



Original Article



Evaluation of Post Obturation Pain Associated with Tricalcium Silicate and Resin-Bond Root Canal Sealer in Single Visit Root Canal Treatment-Quasi-Experimental Study

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ABSTRACT

Despite advancements in root canal sealers, post-obturation pain remains a concern for both patients and clinicians. **Objectives:** To compare the post-obturation pain associated with tricalcium silicate and resin-bond root canal sealer. **Methods:** This quasi-experimental study was conducted at Liaquat University of Medical and Health Sciences, Jamshoro, Hyderabad, using non-probability consecutive sampling on 254 patients. Participants, aged 18 to 45, needed root canal therapy on a permanent single-rooted tooth with a single canal with irreversible pulpitis without apical periodontitis. Group A received AH Plus resin-based sealer, while Group B was treated with BioRoot RCS calcium silicate-based sealer. Root canal procedures followed endodontic guidelines, including pulp testing, anesthesia, canal shaping with nickel-titanium rotary files, obturation with gutta-percha and sealers, and composite resin restoration. The visual analogue scale assessed Pain and treatment efficacy at 24 hours and 7 days post-obturation. **Results:** Group A had 46 male (36.2%) and 81 female (63.8%) with a mean age of 30.2 years (11.2), while Group B had 59 male (46.5%) and 68 female (53.5%) with a mean age of 34.5 years (12.4). At 24 hours, postoperative pain was significantly lower in Group B (3.13 ± 1.23) than in group A (3.59 ± 1.38 , $p=0.008$), while pain differences were not significant preoperatively ($p=0.78$) or after seven days ($p=0.08$). **Conclusions:** It was concluded that in single-visit root canal treatment, both BioRoot root canal sealers (Septodont) tricalcium silicate-based sealer and AH Plus (Dentsply) resin-based sealer demonstrated similar efficacy in post-obturation pain.

INTRODUCTION

Single-visit root canal treatment is increasingly common because it requires less time, has a lower risk of infection, and leads to higher patient satisfaction [1]. Although endodontic treatment can relieve the pain of pulpitis, postoperative discomfort may still occur in some cases [2]. There are several potential causes of postoperative discomfort in endodontic therapy, including chemical,

mechanical, or bacterial damage to the periodontal tissues [3]. To ensure the success of root canal therapy and prevent microbial invasion from the oral environment into the periradicular tissue, it is essential to thoroughly debride the root canal system using chemomechanical methods and seal the canal space. An inadequate seal during obturation might cause oral fluids to seep into



spaces in the obturated root canal and trigger an inflammatory response in the periapical region, which can cause discomfort after surgery [4]. Post-obturation pain can occur in 3% to 58% of cases, with discomfort most commonly reported in the first two days after treatment [4, 5]. Gutta-percha points in the root canal require sealers as luting agents to ensure a secure fit and reduce leakage, contributing to long-term success. Sealers can also fill lateral or accessory canals that obturation material may not adequately infiltrate [6, 7]. AH Plus (Dentsply) is an epoxy resin-based sealer broadly consumed because of its favorable physical properties, strong adhesion to root dentin, low solubility, effective apical sealing, and sufficient antibacterial properties. However, AH Plus has been shown to have varying levels of cytotoxicity and lacks mineralization potential [8]. BioRoot RCS, a tricalcium silicate-based sealer, provides a robust three-dimensional seal along the root canal, enhancing the integrity and longevity of fillings for successful endodontic outcomes. It releases growth factors, reducing cytotoxicity in the periodontal ligament and increasing antibacterial activity [9]. It has excellent penetration capacity into the dentinal tubules and outstanding radiopacity [10]. Moreover, residual calcium hydroxide did not influence the penetrative extent of BioRoot RCS when it was used as an intracanal medicine [11]. Post-obturation pain is a common concern following root canal treatment, impacting patient comfort and satisfaction. This study compares two widely used root canal sealers tricalcium silicate-based sealer (BioRoot RCS) and resin-based sealer (AH Plus)—to evaluate their effectiveness in minimizing post-treatment pain in a single-visit setting. Currently, no local studies have explored this comparison, making this research essential for informing clinical decisions within the region. By assessing the pain outcomes associated with these materials, this study aims to guide sealer selection for effective treatment and improved patient comfort. This study aims to compare the post-obturation pain associated with tricalcium silicate and resin-bond root canal sealer.

