Original Article

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Evaluation of Postoperative Pain with Resin Based Sealer vs Zinc Oxide Eugenol Based Sealer After Single Visit Endodontic

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Author`s Contribution

[1,5]Substantial contributions to the conception or design of the work; or the acquisition, [3,4]Drafting the work or revising it critically for important intellectual content, [2]Final approval.
[3,6]Active participation in active methodology,[3]analysis,or interpretation of data for the work,

Funding Source: None
Conflict of Interest: None

Received: Nov 28, 2024
Revised: Sept 19, 2025
Accepted: Nov 28, 2025

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ABSTRACT

Objective: The aim of this study is to compare the postoperative pain after single visit endodontics using zinc-oxide eugenol sealer and resin-based sealer.

Introduction: Complete root canal system obturation and disinfection, as well as periradicular tissue healing, are the objectives of root canal therapy. One of the key concerns of endodontic practice is pain management both during and after root canal therapy.

Methodology: A prospective, randomized, double-blind clinical trial was conducted at school of dentistry from June 2023 to November 2023 on 180 patients. The study included patients aged 18-60, ASA Class 1 or 2, with single-rooted teeth suffering from symptomatic irreversible pulpitis. Exclusions were made for ASA Class 3-5 patients, those with immature apices, severe periodontal issues, recent analgesic use, and those needing root canal treatment on multiple teeth. Single visit RCT was planned in single rooted teeth as per presentation and these patients were divided in to two groups, in Group A patients zinc oxide eugenol-based sealer was used and in group B resin based sealer was used. Per-operative, postoperative at 24H and 48H pain perception was calculated through VAS. Data was analyzed through SPSS software v20.0.

Results: The mean age of Group A was 32.38±8.28 and Group B was 32.14±8.58. Around 51% of from Group A were male as compare to 34.4% male patients in group B. Majority (53%) of Group A patients have Mild pain as compare to 42% in Group B patients. P value was significant at post-operative pain after 24H and 48H of treatment in either group.

Conclusion: in this investigation found that, between 24 and 48 hours after endodontic therapy, zinc oxide eugenol-based sealers have a slightly higher incidence of discomfort than resin-based sealers.

Key words: Sealer, VAS, Pain, Endodontics

Cite this article as: Amin A, Noor N, Asif S, Maqbool A, Shar MK. Evaluation of Postoperative Pain with Resin Based Sealer vs Zinc Oxide Eugenol Based Sealer After Single Visit Endodontic. Ann Pak Inst Med Sci. 2026; 22(1):102-107. doi. 10.48036/apims.v22i1.1241.

Introduction

Complete root canal system obturation and disinfection, as well as periradicular tissue healing, are the objectives of root canal therapy. One of the key concerns of endodontic practice is pain management both during and after root canal therapy.[1-2] Following root canal therapy, pain is an unwanted side effect that typically peaks in the first 24 hours and progressively decreases over the next 7 days.[3]

After receiving a root canal filling (RCF), up to 40% of individuals experience postoperative pain (POP).[4]Numerous prognostic factors influence the severity and length of POP. One of the most important filling techniques is the use of single cone and warm vertical and cold lateral compaction, which are typically combined with resin-based or zinc-oxyde eugenol sealers.[5-6] The endodontic sealer makes localized, direct contact with the changed periapical tissues during the obturation step of the root canal therapy process. This occurs through the apical foramen and extra lateral canals. The degree of postoperative endodontic discomfort is therefore influenced by the physical and chemical

characteristics of the sealer, including its pH level and consistency.[7] Endodontics frequently uses resin-based sealers (RBS) and zinc oxide eugenol-based sealers (ZOE), each of which has unique processes influencing postoperative pain and recovery. Because of their ability to adhere to dentin and gutta-percha, resin-based sealers (RBS), like methacrylate-based sealers, minimize bacterial infiltration and microleakage while offering better sealing capabilities. However, because RBS releases unreacted monomers such bisphenol A, it can have cytotoxic effects that cause discomfort and inflammation in periapical tissues. Furthermore, gaps may form at the contact with dentin due to polymerization shrinkage during setting, which could make postoperative discomfort worse. Antibacterial drugs have recently been added to RBS formulations to increase their effectiveness against chronic infections while preserving biocompatibility.[8-9]

The biocompatibility and anti-inflammatory qualities of Zinc Oxide Eugenol-Based Sealers (ZOE) are mainly ascribed to eugenol, which provides analgesic benefits that may lessen postoperative discomfort. Although ZOE has a good capacity to seal, it does not have the same adhesive qualities as RBS, which may result in increased rates of microleakage. Long-term effectiveness may also be influenced by the material's solubility in tissue fluids; at the same time, excessive solubility may cause the release of irritants that may eventually trigger inflammatory reactions.[10]

