

## Original Research

### An In Vitro Investigation Comparing the Efficacy of Endosolv and Essential Oil Solvent in Breaking Down Bioceramic Sealers

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#### ABSTRACT:

**Aim:**The purpose of this study was to test and assess how well Endosolv and orange oil solvent dissolved bioceramic sealers. **Material and methods:**Utilizing stainless steel molds, 30 samples of endodontic sealer of pre-mixed bio ceramic root canal sealer were made. These samples were then split into three groups according to the immersion solution. For ten minutes, ten samples from each group were submerged in a particular organic solvent. Endosolv was in group 1, orange oil (essential oil) was in group 2, and the control group was in group 3. A digital analytical scale was used to weigh the samples both before and after immersion. For analysis, the Tukey post-hoc test and one-way analysis of variance (ANOVA) were used. **Result:**Compared to orange oil and the control group, endosolv, an acetate-based solvent, demonstrated the maximum dissolution. **Conclusion:**Endosolv demonstrated remarkable efficacy as a substitute for conventional solvents within the constraints of this investigation and is suitable for dissolving bioceramic sealers.

**Key Words:**Pre-mixed bio ceramic root canal sealer, Endosolv, Orange oil.

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#### INTRODUCTION

The most effective treatment for maintaining our natural teeth is root canal therapy (RCT). Insufficient cleaning, poor obturation, untreated or overlooked root canals, ineffective hermetic sealing, and bacterial survival are the primary causes of endodontic failure. Because of them, endodontic retreatment without surgery is required. For retreatment to be successful, the old root canal filling materials, including sealers, must be thoroughly debrided.<sup>1</sup> Debridement is more challenging, particularly with

resin-based sealers that firmly attach to the root canal dentin. A tiny quantity of residue remains attached to the root canal dentin after the bulk root canal filling material is easily removed with a hand tool and a rotating instrument.<sup>2</sup> Duncan and Chong have proposed using solvents to get rid of this root canal residue.<sup>3</sup>

The necessity for a safe and efficient solvent for endodontic retreatment has grown crucial as the usage of bioceramic sealers has increased due to their improved qualities. By comparing the mass of the

sealer before and after immersion, one can determine the effectiveness of a solvent.<sup>4</sup> Therefore, the purpose of this study was to assess how well two solvents—Endosolv and orange oil—soften bioceramic sealers.

**MATERIALS AND METHODS**

30 samples were prepared using pre-mixed bioceramic root canal sealer (E-MTA Sealer, Kids-e-Dental, India) and placed into standardized stainless-steel molds of 8 mm diameter and 1.5 mm thickness. The molds were then filled with sealers. After that, a microscope slides with a cellophane strip covering it was placed into the top surface to guarantee a smooth surface. All the samples and the steel molds were moved to a room that was kept at 37°C and 80% relative humidity chamber, where they were left alone. After 48 hours, the specimens were taken out of the chamber, and a scalpel was used to trim any extra material. After that, the samples were split into three groups according to the type of immersion solvent that was used:

- Group 1: Endosolv (Septodont, Kogland Commerce Pvt Ltd., France)
- Group 2: Orange oil (Gsol, Maarc Dental, India)
- Group 3: Distilled water (Control group)

With a computerized analytical balance, the samples were weighed three times in grams, and the average values were determined. All sealer samples were left at room temperature and completely submerged in a glass beaker filled with 20 milliliters of solvent. The samples were taken out after a 10-minute immersion, rinsed with 100 milliliters of distilled water, and then blotted dry using absorbent paper. After being dried in an oven at 37°C ± 1°C for 24 hours, they were put in desiccators for storage. Three weigh-ins were performed on the samples, and the mean was then determined. Calculating the difference between the sealer's original and final weights allowed us to establish how much of the sealer had dissolved.

ANOVA and Tukey's post hoc test with p < 0.05 were used to statistically analyze all of the data recorded by means of SPSS software version 23 (Chicago, USA).

**RESULTS**

Table 1 represents mean weight and standard deviation (SD) in grams of samples before and after immersion period of 10 minutes showing endosolv having highest dissolving capacity of bioceramic sealer compared to essential oil and distilled water.

**Table 1: Mean Weight and Standard Deviation (SD) in Grams of Samples Before and After Immersion Period of 10 Minutes**

Groups	Before immersion	After immersion	Intergroup comparison after immersion	
			Groups	p-value
Group 1	2.36±0.89	1.02±0.98	1-2	0.04*
Group 2	2.58±0.78	2.01±0.54	1-3	0.001*
Group 3	2.68±0.65	2.56±0.43	2-3	0.001*
f-value	2.36	6.35		
p-value	0.23	0.03*		

\*-Statistically significant

**DISCUSSION**

For endodontic therapy, the best root canal sealers should provide a great seal, be insoluble in bodily fluids, stick firmly to the walls of the root canal, retain their dimensional stability, be biocompatible, and be simple to remove when needed. A hermetic closure in root canals is accomplished using a variety of root canal sealers, such as epoxy resin-based and bioceramic-based sealers.<sup>5</sup>

The findings of this study underscore the significant role of solvents in the dissolution of bioceramic sealers, particularly in endodontic procedures. The comparative analysis between Endosolv and orange oil solvent offers valuable insights into their effectiveness in removing bioceramic materials.

Bioceramic sealers, such as the Kids-e-Dental E-MTA Sealer utilized in this study, are increasingly popular due to their biocompatibility, low shrinkage, and sealing capabilities containing tricalcium silicate known for its biocompatibility and ability to release calcium ions, promoting tissue regeneration. However, their removal can be challenging, necessitating effective solvents that can aid in

retreatment scenarios. The results indicate that Endosolv, an acetate-based solvent, outperformed orange oil and the control group in dissolving the bioceramic sealers.<sup>6</sup>

The exceptional efficacy of Endosolv can be ascribed to its distinct chemical makeup, which includes thymol, amyl acetate, and ETHYL acetate. This composition enables penetration of the three-dimensional lattice structure, resulting in swelling, a reduction in strength and hardness, and the breakdown of the bioceramic matrix. With the use of endodontic tools, this softening effect makes it easier to remove gutta-percha and sealers. Solvent characteristics, including polarity and viscosity, may have played critical roles in these dissolution processes. Endosolv's acetate base likely enhances its solubility capabilities for the components within the bioceramic sealers, whereas the natural properties of orange oil may lack the necessary strength to achieve similar results.<sup>7</sup>

Furthermore, immersion time was held constant at 10 minutes for all samples, providing a standardized comparison between groups.<sup>8</sup> Future studies could

explore varying immersion times to better delineate how time influences the efficacy of different solvents. Additionally, the use of a diverse range of bioceramic sealers might yield broader insights into the generalizability of these findings across different formulations.

It is also important to note the limitations of the current study. The sample size, while adequate for preliminary findings, could be expanded in future research to enhance statistical power and address variability. Moreover, the study was conducted in vitro, which may not fully replicate the conditions within a clinical environment. In vivo studies examining the long-term effects and clinical applicability of using Endosolv compared to other solvents are warranted.

The implications of these findings are particularly relevant for dental practitioners. The demonstrated effectiveness of Endosolv in dissolving bioceramic sealers suggests it should be considered as a viable option for dental retreatment procedures. As the dental community continues to embrace bioceramic materials for their numerous benefits, identifying efficient methods for their removal is paramount.

#### CONCLUSION

This study highlights Endosolv as a highly effective alternative to traditional solvents for dissolving bioceramic sealers. Continued research in this area may lead to improved endodontic outcomes through

enhanced removal techniques, thereby fostering better patient care and treatment success rates.

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