

# Comparison of Post-Operative Pain after Single Visit Root Canal Filling using Resin Based Sealer and Bioceramic Sealer

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## ABSTRACT

**Introduction:** The incidence of postoperative pain after the root canal treatment is reported to range from 3%-58%. The intensity and duration of postoperative pain after single visit root canal treatment are subjective and multifactorial. The main objective of this study was to compare the postoperative pain following single visit root canal treatment using a resin based sealer and bioceramic sealer.

**Methodology:** This is a prospective comparative interventional study. 88 patients requiring root canal treatment were selected for the study, 44 in each sealer group. Single visit root canal treatment was carried out using standard protocol and root canals were filled using gutta percha and either resin based sealer or bioceramic sealer. The patient were informed to register their post-operative pain in a visual analog scale ranging from 0 to 10 at 4hours,24 hours and 48 hours intervals. Postoperative VAS score between the groups were compared using independent t-test and paired t-test.

**Results:** There was no significant difference in postoperative pain among two sealer groups, however, a reduction in pain was seen in each group with time. When the association between demographic and clinical characteristics with postoperative was checked, only preoperative pain was found to be related to postoperative pain in both the groups.

**Conclusions:** There was no difference in incidence and intensity of postoperative pain among a resin based sealer and a bioceramic sealer.

**Keywords:** *Bioceramic sealer, postoperative pain, resin-based sealer, Root canal filling*

## Introduction

The incidence of postoperative pain after the root canal treatment is reported to range from 3%-58%.<sup>1</sup> The intensity and duration of postoperative pain after single visit root

canal treatment are subjective and multifactorial which includes age, gender, systemic diseases, pulpal status, preoperative pain level, number of roots, the choice of instrument, the choice of root canal sealer etc.<sup>2-5</sup>

After the proper cleaning and shaping procedures root canal systems are obturated with gutta –percha and endodontic sealer which must be confined within the root canal system. However, the sealer placed in the root canals interfere with the periodontal tissues through the apical foramen and additional lateral canals. The physical and chemical properties of the sealer, such as pH-level, consistency etc., affect the intensity of local inflammatory reactions in these tissues resulting in post-obturation

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pain.<sup>6-7</sup> There are different types of sealers available based on their compositions and properties.

Resin-based sealer is frequently used because of its favorable physicochemical properties and adaptability to root canal walls.<sup>8</sup> Bioceramic sealer is a newer sealer that has gained popularity due to its biocompatibility, antimicrobial and bioactive properties helping in periapical healing. They are less cytotoxic than resin based sealer.<sup>9</sup><sup>10</sup> Due to these potential benefit of bioceramic sealers over resin based sealer it can be considered to have lesser incidence and intensity of postoperative pain than resin based sealer. However there were limited studies evaluating potential impact of bioceramic sealer to resin sealer on postoperative pain and to the best of our knowledge none had been documented in our country.

Hence, the main aim of this prospective comparative interventional study was to compare the incidence of postoperative pain after single visit root canal treatment using resin-based (AH plus) and Bioceramic (Ceraseal) sealer.

### Methods

#### Patient selection and pre-treatment assessment

This is a prospective comparative interventional study done in conservative dentistry and endodontics unit, Department of dental surgery, NAMS, Bir Hospital. The ethical clearance was taken from institutional review board. The study was conducted from October 2022 to May 2023. A total of 88 patient were selected based on inclusion and exclusion criteria and divided equally into two groups.

Patients visiting the dental clinic of age 18 and above with tooth requiring nonsurgical root canal treatment were included. The written informed consent was taken from all the patient included in the study. The exclusion criteria were:

1. Patient with medical history with ASA class III/IV
2. Patient taking analgesic, anti-inflammatory medication, or antibiotic with in the 7 days prior to the beginning of treatment
3. Teeth with resorptions and calcification
4. Teeth with periodontal problems
5. Non restorable teeth

After a through clinical and radiographic evaluation single visit root canal treatment was done by the same faculty of conservative dentistry and endodontic unit. Prior to the treatment, patients were instructed about visual analogue scale (VAS) to determine their pain scores. Preoperative pain levels were recorded.

#### Root canal treatment procedures

In all the patients, teeth were anaesthetized using 2% lidocaine containing 1: 100000 epinephrine. For the maxillary teeth, slow local infiltration in the buccal vestibule or posterior superior alveolar nerve block was given. For the mandibular teeth, an inferior alveolar nerve block and lingual nerve block was used.

