCOHOL (Group 3)			
Comparison	Mean changes (+/- S E)	't' value	Significance
C v/s M	0.81(+/- 0.43)	1.86	P < 0.05 Not Significant
C v/s A	0.27(+/- 0.22)	2.85	P < 0.05 Significant
LENTULOSPIRAL & SODIUM HYPOCHLORITE (Group 4)			
C v/s M	0.49(+/- 0.25)	2.0	P < 0.05 Not Significant
C v/s A	0.92 (+/- 0.24)	3.81	P < 0.002Significant

Table 4: 't' values and standard error for all groups (Comparison of middle and apical third)

FILE				
	Comparison	**Mean changes (+/- SE)**	**'t' value**	**Significance**
Middle	Alcohol v/s Sodium hypochlorite	0.24 (+/- 0.34)	0.71	P > 0.05 Not Significant
Apical	Alcohol v/s Sodium hypochlorite	0.30 (+/- 0.59)	0.51	P > 0.05 Not Significant
LENTULOSPIRAL				
Middle	Alcohol v/s Sodium hypochlorite	0.40 (+/- 0.34)	1.53	P > 0.05 Not Significant
Apical	Alcohol v/s Sodium hypochlorite	0.30 (+/- 0.45)	0.44	P > 0.05 Not Significant

RESULTS

1. For group 1, the mean sealer coverage values were 5.64mm for coronal, 4.66mm for middle, 4.30mm for apical thirds respectively and standard deviations were 0.31mm, 0.74mm and 1.48mm for coronal, middle and apical thirds respectively.

2. For group 2, the mean sealer coverage values were 5.54mm, 4.90mm and 4.00mm for coronal, middle and apical thirds respectively and standard deviations were 0.40mm, 0.69mm, and 0.97mm for coronal, middle and apical thirds respectively.

3. For group 3, the mean sealer coverage values were 5.38mm, 4.57 and 4.26mm for coronal, middle and apical thirds respectively and standard deviations were 0.40mm, 1.23mm and 0.75mm for coronal, middle and apical thirds respectively.

4. For group 4, the mean sealer coverage values were 5.39mm, 4.90mm and 4.47mm for coronal, middle and apical thirds respectively and standard deviations were 0.44mm, 0.59mm and 0.58mm for coronal, middle and apical thirds respectively.

There was a significant difference between the sealer coverage of coronal and apical thirds in all four groups and no significant difference between the middle and apical thirds of all four groups.

DISCUSSION

Failure following endodontic treatment has been attributed to many factors. One of them is incompletely sealed root canal space leading to

chronic periapical infection and other pathoses.[6] Development of an impervious seal is therefore imperative that involves the use of a solid core material which is obturated with a sealer. However none of the available sealers consistently prevent apical leakage.[7]

The lack of a primary bond may be due to the presence of residual moisture in the root canal that may prevent the sealer from completely coating the canal walls.[8] Alcohol, a volatile solvent has been suggested to dehydrate the canal walls before placement of the sealer.[9]

In the light of the above, this in vitro study was carried out to evaluate and compare the sealer coverage of the root canal using 95% ethanol or 5.25% sodium hypochlorite as final irrigant with the same sealer(AH26) and obturating material and technique, with the sealer being placed in the root canal using either a file or a lentulospiral.

Biomechanical preparation was done using step back technique as it presents with the best taper and apical stop design.[10] 5.25% NaOCl solution was used as dissolves vital tissue and necrotic tissue remnants at higher concentrations.[11] 95% ethanol was used as it has been reported to dehydrate the canal walls before sealer placement.[12] AH-26 sealer was used as it is superior to zinc oxide based sealers with respect to strength, flow, shrinkage adhesion and solubility.[13] Sealer placement was done using either a 35 K file or a lentulospiral. Gutta percha was used as a core filling material as it is the most commonly used obturation material[14,15], along with lateral compaction technique as it has been found to be the most effective obturation technique involving the use of gutta percha.[16] Carbon black powder was added to the AH26 sealer to impart a gray colour to make it miscible after clearing. It does not dissolve in nitric acid.

5% nitric acid was used as a decalcying agent as it is rapid in its action, causes less damage to the tissue and allows staining techniques to be applied. The samples were dehydrated in increasing strengths of ethanol because the clearing agent in not miscible in water but is miscible in alcohol.[17] Methyl salicylate was used in this study as it is less toxic than xylene and causes minimal tissue distortion when compared with other clearing agents.[18]

The best sealer coverage was seen in the coronal third with high variability in the middle and apical thirds. This may be due due the sealer being wiped off in the coronal part while being introduced with either a file or a lentulospiral, resulting in less sealer being available to coat the middle and apical portions of the canals. No statistically significant difference was observed in the sealer coverage when alcohol was used as the final irrigant as compared to sodium hypochlorite.

Lisa Wilcox et al (1995)[12] performed a study on sealer coverage of root canals using alcohol as final irrigant. They concluded that alcohol did not improve the sealer coverage of root canals when used as the final irigant.

The results of this study are in agreement with the studies carried out by Micheal C Hall et al (1996)[19] and M.K.Wu et al (2000)[20]. A recent study by Gregory T. Engel et al(2006)[21] also showed that a final rinse with 70% isopropyl alcohol did not increase sealer penetration neither affected apical microleakage.. Wettability of a surface been shown to be dependant on the chemical composition of the solid surface, its roughness and hydration state. Dentin has shown to become more hydrophobic after dehydration by exposing more hydrophobic moieties and may therefore make dentin more compatible with many endodontic sealers.[22]

CONCLUSION

Within the limits of this study it was concluded that irrespective of the final irrigant used the coronal third had more than 50% sealer present in all the teeth and the middle and apical thirds showed the most variability in sealer coverage. However further studies are required for determining the role of tensioactive agents that

may help in a better coverage of root canals with sealer.

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ADDENDUM to Vol. 25, March 2011, issue to article "All Ceramic System to Mask Gingival Discolouration – A Case Report.
Read Jurel S.K.** after author Kumar Rajeev*.
** *Asst Prof. (Prosthodontics), UP King George University of Dental Sciences, Lucknow*