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Original Research Article

Comparative evaluation of post-operative pain & analgesic intake after root canal treatment using three bioceramic sealers- An In-vivo study

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ABSTRACT

Aim: To evaluate the occurrence and intensity of post-operative pain & number of analgesic tablets intake after single visit endodontic treatment using three different Bioceramic sealers.**Materials and Methods:** 45 single rooted teeth diagnosed with asymptomatic irreversible pulpitis requiring endodontic treatment were randomly assigned to three groups (n=15) according to sealer used during obturation. To avoid bias in post-operative pain perception, each sealer is evaluated in three different single rooted teeth of the same patient. The different groups are Group I-MTA-Fillapex, Group –II Ceraseal RCS, Group-III BioRoot RCS. Single visit Endodontic treatment was performed and teeth were obturated using cold lateral compaction and different root canal sealers with no radiographic material extrusion beyond the apex. Severity of post obturation pain was assessed by Visual Analog Scale (VAS) with score ranging from 0 to 10 at 6hrs, 12hrs, 24hrs and 48hrs intervals. The need for analgesic (Tab. Aceclofenac 100 mg) intake was also recorded. Differences in incidence of postoperative pain were analyzed using the Kruskal Wallis test followed by Mann Whitneys Post Hoc to compare the mean VAS score & number of analgesics taken between three groups at different time intervals (p<0.05).**Result:** MTA Fillapex shows statistically significant difference in mean VAS score (more pain) at 6hrs, 12hrs (p value < 0.001) & at 24hrs (p<0.005) than Ceraseal RCS and BioRoot RCS. There is statistically significant difference in the no. of analgesic intake for MTA Fillapex i.e., more tablets taken by the patient to relieve pain (p<0.001) as compared to Ceraseal RCS and BioRoot RCS. The decrease in pain was statistically significant for each time intervals from 6hrs to 48hrs for all the three groups.**Conclusion:** The teeth of the patients where MTA Fillapex sealer was used as a sealer in the obturation showed significantly more pain at 6hrs & 12hrs and needed to take more analgesics than teeth obturated with other two sealers. This probably could be due to leaching out of resin constituents from MTA Fillapex.This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.For reprints contact: reprint@ipinnovative.com

1. Introduction

A successful root canal treatment aims for complete debridement of pulp tissue, microorganism and their virulent byproducts from the canal following the cleaning and shaping tridimensional root canal space is obturated using a sealer and obturating material.

All these steps should be performed without injury to the periapical tissue and minimal post-operative pain. Pain following the treatment usually manifests rapidly in hours and can persist for several day.¹ Periapical tissue injury following chemical, mechanical, or microbial injury causes acute inflammation and results in severe post-operative pain and discomfort.² Over instrumentation and over filling is one of the factors predisposing to post-operative pain.³ Sealers used in obturation come in close contact with

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the periapical tissue through apical and lateral foramina. The Chemical composition of sealer affects the cytotoxic potential and degree of tissue reaction elicited by the sealer.⁴

Root canal sealer due to their constituents have the potential to activate sensory neurons resulting in an inflammatory response.⁵ This can cause postoperative pain after root canal treatment.

There is no conclusive result explaining the role of different root canal sealers in causing post-operative pain. In a study done by Ates et al.⁶ Resin based AH-Plus was compared with calcium silicate based iRoot SP and found no difference regarding post-operative pain. But contrasting results were reported by Shashirekha et al⁷ when Resin based AH Plus, ResinoSeal were compared to calcium hydroxide based Sealapex & Apexit Plus.

Limited studies compared the different types of Bioceramic based sealers i.e MTA based root canal sealer MTA Fillapex, powder–liquid bioceramic sealer BioRoot (BR), and premixed calcium silicate-based sealer CeraSeal (CS) the composition and, the manual mixing and any alteration of the powder–liquid ratio of such sealers & pre-dosed sealer can influence the physicochemical properties such as post-operative pain of these bio ceramic sealers.

2. Materials and Methods

Inclusion criteria included the following, Patients who had single rooted teeth diagnosed with asymptomatic irreversible pulpitis due to deep caries that would result in large pulp exposure during caries removal resulting in endodontics treatment were included. Other inclusion criteria included patients that had not taken any analgesic or antibiotic in past 7 days. Presence of no radio graphically visible periapical changes. Exclusion criteria for the study included teeth with open apex, presence of calcification, or presence of resorption, overfilling of gutta percha or sealer. Medically compromised patients with immunosuppressive/systemic diseases and patients taking medications were excluded from the study. All patients who took part in the study were informed and signed a written informed consent form.