All teeth were isolated with rubber dam and the procedure was performed under a dental operating microscope. After removal of caries, endodontic access preparation was done with sterile diamond bur. The working length was determined with an apex locator and confirmed radiographically. A glide path was prepared with #10 k file and the canals were prepared by 0.04 taper Hyflex CM files (Coltene/Whaledent Inc, USA) according to the manufacturer instruction. Canals were irrigated with 3% sodium hypochloride, 17% EDTA. Normal saline was used to flush in between the two irrigants and as a final irrigant. After confirmation of the master cone radiograph, canals were dried with paper points and obturated with sigle cone technique using either resin sealer i.e. AH plus sealer (Dentsply DeTrey GmbH, Germany) and gutta percha or bioceramic sealer i.e. Ceraseal sealer (Meta Biomed, South Korea). Then the access cavity was closed with temporary cement. Post-obturation radiographs was taken and evaluated for the presence or absence of sealer extrusion from the root canal system.

#### Pain assessment

After completion of root canal filling the patients were instructed about VAS and asked to rate their pain on a Visual analogue scale (VAS) at the duration of 4 hours, 24 hours, and 48 hours. Patients was instructed to take 1000mg acetaminophen in case of severe pain and asked to record the dose and time on the survey. They were contacted on phone by the principal investigator to remind them register their pain according to specified time. They were instructed to return the questionnaire at the second appointment after 48 hours when coming for follow up and permanent restoration.

Statistical analysis

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Statistical analysis of the data was performed with R version 4.3.1. Postoperative VAS score between the groups were compared using independent t-test and paired t-test. A linear regression analysis was performed to find the association of postoperative pain with age, gender, and tooth location, number of roots, vitality, preoperative pain and sealer extrusion.

### Results

A total of 88 patients, 44 in each group participated in the study. Out of 88, 53 were female and 35 were male. The age ranged from 18 years to 75 years with mean SD: 36.18±13.6 years. The demographic and clinical characteristics of the patient are presented in Table 1. All the presented characteristics showed no statistically significant differences among two sealer groups. When the association between these characteristics with postoperative was checked, only preoperative pain was found to be related to postoperative pain in both the groups (Table 2). There was no significant difference in postoperative pain among two groups, however, a reduction in pain was seen in each group with time (Table 3). There is a significant reduction in pain after 4 hours of root canal treatment but statistical significance was not seen in 24 hours and 48 hours among the each groups (Table 4). In the AH plus group, the reduction of pain was 91.6% whereas in the BC group it was 92.3% after 48 hours (Table 4). The mean reduction of pain was higher in BC group than AH plus group as shown in Figure 1.

**Table 1:** Demographic and Clinical Characteristics for Post-operative VAS Score

Clinical Characteristics		Resin based sealer Group n=44	Bioceramic sealer group n= 44
Age	mean±sd	36.8±12.7	35.6±14.6
Gender	Female	28	26
	Male	16	18
Vitality	No	26	23
	Yes	18	21
Sealer Extrusion	No	41	43
	Yes	3	1
Number of roots	M	35	26
	S	9	18
Location	Mandible	19	19
	Maxilla	25	25
Preoperative pain	No pain	32	31
	Pain	12	13

**Table 2:** Regression Analysis of postoperative pain

Variable	Coefficient	Standard Error	t-value	P-value
Preoperative VAS	0.31	0.04	6.52	<0.001
Age	0.011	0.009	1.25	0.21
Gender	-0.254	0.25	-0.99	0.321
Sealer	-0.215	0.24	0.895	0.374
Vitality	-0.301	0.245	-1.228	0.223
Location	0.047	0.252	0.188	0.851

**Table 3:** Test of significance of Resin based sealer Group and Bioceramic sealer Group

Time	mean±sd	Mean difference	t value	p-value
<b>Bioceramic sealer group</b>				
Preoperative	1.57±2.60			
Four hours	0.318±1.22	1.25	3.78	<0.001
24 hours	0.205±0.851	0.113	0.81	0.41
48 hours	0.045±0.302	0.15	1.73	0.089
<b>Resin based sealer group</b>				
Preoperative	1.55±2.65			
Four hours	0.591±1.40	0.95	2.98	0.0047
24 hours	0.227±1.08	0.36	1.48	0.146
48 hours	0.045±0.302	0.18	1.27	0.209

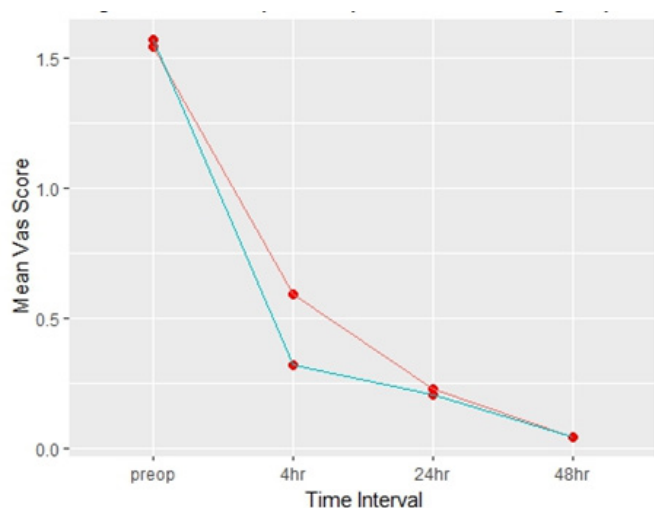
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**Table 3:** Comparison of pain Intensity preoperatively and Post operatively between Resin based sealer and Bioceramic sealer groups.

