

Comparative Evaluation of Microleakage of Endodontically Treated Teeth Using New Root Canal Sealers: An In Vitro Study

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ABSTRACT

Aim: The purpose of this study was to compare and evaluate the microleakage of endodontically treated teeth using new sealers.

Materials and Methods: Forty five extracted central incisor teeth were assigned and divided into 2 experimental (Roeko seal, Bioceramic) group and one control group (Zinc oxide eugenol). The samples were obturated with gutta percha and the sealers were applied according to the various groups. Thereafter, all the specimens were stored at 37 °C and 100% relative humidity in incubator for 24 hours then immersed in 2% methylene blue dye. Dye penetration was recorded under stereomicroscope and was considered as an indicator of microleakage. Analysis of variance (One Way ANOVA) and bonferroni tests were used for statistical analysis.

Results: The mean value of microleakage of bioceramic was statistically less than Roekoseal and Zinc oxide eugenol $p < 0.001$. Though intergroup comparison were highly significant with and within the groups at p value of < 0.001 .

Conclusion: Bio ceramic sealers being hydrophilic show better sealing ability compared to Roekoseal and eugenol-based sealers.

Keywords: Microleakage, sealers, bioceramic.

INTRODUCTION

A mindful practice is the objective that continuously monitors and re evaluates results and techniques over with introspection¹. The ultimate goal of the endodontic therapy should be to return the involved tooth to a state of health and function without surgical intervention. The success of root canal treatment depends mainly on appropriate cleaning, ideal shaping of canals and 3 dimensional obturation². Thus, obturation plays an important role and impedes any sort of communication between periapex, periodontal space and root canal.

The filling techniques which are most often applied involve the use of gutta-percha cones and an endodontic sealer²

Root canal sealers are considered a medium that play the role of lubricant, close the interface between obturation material and root canal dentin. Sealers also fill voids and irregularities in the root canal, lateral and accessory canals, and spaces between gutta-percha points used in lateral compaction thus preventing leakage. Therefore, if we are able to obtain an impermeable sealer we will be

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able to enhance success rate of root canal treatment immensely³.

The most popular commonly used sealers are zinc-oxide eugenol formulations, calcium hydroxide sealers non -eugenol sealers, glass ionomers and resins. Zinc oxide eugenol sealers though have a history of successful use over an extended period of time mainly because of its antimicrobial activity but they exhibit a slow setting time, shrinkage on setting which makes root canal susceptible for percolation of oral fluids apically and coronally and thus microleakage⁴

Therefore if we could replace zinc oxide eugenol with some other more biocompatible material which is forming a impermeable seal between the hydrophobic gutta percha and dentinal walls we might be able to reduce the microleakage and thus increase the success rate of root canal treatment immensely. Thus the present study has been undertaken to evaluate and compare the microleakage of endodontically treated tooth using different sealers.

AIMS AND OBJECTIVE

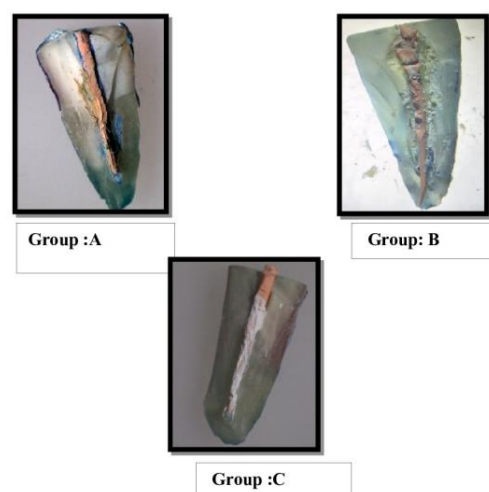
To evaluate and compare the microleakage of endodontically treated tooth using newly introduced bioceramic roekoseal keeping the zinc oxide eugenol as control under stereomicroscope.