2.1. Treatment procedure

The teeth were treated in single visit root canal treatment to eliminate bias in post operative pain due to pain inducing factors that might be caused by multiple visits. After adequate local anesthesia the tooth was isolated with rubber dam, caries and old restoration were removed with water-cooled high-speed diamond burs. Apical patency was established and maintained with 10 k-file. Root canal length was determined using apex locator (JW Morita). Canals were prepared with a combination of hand files and protaper Gold rotary NiTi files (Denstply Maillerfer) following

manufacturer's instructions 10 ml of 5% NaOCl was used with a 30-gauge side vented irrigation needle. The irrigation needle was kept 2 mm short of working length to avoid an irrigant extrusion. Apical enlargement was done by finishing rotary files which ranged from F1 to F5 depending on the initial diameter of the root canals. A final flush with 3 ml of 17% EDTA, 3ml of 5% NaOCl was used. Manual dynamic irrigation was done using a fitting gutta percha cone for 30 seconds the canals were dried using paper points. 45 single rooted teeth were randomly assigned to three groups (n=15) according to sealer used during obturation the allocation was done randomly to prevent bias.

Group I: MTA Fillapex

Group II: CeraSeal

Group III: Bio Root RCS

After the allocation of patients into the experimental groups. A single tapered gutta percha cone was adapted to the root canal and the position of the cone was confirmed with a periapical radiograph. MTA Fillapex has a double barrel syringe with auto mixing tip. CeraSeal is a premixed calcium-silicate-based material sealer with (auto-mixing tip). BioRoot RCS is a powder–liquid bioceramic sealer that requires manual mixing procedures Powder (1 scoop) and liquid 5 drops.

Master cone was coated with the experimental sealer and the canal wall was coated thoroughly with the sealer. Following sealer application, the root canals were obturated using cold lateral obturation technique. The coronal access cavities were restored with a direct adhesive composite restorative material.

For post-operative pain patients were prescribed tablet Aceclofenac 100 mg and patients were recommended tablet intake only in case of severe pain

2.2. Evaluation of post-operative pain

After treatment patients were given two forms. One designed to record pain having shown visual analog scale (VAS), were value of “0” indicated “no pain” and “10” indicated “unbearable pain”.

The second form was used to record the frequency of analgesic intake. The patients were asked to complete this form at 6,12,24 and 48 hours after treatment.

2.3. Statistical analysis

Statistical Package for Social Sciences [SPSS] for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp was used to perform statistical analyses.

Descriptive analysis includes expression of VAS scores and number of analgesics taken in terms of Mean & SD for each study group.

Kruskal Wallis test followed by Mann Whitney's Post hoc analysis was used to compare the mean VAS scores and number of analgesics taken between 3 groups at different

time intervals.

Friedman's test followed by Wilcoxon Signed Rank post hoc analysis was used to compare the mean VAS scores between different time intervals in each study group. The level of significance was set at $P < 0.05$.

3. Results

There are significant differences between the groups based on VAS scores. MTA Fillapex shows statistically significant difference in mean VAS score (more pain) at 6hrs, 12hrs (p value < 0.001) & at 24hrs ($p < 0.005$) than Ceraseal RCS and BioRoot RCS. There is statistically significant difference in the no. of analgesic intake for MTA Fillapex i.e., more tablets taken by the patient to relive pain ($p < 0.001$) as compared to Ceraseal RCS and BioRoot RCS. (Tables 1, 2, 3 and 4) The decrease in pain was statistically significant for each time intervals from 6hrs to 48hrs for all the three groups. (Figure 1)