There is a lack of thorough research specifically comparing these two types of sealers in the context of single-visit endodontics, despite previous research showing that the composition of root canal sealers can influence inflammatory responses, which in turn affects postoperative pain levels. In this regard, ZOE sealers are known for their biocompatibility and analgesic properties, potentially reducing inflammation and pain, while resin-based sealers, while offering superior adhesion and sealing capabilities, may release cytotoxic monomers that could increase inflammatory reactions. By filling this gap, our study hopes to offer significant insights into how the choice of sealer affects postoperative pain outcomes. In the endodontics sector, this work contributes to the development of existing research and has significant implications for clinical practice, which will eventually enhance patient care and public health outcomes. Therefore, this study aims to evaluate and compare the postoperative pain experienced after root canal treatment utilizing these two different sealing materials.

Methodology

The study was designed as A prospective, randomized, double-blind clinical trial conducted at the School of Dentistry, Shaheed Zulfiqar Ali Bhutto Medical University in Islamabad. The ethical approved was obtained from SOD ref no. SOD/ERB/2023/19The duration of the study spanned from June 1, 2023, to November 31, 2023. The sample size was determined using the World Health Organization (WHO) calculator, resulting in a total of 180 participants, with 90 assigned to each group. This calculation was based on a significance level of 5%, a power of the test set at 80%, a test value proportion mean of 1.30, an anticipated population mean of 0.78, a population standard deviation of 1.235, and a population variance of 1.525.[11,13] non-probability sampling techniques were employed to select participants. Inclusion criteria for the study required that patients be willing to participate, classified as ASA Class 1 or 2, aged between 18 and 60 years, and have single-rooted maxillary or mandibular teeth with symptomatic irreversible pulpitis, either with normal apical tissue or symptomatic apical periodontitis. Exclusion criteria included patients classified as ASA Class 3 to 5, those with immature apices or root resorption, severe periodontal issues, vertical or horizontal root fractures, individuals who had taken analgesics within the last 24 hours, and those requiring root canal treatment on two or more ipsilateral teeth to avoid confounding pain assessments.

Patients with either gender with age in-between 18-60 years and ASA Class 1 or 2 and willing to give informed permission in order to meet the study's inclusion requirements. Adults with single-rooted maxillary or mandibular teeth diagnosed with symptomatic irreversible pulpitis who either presented with normal apical tissue or symptomatic apical periodontitis were eligible. They had to be between the ages of 18 and 60. On the other hand, patients designated as ASA Class 3 to 5; those with immature apices or root resorption; those with severe periodontal disease; and those with vertical or horizontal root fractures were excluded. In order to prevent confusing pain assessments, participants who needed root canal therapy on two or more ipsilateral teeth weren't allowed to participate, nor were those who had taken analgesics in the 24 hours prior.

The study included 180 patients who met the inclusion and exclusion criteria and needed endodontic treatment for permanent single-rooted teeth; the patients were chosen at random for the study; the treatment and study design were

explained to the patients in language they could understand; the voluntary patients gave their written

informed consent; pulp vitality was assessed using an electric pulp test and a cold test; the patients were diagnosed with irreversible pulpitis based on clinical and radiographic findings.

Patients were randomly divided into two groups through lottery methods as Group A and B. Group A patients were treated with Zinc Oxide Eugenol Sealer and Group B patients with Resin Based Sealer (AH Plus DentsplySirona)[12]. The participants were taught how to evaluate their pain using a visual analogue scale (VAS) before beginning treatment. The distance (mm) on the 10-cm line between the patient's mark and the "no pain" anchor is used to calculate the VAS score, which ranges from 0 to 100mm. This measure was done using a ruler. More points correspond to more intense pain. The VAS cut points for pain are as follows: no pain (0–4 mm), mild pain (5–44 mm), moderate pain (45–74 mm), and severe pain (75–100 mm). These cut points are based on the distribution of pain and are used to score per operative and post-operative pain in patients who described their postoperative pain intensity as no pain, mild pain, moderate pain, or severe pain.[11-13] 2% lignocaine in a local anesthetic Following the monitoring of preoperative pain levels, each patient received a local anesthetic with 2% lignocaine containing 1:80000 epinephrine. There was a rubber dam in place. Endo access burs were used to prepare the endodontic access cavities. The #10 K file was used to establish the working length, and a one-shape rotary method was used to instrument the root canal up to #25.6% while copious amounts of 3% sodium hypochlorite and regular saline were irrigated. Root canals were thoroughly rinsed with 5 milliliters of 17% EDTA solution prior to obturation. Paper points were used to dry the root canals in both groups, and the patients in Group B received zinc oxide eugenol sealer, whereas Group A patients used gutta-percha cones and resin-based sealer. The root canals were then obturated using the cold lateral compaction technique. Dentinal adhesives and universal composite resin were used to restore coronal access cavities with direct composite restorations. Prior to the endodontic surgery, as well as 24 and 48 hours later, preoperative and postoperative VAS scores were taken to gauge the patients' level of pain.