METHODS

This quasi-experimental study was conducted from January 2022 to December 2022 at the Department of Operative Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro, Hyderabad, using non-probability sequential sampling. The minimum required sample size was calculated using OpenEpi software to be 96, based on a 72.3% pain incidence on day 3 after obturation with a resin-based sealer and 27.7% with a calcium-based sealer, at 90% power and a 95% confidence level. However, 254 patients (127 per group) were included in the study. Written informed consent was obtained from

all participants. Ethical approval was obtained before the start of the study (LUMHS/REC/.186). Patients were divided into two groups: Group B received resin bond sealer treatment (127 patients), and Group A received tricalcium silicate sealer treatment (127 patients). Patients aged 18 to 45 years requiring root canal therapy for a permanent single-rooted tooth with a single non-calcified canal diagnosed with irreversible pulpitis were included in the study, while patients having active periodontal disease or apical periodontitis were excluded from the study. Additionally, these patients needed to present with moderate to severe pain, scoring between 4 and 10 on a visual analogue scale. Before treatment, pulpal sensibility was evaluated using the Waldent electric pulp tester and the cold test (ethyl chloride). Percussion and palpation tests were also performed. Patients with irreversible pulpitis received treatment according to the dental endodontic guidelines. The tooth was anaesthetized with 2% lignocaine containing 1:100,000 epinephrine (Septodont) and isolated using a rubber dam. An access cavity was created with a No.2 round carbide bur after carious lesions and flawed restorations were eliminated and enlarged with an Endo Z bur using a sterile high-speed handpiece (Easy) with water irrigation. A periapical radiograph was used to validate the working length, which was established utilizing an electronic apex finder (E-PEX PRO Eighteenth, Changzhou Sifary Medical Tech) and a No. 10 K-file (Mani) following coronal flaring of the cervical third of the root canal. Using the crown-down technique, nickel-titanium rotary files (M3-Pro Gold) and 3% sodium hypochlorite (Canasol) were used to clean and shape the canals. Stainless steel K-files were used to complete the process in larger canals. Following shaping and cleaning, the canals were allowed to dry before being obturated with Gutta Percha cones (Gapadent) and either AH Plus or Bioroot RCS sealers. The subjects were allocated into two groups without randomization as per the type of sealer used. In group A, AH Plus (Dentsply) was employed as the root canal sealer: Radiographs were used to validate the apical range of the master cone. The sealer was prepared as per the manufacturer's suggestions. The root canal was sealed utilizing lentulospirals and a slow-speed handpiece. The obturation was carried out with the lateral compaction technique and gutta-percha cones (Gapadent). Group B: BioRoot RCS, a calcium silicate-based sealant was used. The sealer was prepared following the instructions provided by the manufacturer. The obturation procedure followed the same protocol as Group A. Enduring restoration was performed with composite resin (Biodinamica-Master fill), and the occlusion was relieved. A visual analogue scale (VAS) was employed to quantify postoperative pain after obturation. The patient was contacted 24 hours and 7 days later to measure pain and

efficacy using the VAS. When there was little or no pain (0–3) on the VAS, the clinical effect was classified as positive, and when there was pain (4–10) on the VAS, it was classified as negative. The data were analyzed using version 22.0 of SPSS. Frequencies and percentages were calculated for qualitative factors, including background, tooth type (anterior and posterior), sex, and distribution according to effectiveness. Mean and standard deviation were calculated for age and pain. Pain scores and the presence of pain were compared between the two groups using independent samples t-tests and chi-square tests, respectively. A threshold of $p \leq 0.05$ was considered the level of significance.

RESULTS

There were 46 male (36.2%) and 81 female (63.8%) in Group A, while Group B had 59 male (46.5%) and 68 female (53.5%). The difference was not significant ($p=0.09$). The AH plus sealer group ($n=127$) had a mean age of 30.2 years (SD 11.2) and an age range of 18 to 55 years, while the BioRoot RCS sealer group ($n=127$) had a mean age of 34.5 years (SD 12.4) with an age range of 18 to 70 years. The difference was statistical significance ($p=0.004$). Patients had the anterior tooth type (65.4%); however, 83 subjects in AH plus sealer and 86 subjects in BioRoot RCS were found, whereas posterior tooth types were seen less frequently (34.6%) with 44 subjects in AH plus sealer and 41 participants in BioRoot RCS. There was no significant difference ($p=0.69$) (Table 1).

Table 1: Tooth Type Distribution in Both Groups ($n=254$)

Tooth Type	AH Plus Sealer (n=127)	BioRoot RCS Sealer (n=127)	p-value*
Anterior	83 (65.4%)	86 (67.7%)	0.690
Posterior	44 (34.6%)	41 (32.3%)	

*Chi-Square Test

Pre-operative pain scores were similar for both groups, with mean scores of 7.54 ± 1.13 for the AH plus sealer and 7.56 ± 1.20 for the BioRoot RCS sealer ($p=0.78$). However, significant differences were observed in postoperative pain after 24 hours, with the AH plus sealer group reporting a mean pain score of 3.59 ± 1.38 compared to 3.13 ± 1.23 in the BioRoot RCS sealer group ($p=0.008$). After 7 days, the pain scores were minimal, with the AH plus sealer group reporting 0.02 ± 0.15 and the BioRoot RCS group reporting 0.00, showing no significant difference ($p=0.08$) (Table 2).