MATERIAL AND METHOD

45 extracted anterior were taken for the study and were divided into three groups. Group A: Zinc Oxide Eugenol, Group B: Roeko Seal, Group C: Bioceramic. All the teeth were decoronated and instrumented using a rotary Protaper system up to size F3. Irrigation was done with 5.25% sodium hypochlorite, followed 17% EDTA and 5 ml of normal saline respectively for 30 second. Obturation was done using single cone of F3 gutta-percha (0.6% tape). The gutta percha was luted with the respective sealers of corresponding groups and placed into the prepared root canal. Thereafter the access cavity was sealed with intermediate restorative material. Nail varnish was applied on all the surfaces keeping 1mm of window in the apical region. All the specimens were placed in 2% methylene blue dye solution for 24 hours. After 24 hours, the samples were rinsed and cleaned with

tap water. Later the samples were split longitudinally parallel to long axis of the tooth subjected to microleakage. Each section was examined using a Stereomicroscope with microscope camera at 40X magnification to assess the linear breakthrough of the dye using the standard measurements of a Stereomicroscope and evaluated by a single operator via pictures. The results of the study were noted according to the scoring criteria :Score 0: Dye not visible on root canal walls Score 1: Dye visible on the root canal walls. Score 2: Dye infiltration upto half of the distance longitudinally. Score 3: Dye infiltration more than half of the root surface longitudinally. After the microleakge evaluation statistical analysis was done accordingly. Fig 1.

Fig 1:



- ✚ Group A(zinc oxide eugenol)
- ✚ Group B(roeko seal)
- ✚ Group C(bioceramic)

RESULTS

The data was statistically analyzed using SPSS Version 15.0. The Analysis of Variance (ANOVA) and Post-Hoc Test (Bonferroni) were performed to know the effect of each variable and to reveal the statistical significance. The values were represented in number and mean $\pm$ SD. For the purpose of statistical interpretation p value of 0.05 was considered statistically significant. The mean value of the microleakage for Group A (Zinc oxide

Eugenol), Group B (Roekoseal) and Group C (Bioceramic) were 3.33, 1.24 and 0.333 respectively. It was found that Group A (ZoE) had highest mean value followed by Group B (Roeko seal) and lowest in Group C (Bioceramic). Table 1

All the intergroup comparison were found to be highly significant when Bonferroni and post hoc test were applied at p value 0.05. Table 2.

Table 1: Mean value of microleakage in various groups

Group	N	Mean	Std. Deviation	Median
Group A	15	3.33	1.098	102
Group B	15	1.266	0.191	98
Group C	15	0.333	0.113	77

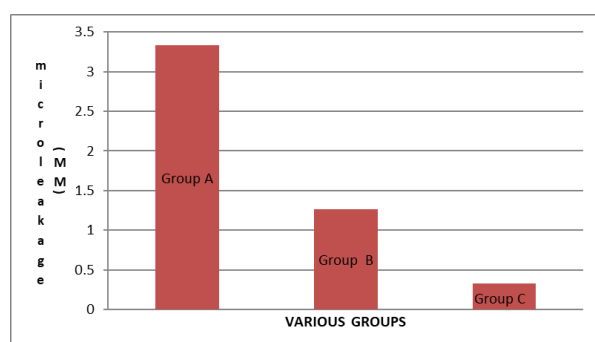
✚ Group A (zinc oxide eugenol)

✚ Group B (roeko seal)

✚ Group C (bioceramic)

Table 2: Intergroup comparison of microleakage among various groups was done by Post-hoc (Bonferroni Test)

	(I) GRP	(J) GRP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	1	2	-2.064	.17457	.000	-1.3687	-.4980
		3	2.997	.17457	.000	-3.4353	-2.5647
	2	1	-2.064	.17457	.000	.4980	1.3687
		3	.933	.17457	.000	-2.5020	-1.6313
	3	1	-2.997	.17457	.000	2.5647	3.4353
		2	0.933	.17457	.000	1.6313	2.5020



Graph 1: The mean microleakage among all the group.