The SPSS program (version 20.0) was used to analyses the data. Age and VAS were measured before and after surgery at 24 and 48 hours, respectively, and their means and standard deviations were determined. For qualitative factors such as gender, pain intensity, and number of treated teeth, frequency and percentages were computed. The patients' means were compared using the Chi-square test. The P_value of less than 0.05 was used as significant. Results of the study were represented in Tables as shown in results section of this study.

Results

The present randomized control trial was conducted on 180 patients, these patients were randomly divided in two groups with 90 participants in each group. Around 51% of the participants from Group A were male as compare to 34.4% male patients in group B participants. Majority (53%) of Group A patients have Mild pain on VAS preoperatively as compare to 42% in Group B patients. Postoperatively pain perception was also recorded in both groups at 24H and 48H respectively and frequency with percentage of treated teeth in either group also shown in Table No. I.

The mean age of Group A participants was 32.38±8.28 and Group B patients was 32.14±8.58 which is shown in Table No. II along with the mean VAS pain score at preoperatively and postoperatively at 24 and 48H respectively.

Chi-square test was used to see any significant different in the intensity of post-operative pain after 24H and 48H of treatment in either groups. Table No.III shows significant different as p_value was <0.05.

Discussion

An essential component of a successful root canal treatment is root canal obturation. In addition to helping to create three-dimensional root canal filling with gutta-percha cones, root canal sealers also cover the voids that exist between gutta-percha and root canal walls, lateral canals, and accessory canals.[14]

Although it may appear a few hours to a few days following endodontic treatment, postoperative discomfort is an unwanted side effect. There is a range of 3% to 60% in postoperative discomfort, according to several researches. Mechanical, chemical, or microbiological factors can all induce pain.[15] Postoperative pain can result from a multitude of treatment-related causes, some of which include instrumentation technique, loss of working length, excessive use of intra canal irrigants, vigorous instrumentation, and sealer selection.[16]Sealers have a tendency to interact with the surrounding periodontal tissues as well as the periapical tissues, which could

doi. 10.48036/apims.v22i1.1241

Table I: Shows Frequency and Percentages of Gender distribution, pain perception before and after the procedure of Group A and B participants.

Variable		Study Groups			
		Group A; Zinc Oxide Eugenol Sealer		Group B; Resin Based Sealer	
		N	Percentage	N	Percentage
Gender	Male	46	51.1%	31	34.4%
	Female	44	48.9%	59	65.6%
	Total	90	100.0%	90	100.0%
Pain by VAS preoperatively	No pain	14	15.6%	21	23.3%
	Mild pain	48	53.3%	38	42.2%
	Moderate pain	8	8.9%	5	5.6%
	Sever pain	20	22.2%	26	28.9%
	Total	90	100.0%	90	100.0%
Pain by VAS after 24 hours	No pain	66	73.3%	43	47.%
	Mild pain	24	26.7%	46	51.1%
	Moderate pain	0	0.0%	1	1.1%
	Sever pain	0	0.0%	0	0.0%
	Total	90	100.0%	90	100.0%
Pain by VAS after 48 hours	No pain	65	72.2%	90	100.0%
	Mild pain	25	27.8%	0	0.0%
	Moderate pain	0	0.0%	0	0.0%
	Sever pain	0	0.0%	0	0.0%
	Total	90	100.0%	90	100.0%
Tooth treated	Mandibular Central Incisors	0	0.0%	7	7.8%
	Mandibular Lateral Incisors	6	6.7%	5	5.6%
	Mandibular Canine	10	11.1%	9	10.0%
	Mandibular Premolars	15	16.7%	14	15.6%
	Maxillary Central Incisors	12	13.3%	10	11.1%
	Maxillary lateral Incisors	13	14.4%	13	14.4%
	Maxillary Canine	9	10.0%	11	12.2%
	Maxillary Second Premolars	25	27.8%	21	23.3%
	Total	90	100.0%	90	100.0%

Table II: Shows descriptive statistics of Group A and Group B participants.

Variable	Study groups	Minimum	Maximum	Mean ± Sdt.
Age	Group A; Zinc Oxide Eugenol Sealer	19	55	32.38±8.28
	Group B; Resin Based Sealer	21	51	32.14±8.58
VAS Score preoperatively	Group A; Zinc Oxide Eugenol Sealer	2.00	93.0	39.64±27.27
	Group B; Resin Based Sealer	2.0	93.0	40.26±34.04
VAS Score after 24 hours	Group A; Zinc Oxide Eugenol Sealer	1.00	44.00	9.76±12.63
	Group B; Resin Based Sealer	1.0	37.0	12.48±12.01
VAS Score after 48 hours	Group A; Zinc Oxide Eugenol Sealer	0.0	35.00	6.92±9.76
	Group B; Resin Based Sealer	0.0	4.0	0.82±1.16

Table No. III. Shows Cross tabulation using Chi-square test.