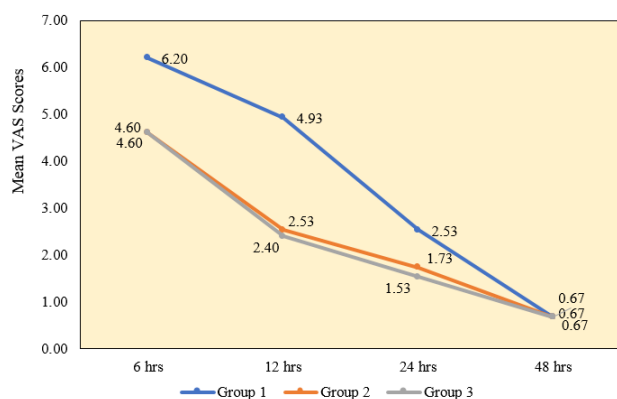


Fig. 1: Mean VAS scores between different time intervals in each group

4. Discussion

The incidence of pain after root canal treatment is multifactorial and can be attributed to various biological (microorganism) and non-biological (chemical or mechanical) factors.⁸ Post-operative pain may be associated with the preoperative pain, pulpal and periradicular status of tooth, procedural factors such as instrumentation, irrigation and root canal filling, type and composition of sealers used for obturation.⁹ Local inflammation in the periapical region may be due to chemical irritants leached out during setting of endodontic sealers.¹⁰ As reported by Camargo et al,¹¹ biochemical mediators such as reactive oxygen species production is found to increase by 4-7 folds when human pulp cells were exposed to root canal sealers.

Pain is subjective in nature, difficult to measure exactly and depends upon the assessment of the patient. To avoid bias in post-operative pain perception, three different sealers

used in this study are evaluated in three different single rooted teeth of the same patient using a visual analog scale (VAS). VAS describes pain from patients' perspective, this spectrum appears continuous and the pain does not take discrete jumps, as a categorization of none, mild moderate and severe would suggest. This makes VAS preferred tool for measuring pain in endodontics.¹²

Teeth with asymptomatic irreversible pulpitis were selected to avoid bias due to preoperative pain. Root canal treatment was completed in single visit. Completing the root canal in a single visit eliminated the possible chances of postoperative pain due to periapical tissue reaction from intracanal medication placement or possible microbial contamination in between the visits.

Bioceramic sealers promote periapical tissue healing by reducing inflammation and have less severe cytotoxic effects when compared to resin-based counterparts such as AH Plus.¹³

In case of bioceramics, due to its wettability and viscosity, the bioceramic could spread into any root canal irregularity and noninstrumented space. These sealers exhibit the formation of calcium hydroxide on hydration and thus would potentially promote bioactivity and adhesion to the canal wall through mineral tags.¹⁴

The present study aimed to evaluate post operative pain following use of MTA-Fillapex, Ceraseal RCS, BioRoot RCS. The intensity of post operative pain was recorded at 6hrs, 12hrs, 24hrs and 48hrs intervals. The decrease in pain was statistically significant for each time intervals from 6hrs to 48hrs for all the three groups

MTA Fillapex sealer used in obturation resulted in more pain at 6hrs, 12hrs & at 24hrs than Ceraseal RCS and BioRoot RCS.

There is statistically significant difference in the no. of analgesic intake for MTA Fillapex i.e., more tablets taken by the patient to relive pain as compared to other two groups.

The most severe pain that occurred after treatment was present till first 24hrs postobturation and decreased gradually with increasing time period. This is similar as seen in previous researches done by Graunaite et al.¹⁵

MTA Fillapex is composed of paste-paste system and uses a salicylate resin matrix., It is an attempt to combine physical properties from resin-based sealers with the biological and sealing properties of MTA.

The salicylate resin matrix is meant to allow fluid movement, thus enabling hydration of the cement particles. The reaction of the salicylate occurs in the presence of calcium ions, thus enabling the formation of calcium salicylate and material hardening. Traces of magnesium Aluminum and sulfur which are known to cytotoxic are found in MTA Fillapex.¹⁶ Short term pain seen in MTA Fillapex group can be due to leaching out of unpolymerised salicylate resin and other diluting resins present in the sealer during its setting. The leaching components can result in

Table 1: Comparison of mean VAS scores between 3 groups at different time intervals using Kruskal Wallis Test (a) followed by Mann Whitney Post hoc Test (b)