Vas Score	Resin based mean±sd	Bioceramic mean±sd	P-value
Preoperative	1.55±2.65	1.57±2.60	0.967
After four hours	0.591±1.40	0.318±1.22	0.3325
After 24 hours	0.227±1.08	0.205±0.851	0.912
After 48 hours	0.045±0.302	0.045±0.302	NA

**Table 5:** Reduction in pain

VAS score	Resin based sealer			Bioceramic sealer		
	No pain	Pain	Pain improvement	No pain	Pain	Pain improvement
Preoperative	32	12		31	13	
After four hours	37	7	41%	41	3	76%
After 24 hours	41	3	83%	42	2	92%
After 48 hours	43	1	91.6%	43	1	92.30%



**Fig 1:** Mean VAS to Time Interval

Resin based sealer (red line)

Bioceramic sealer (blue line)

## Discussion

In this study single visit root canal treatment was carried out and the protocol was same in both groups except for the sealer used. Single visit root canal treatment was preferred because of the time efficiency both to the patient and the clinician and also to avoid inter-appointment flare ups. In the previous studies it has been observed that post-operative pain levels between single and multiple visits did not differ.<sup>11</sup> In this study Visual Analogue Scale (VAS) was used as an instrument to evaluate pain which is similar

to several endodontic studies on postoperative pain.<sup>11-13</sup> The postoperative pain following the single visit root canal treatment was observed at 4 hours, 24 hours and 48 hours. The 4 hours VAS was chosen to exclude the effect of local anesthesia. Also the postoperative pain declines significantly after 48 hours, hence 48 hours VAS was taken as final postoperative pain score in this study.<sup>12</sup>

Post-operative pain is not confined to a single factor, rather it may be associated with several factors like age, gender, tooth location, number of root, pulp vitality, preoperative pain, obturation material and technique, sealer extrusion etc.<sup>13,14</sup> In the present study, multiple logistic regression analysis was conducted to determine the effect of these factors on pain incidence. There was no association of postoperative pain with any of these factors except for the preoperative pain. Some studies have found association of postoperative pain with patient related factors including age and gender and some have not.<sup>13-19</sup> In the present study, there was no significant association of age and gender with postoperative pain. Similarly there was no association of tooth location and pulpal status (vitality) with postoperative pain which was similar to other studies.<sup>18, 20</sup> In contrary to previous studies there was no association between number of roots and postoperative pain in our study.<sup>20, 21</sup>

However, there was a relation between preoperative and postoperative pain. In this study 27% cases in resin based sealer group and 29% in bioceramic sealer group had preoperative pain. The postoperative VAS score reduced gradually with time in both the groups. The mean reduction

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in pain after 4 hours of obturation was more in bioceramic sealer group compared to AH plus sealer but there were no differences in 24 hours and 48 hours. This signified that, the postoperative pain was not related to the sealer type. This result was similar to many previous studies comparing the postoperative pain between resin based sealer and bioceramic sealer.<sup>18-20</sup>

In the present study, the sealer extrusion was seen in 3 cases in resin-based sealer group and 1 case in bioceramic sealer group. But none of these cases showed increased postoperative pain. This is in contrary to different previous studies which had shown association of sealer extrusion with postoperative pain.<sup>15</sup> The reason behind may be the amount of sealer extrusion which was very less to cause any inflammatory reaction and pain.<sup>18, 21, 22</sup> Less sealer extrusion may be attributed to precise working length determination using an electronic apex locator along with IOPA radiograph, cleaning and shaping technique thus avoiding over-instrumentation and overfilling. Another factor could be that all the cases were primary treatment cases, not retreatment cases and hence had lesser chances of over instrumentation of canals.<sup>19</sup>

### Conclusion

Within the limitation of our study it can be concluded that there was no difference in prevalence and intensity of postoperative pain among a resin based sealer and a bioceramic sealer. Post-operative pain was not affected by age, gender, tooth location, pulp vitality, number of roots and sealer extrusion but only associated with preoperative pain.

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