Table 2: Comparison of Pain at Various Time Points Between Both Groups ($n=254$)

Time of Pain Measures	AH Plus Sealer (n=127)	BioRoot RCS Sealer (n=127)	p-value*
Pre-operative Pain	7.54 ± 1.13	7.56 ± 1.20	0.78
Postoperative Pain After 24 Hours	3.59 ± 1.38	3.13 ± 1.23	0.008
Postoperative Pain After 7 Days	0.02 ± 0.15	0.00	0.08

*Independent Samples T-Test

After 24 hours, the pain was reported by 126 participants (99.2%) in the AH plus sealer group and by 125 participants (98.4%) in the BioRoot RCS sealer group and the results were not statistically significant ($p=0.56$). After 7 days, all participants in both groups reported pain relief ($p=1.0$) (Table 3).

Table 3: Comparison of Pain at Various Time Points Between Both Groups ($n=254$)

Variables	AH Plus Sealer (n=127)	BioRoot RCS Sealer (n=127)	p-value	
Pain After 24 Hours	Yes	126 (99.2%)	125 (98.4%)	0.561
	No	1 (0.8%)	2 (1.6%)	
Pain After 7 Days	Yes	127 (100.0%)	127 (100.0%)	1.000
	No	0 (0.0%)	0 (0.0%)	

DISCUSSION

The adoption of clinical treatments in endodontic therapy is contingent upon the reduction of patient suffering, in addition to their effectiveness and biological implications. Studies have concentrated on problems associated with therapies or methods meant to provide proof to bolster medical judgements. In this study, pre-operative assessment of pain shows a non-significant difference (p -value=0.788) in both groups i.e., 7.54 ± 1.13 and 7.56 ± 1.20 in group A and group B respectively. Postoperative assessment of pain showed a significant difference (p -value=0.008) in both groups (3.59 ± 1.38 and 3.13 ± 1.23 , respectively) after 24 hours and a non-significant difference (p -value=0.082) in both groups i.e., 0.02 ± 0.15 and 0.0 ± 0.0 after 7 days in group and group B respectively. According to a study by Tan *et al.*, there was no discernible difference in pain experienced 1, 3, and 7 days after obturation between teeth filled with AH Plus or Total Fill BC Sealer and those filled with resin-based sealers [12]. This study evaluated post-obturation discomfort associated with these sealer procedures. In a study published in 2013, the effectiveness of poxy-based sealer (AH plus) and calcium silicate sealer (BioRootTM RCS) was examined by Zavattini *et al.*, [13]. Comparing BioRoot RCS (Septodont) with a single cone to warm vertical condensation and AH Plus (Dentsply DeTrey, Konstanz), they discovered that the success rate for patients was comparable. A meta-analysis and systematic review of clinical trials comparing the outcomes of nonsurgical endodontic therapy using calcium silicate-based vs. resin-based sealers was conducted by Chopra *et al.*, [14]. According to research, sealers based on calcium silicate functioned as well as resin-based sealers, exhibiting comparable outcomes regarding mean post-obturation discomfort level, onset threat, and pain threshold at 24 and 48 hours. In a different research, Song *et al.*, [15], examined the use of epoxy-resin-based and calcium-silicate-based sealers for root canal obturation. They found no discernible differences between the sealers, and postoperative discomfort was

not strongly influenced by either form. To evaluate the effects of one epoxy resin-based sealer and two calcium silicate-based sealers on postoperative pain, Aslan et al., [16]. performed a study. The findings revealed no discernible variation in the degree of postoperative discomfort after a single-visit root canal procedure between AH Plus, Endoseal Mineral Trioxide Aggregate (MTA), and Endosequence BC Sealer. Ferreira et al., investigated post-procedure pain after root canal filling with several endodontic sealers and found that EndoFill, MTA Fillapex, and AH Plus caused the same amount, frequency, and need for analgesic use [17]. Based on Thakur et al., [18]. MTA may be utilized as a root canal sealer, as well as sealers based on epoxy resin or zinc oxide eugenol when comparing pain, periapical status, and area measurement after root canal filling with various endodontic sealers. A possible reason for postoperative pain can be preoperative discomfort [19, 20]. Current research is significant because it showed that the AH Plus resin-based sealer is more effective than the BioRoot RCS tricalcium silicate-based sealer in managing post-obturation pain during single-visit root canal treatments at 24 hours but the effect becomes similar after one week.

CONCLUSIONS

It was concluded that in single-visit root canal treatment, both BioRoot RCS (Septodont) tricalcium silicate-based sealer and AH Plus (Dentsply) resin-based sealer demonstrated similar efficacy in terms of post-obturation pain.

Authors Contribution

Conceptualization: TE

Methodology: TE, MAAA, AGS

Formal analysis: SS²

Writing review and editing: KM, BB, SS¹

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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