✚ Group A: Zinc Oxide Eugenol

✚ Group B: Roeko Seal

✚ Group C: Bioceramic

DISCUSSION

Endodontics or root canal therapy is a sequence of treatment for the infected pulp of a tooth which results in the elimination of infection and the protection of the decontaminated tooth from future microbial invasion. The obturation of the prepared radicular space has been achieved by using a wide

variety of materials selected for their intrinsic properties and handling characteristics. These core materials have been classified as cements, pastes or solids. Gutta-percha, in its various forms, has remained the paragon as a root canal filling material during the course of the last century. Because of its various advantages like compatibility, non porous, radioopacity, dimensionally stable and good tissue tolerance³⁵. It was first introduced in 1847 and is considered the gold standard in root filling material. But gutta percha is a non-adhesive material so there remains interfacial gaps between the material and root canal walls. Here comes the role of the root canal sealers which are necessary to seal the space between the dentinal wall and the obturating core interface. The root canal sealer is used to fill any irregularities or minor discrepancies between the gutta-percha filling material and canal walls. An ideal sealer should be tacky when mixed, must be able to provide adhesion/sealing between the canal walls and the core obturating material. It should be flowable and non-irritating to the tissues. It should also be bactericidal and must be radio-opaque. Keeping this in mind the following study was aimed to evaluate the microleakage on endodontically treated tooth using new root canal sealers.

In present study mean microleakage of Bioceramic sealer was statistically lesser than RoekoSeal and zinc oxide eugenol. The obturation done with bioceramic showed least microleakage as it is a premix calcium phosphate silicate based sealer dispersed in non aqueous but water miscible carrier which harden on exposure to moisture in root dentin. It is hydrophilic in nature and it expands on setting forming a self seal. This expansion reaches upto 0.02% on completion of the setting reaction. This chemical and micromechanical expansion in total increase the bonding of the sealer to root canal walls. **Ghoneim et al(2011)** also did a study which showed that Bioceramic sealer (iRoot SP) showed least microleakage in endodontically treated roots⁶.

Also silicon based sealer showed least microleakage to that of zinc oxide eugenol. This is because Silicon based sealer (RoekoSeal Automix), is a thixotropic material having, low film thickness, better biocompatibility and good adaptation to dentin⁷. Due to its better adhesion properties to the root dentin, it forms a single unit within the root canals and bonds to the dentinal walls⁴⁹. This bond

is because of the calcium silicates present in the powder which upon hydration produces calcium silicate and calcium hydroxide. This calcium hydroxide reacts with phosphate ions of the dental hard tissue to form hydroxyapatite. **Shetty R R et al (2009)** did a study in which Resilon was compared to gutta-percha with silicone based sealer (Roeko Seal Automix) and Zinc Oxide Eugenol sealers⁷.

In the present study, Zinc Oxide Eugenol based sealer (Group C) showed highest mean value of microleakage. This is because zinc oxide eugenol is hydrophobic in nature due to which it does not adhere to the canal walls which leads to the dimensional instability. Also Zinc oxide based sealers do not bond to the root dentin and promotes the apical leakage in the root end therefore, resulted in compromised seal of the root canal. **Kwang-Won Lee MC (2002)** did an in vitro study to evaluate the adhesion of endodontic sealers to dentin and gutta-percha⁸. Their results showed that, Zinc oxide based sealers have the lowest bond strength with greater microleakage at the apical end.

Thus, it was concluded that Microleakage was exhibited in all endodontically treated teeth using various sealers namely Bioceramic, Roeko Seal, Zinc oxide Eugenol. However least microleakage was seen in bioceramic and highest in zinc oxide eugenol. We recommend further studies to authenticate these results. Clinical trials should be made so as to check its biocompatibility and various other properties in the intraoral environment.

CONCLUSION

Bioceramic sealer exhibited significantly least microleakage followed by RoekoSeal and was maximum in Zinc oxide eugenol.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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