Time	Groups	N	Mean	SD	P-Value ^a	Sig. Diff	P-Value ^b
6hrs	Group 1	15	6.20	0.56	<0.001*	1 vs 2	<0.001*
	Group 2	15	4.60	0.83		1 vs 3	<0.001*
	Group 3	15	4.60	0.63		2 vs 3	0.98
12hrs	Group 1	15	4.93	0.70	<0.001*	1 vs 2	<0.001*
	Group 2	15	2.53	0.99		1 vs 3	<0.001*
	Group 3	15	2.40	0.91		2 vs 3	0.81
24hrs	Group 1	15	2.53	0.64	0.005*	1 vs 2	0.008*
	Group 2	15	1.73	0.96		1 vs 3	0.003*
	Group 3	15	1.53	0.92		2 vs 3	0.66
48hrs	Group 1	15	0.67	0.62	1.00	1 vs 2	..
	Group 2	15	0.67	0.72		1 vs 3	..
	Group 3	15	0.67	0.62		2 vs 3	..

*Statistically Significant

Table 2: Comparison of mean no. of analgesics taken between 3 groups using Kruskal Wallis Test followed by Mann Whitney Post hoc Test

Variable	Groups	N	Mean	SD	P-Value ^a	Sig. Diff	P-Value ^b
Analgesics Taken	Group 1	15	3.00	0.00	<0.001*	1 vs 2	<0.001*
	Group 2	15	1.13	0.35		1 vs 3	<0.001*
	Group 3	15	1.13	0.35		2 vs 3	1.00

Table 3: Comparison of mean VAS scores b/w different time intervals in each study group using Friedman's Test

Groups	Time	N	Mean	SD	Min	Max	P-Value
Group 1	6hrs	15	6.20	0.56	5	7	<0.001*
	12hrs	15	4.93	0.70	4	6	
	24hrs	15	2.53	0.64	2	4	
	48hrs	15	0.67	0.62	0	2	
Group 2	6hrs	15	4.60	0.83	3	6	<0.001*
	12hrs	15	2.53	0.99	1	5	
	24hrs	15	1.73	0.96	0	4	
	48hrs	15	0.67	0.72	0	2	
Group 3	6hrs	15	4.60	0.63	4	6	<0.001*
	12hrs	15	2.40	0.91	1	4	
	24hrs	15	1.53	0.92	0	3	
	48hrs	15	0.67	0.62	0	2	

Table 4: Multiple comparison of mean diff. in VAS scores b/w different time intervals in each group using Wilcoxon Signed Rank Post hoc Test

Time	6 vs 12	6 vs 24	6 vs 48	12 vs 24	12 vs 48	24 vs 48
Group 1	0.001*	0.001*	<0.001*	0.001*	<0.001*	<0.001*
Group 2	0.001*	<0.001*	<0.001*	0.001*	0.001*	0.001*
Group 3	<0.001*	0.001*	0.001*	0.004*	<0.001*	0.002*

post operative pain and inflammation due to induction of reactive oxygen species.¹⁷

A high resin/MTA ratio helps in achieving a desired flow to the sealer, but this may result in the dissolution of a sealer & the release of chemical compounds that could irritate the periapical tissues.¹⁸

The results of our study are in concordance with other studies which evaluated the biological response of MTA

Fillapex, fresh mix of this material showed high cytotoxicity and genotoxicity.¹⁹ But the initial toxic effects decreased after the initial set of the material was achieved. Another study showed that when this sealer was implanted in subcutaneous tissues in rats, it remained toxic even after 90 days.²⁰ The current results showing increased VAS scored and increased analgesic intake in teeth obturated with MTA Fillapex corroborate these findings.

BioRoot RCS, is composed of pure tricalcium silicate & Ceraseal is a premixed calcium silicate. Thus, both Ceraseal and Bio Root RCS have biocompatible ingredients without resin and have shorter setting time, therefore they may be expected to cause significantly less severe post operative pain.

In the present study, to control the pain 100 mg Acefenac tablet was recommended. Acefenac is a most commonly available NSAID can be taken orally by the patient and has significant effect on reducing post operative pain.

In terms of analgesic intake, there is significant difference among the groups with highest intake seen in MTA Fillapex group from 6hrs to 12hrs. The decrease in pain was statistically significant for each time intervals from 6hrs to 48hrs for all the three groups. The analgesic intake decreased after 24hrs. similar results were seen in a study done by Atav Ates et al.⁶ and the increased pain immediately post operative can attributed to many procedural factors such as the injection of local anesthesia rubber dam clam and prolonged mouth opening.

5. Source of Funding

None.

6. Conflicts of interest

There are no conflicts of interest.

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