Variable		Study Groups				
		Group A; Zinc Oxide Eugenol Based Sealer		Group B; Resin Based Sealer		
		Frequency	Percentage	Frequency	Percentage	*P*-value
Pain by VAS after 24 hours	No pain	66	73.3%	43	47.%	
	Mild pain	24	26.7%	46	51.1%	
	Moderate pain	0	0.0%	1	1.1%	0.002
	Sever pain	0	0.0%	0	0.0%	
	Total	90	100.0%	90	100.0%	
Pain by VAS after 48 hours	No pain	65	72.2%	90	100.0%	
	Mild pain	25	27.8%	0	0.0%	
	Moderate pain	0	0.0%	0	0.0%	0.000
	Sever pain	0	0.0%	0	0.0%	
	Total	90	100.0%	90	100.0%	

impede the healing process. They frequently protrude into the periapex, which may result in inflammatory responses locally. The inflammatory response is also significantly influenced by the sealer's composition.[17] In endodontics, various kinds of sealers are frequently utilized. The two

most widely used types are resin-based sealers and zinc oxide eugenol-based sealers.[18]

Since resin-based sealers have better physico-chemical qualities, they have been employed extensively in endodontics. According to endodontic literature, one of the most well-liked and often applied epoxy resin-based sealers is AH Plus (Dentsply Sirona). The longer setting time and improved flow of AH Plus sealer allow it to better entwine with the dentine structure and can even reach lateral root canals and microscopic imperfections.[12]

In this Randomized clinical trial patients who were treated with single visit root canal obturation using Resin based sealers shows decrease in postoperative pain on the basis of VAS and shown significant different as shown in table No III. This pattern is also reported by Indre Graunite et al. reported 35% patients having postoperative pain among them 1 was in sever pain and no pain after 72H.[16] In another study, Fonseca et al. reported on the pain intensity experienced by patients in the resin-based group (RG) after endodontic treatment. Specifically, after 24 hours, 53.13% of participants reported no pain, while 21.88% experienced mild pain and 25% reported moderate pain. By the 48-hour mark, the situation improved significantly, with 78.12% of patients indicating no pain and 21.78% reporting mild pain. These findings are consistent with our results, which also demonstrate a notable reduction in postoperative pain over time, particularly among patients treated with resin-based sealers, but was no statistically significant difference between the tested root canal sealers which is in contradiction to our study.[18-20]

However, as shown in table No. I, patients who had single-visit root canal obturation using zinc oxide eugenol-based sealers reported somewhat higher pain perception, ranging from mild discomfort after 24 hours to none at all after 48 hours. Additionally, Khandelwal et al. reported in patients treated with zinc oxide eugenol (ZOE) based sealers that at 24 hours, 5.3% reported no pain, 68.4% had mild pain, and 26.3% experienced moderate pain. By 48 hours, 84.2% reported no pain, and this trend continued at 72 hours, with none of the patients reporting pain by day7. These results emphasize the effectiveness of ZOE sealers in reducing postoperative discomfort over time.[13]

Eugenol's characteristic is the reason for this modest increase in pain sensitivity after 24. Zinc eugenol is created when zinc oxide and eugenol are combined by a chelation process. Eugenol and zinc oxide are produced when zinc eugenol is hydrolyzed in aqueous media, such as saliva or dental fluid. Zinc oxide releases eugenol, which can permeate dentin and enter saliva. In addition to ZOE's antibacterial effect, the presence of para formaldehyde causes localized inflammation in related soft and hard tissue. This group's pain levels in the current investigation varied from mild to severe. This kind of discomfort controls the horrendous cytotoxic effects as well as the histological relationship between zinc oxide eugenol and periapical tissues. Previous research has demonstrated the same outcome.[21-22]

The present study employed a 100 mm Visual Analogue Scale, which is regarded as an efficient technique for measuring postoperative pain in clinical research. Its use has been extensively documented, although it is thought to have some drawbacks, such as subjectivity based on personal pain sensitivity.

Conclusion

In the Conclusion, this clinical randomized trial found that zinc oxide eugenol-based sealers (ZOE and Tubli Seal) are associated with a slightly higher incidence of discomfort compared to resin-based sealers within 24 to 48 hours after endodontic therapy. These results underscore the need for further research to assess the advantages and disadvantages of various sealing materials, which can enhance clinical decision-making in endodontics. To draw more definitive conclusions regarding the effectiveness of these sealers, future studies should involve larger patient populations and longer follow-up periods.

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