International Journal of Chemical and Biochemical Sciences
(ISSN 2226-9614)

Journal Home page: www.iscientific.org/Journal.html

Assessment of postoperative pain of two bioceramic root canal sealers after different obturation techniques: a randomized clinical trial

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Abstract

This study aimed to compare the postoperative pain levels following obturation using different sealers and obturation techniques. This clinical trial has been reported according to the Preferred Reporting Items for Randomized Trials in Endodontics 2020 guidelines. The study protocol was registered at the clinical trial registry (ClinicalTrials.gov) with identifier number (NCT06075550). Sixty Patients with vital maxillary anterior teeth in need of endodontic treatment were randomly allocated into two groups (n=30): group I, obturation with Total Fill BC Sealer using single cone technique and group II, obturation with Total Fill BC Sealer HiFlow using warm vertical compaction technique. Postoperative pain was recorded on a visual analog scale (VAS) from 0-10 after 6, 12, 24, 72 hours, and 1 week. Statistical analysis was done using Mann-Whitney U test for intergroup comparisons and Friedman's test followed by Nemenyi post hoc test for intragroup comparisons. The significance level was set at $p<0.05$ within all tests. Sealer extrusion occurred in 8(26.7%) cases in group (I) and in 30(50%) the cases in group (II) and the difference between both groups was not statistically significant ($p=0.063$). Regarding postoperative pain, at all intervals, there was no significant difference of pain severity between both groups ($p>0.05$). The findings of this clinical trial showed no significant difference in postoperative pain between teeth obturated with TotalFill BC Sealer using single cone technique and teeth obturated with Total Fill BC Sealer HiFlow using warm vertical compaction technique.

Keywords: Obturation technique, Postoperative pain, Analgesic intake, bioceramic sealer, warm vertical compaction technique.

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1. Introduction

Endodontic treatment is associated with the highest pain incidence among dental treatments [1]. Postoperative pain as a result of endodontic treatment was found to occur at a range of 1.9% (2) to 82.9% [3,4], while patients experiencing severe pain are found to be less than 12% [5]. Postoperative pain as a result of periapical periodontitis was found to be initiated due to microbial, chemical, and mechanical irritation to the periapex. Therefore, several factors may induce postoperative pain after an endodontic treatment; however these factors may include the type of the root canal sealer [6] and the obturation technique used [7]. Although root canal sealers should be limited to the root canal space, sometimes sealers may extrude and become in contact with periodontium, through the apical foramen, lateral or accessory canals, and/or perforations, which might lead to inflammation and pain following treatment. Large varieties of endodontic sealers are present having different composition, which may include bioceramic, calcium hydroxide, epoxy resin, methacrylate and zinc oxide and eugenolbased sealers. Bioceramic materials are composed of zirconia, alumina, glass ceramic, bioactive glass, calcium phosphate, and hydroxyapatite. The uses of these bioceramic (calcium silicate) materials showed to be suitable for root canal filling, perforation repair, vital pulp therapy and as a root end filling material [8]. Different obturation techniques present may also play a role in postoperative pain. Recently, single cone obturation technique in conjunction with bioceramic sealers was introduced, which provided an easy and time saving obturation method [9]. Warm vertical

obturation techniques provide the use of high temperature that allows and facilitate the flow of thermoplasticized gutta percha and sealers into canal irregularities, isthmuses, lateral and accessory canals [10]. It was found that warm vertical compaction provides more efficient filling ability of lateral and accessory canals when compared with cold lateral compaction [10]. However, lack of length control is the main disadvantage of such technique as slow filling may lead to underfilling whereas rapid insertion may lead to overfilling [11]. It has been reported that the application of increased heat might affect the physical properties of bioceramic sealers. A study showed that bioceramic sealers revealed decreased setting time and a lower flow at increased temperature (140ºC) when compared to room temperature [12]. Therefore, the use of bioceramic root canal sealers with warm vertical compaction is questionable. While, TotalFill BC Sealer (FKG, La Chaux-de-Fonds, Switzerland) is a calcium silicate based premixed root canal sealer providing increased radiopacity, hydrophilic, creates hydroxyapatite during setting, in addition to chemical bond to the dentinal wall [13]. However, a new version, TotalFill BC Sealer HiFlow (FKG, La Chaux-de-Fonds, Switzerland) has been introduced to be compatible with warm obturation techniques. According to the manufacturer this sealer maintains decreased viscosity at high temperatures compared to BC sealer [14]. To the best of our knowledge, the difference in the postoperative pain following the use of bioceramic sealer with both single cone technique and warm vertical compaction technique is unknown. Therefore, the aim of the present study was to compare the postoperative pain following the use of TotalFill BC sealer using single cone technique and TotalFill BC sealer Hiflow using warm vertical compaction technique. The null hypotheses tested was that there was no difference between both techniques with regard to the postoperative pain using both sealers.

2. Materials and methods

2.1. Trial design

The study was conducted after obtaining the approval of the ethical committee of the Faculty of Dentistry at Minia University (Minia, Egypt; approval no.439). The study was also registered in the Clinical Trials Registry (ClinicalTrials.gov) with identifier number (NCT06075550). This study was designed as a randomized clinical trial with two arm parallel groups with an allocation ratio of 1:1. It was conducted at Minia University Dental Hospital over a period of 10 months. The study followed the Consolidated Standards of Reporting Trials (CONSORT) guidelines and the Preferred Reporting Items for Randomised Trials in Endodontics guidelines [15].

2.2. Sample size

Based on a previous study by Graunaite et al., 2018 (16), the difference in pain score between groups is 4.5±6. Using power 80% and 5% significance level we will need to study 30 patients in each group. Sample size calculation was achieved using PS: Power and Sample Size Calculation software Version 3.1.2 (Vanderbilt University, Nashville, Tennessee, USA)

2.3. Eligibility criteria

Sixty patients were randomly selected from the incoming patients in need of endodontic treatment of a maxillary anterior tooth, at the faculty's endodontic department outpatient clinic. Patients with the desired inclusion criteria for the study were selected continuously, till the target number of patients was achieved. Patients included for this study were 20-50 years old, free of systemic diseases and any known hypersensitivity reactions; only medically free patients were selected who required an endodontic treatment of a vital single rooted maxillary anterior tooth with mature apex. Diagnosis was performed by obtaining patient's history in addition to clinical and radiographic examinations. All included patients had vital pulps of preoperative pain record ranging from 0 to 3 on VAS. The diagnosed vital pulp was either, asymptomatic irreversible pulpitis due to carious lesion, normal pulp of patient referred for intentional endodontic treatment for prosthetic purpose, or patients experiencing mild preoperative pain ranging from 1 to 3 on VAS. A preoperative radiographic examination was obtained using a size number 2 periapical film (Kodak International, Rochester NY, USA). Tooth vitality was confirmed by a pulp sensibility test using an electric pulp tester (Pulp Tester DY 310; Denjoy Dental Co., Ltd, Changsha, China). A lip clip was placed and the tooth to be examined was isolated and dried. A piece of toothpaste was placed on tooth surface and the test was performed. Patients that were excluded from the study included: teeth diagnosed with non-vital pulp, teeth with vital pulp having a preoperative pain record higher than 3 on VAS, periodontally compromised teeth, teeth with abnormal anatomy or calcified canals, non-restorable teeth, immature teeth with open apices, complications during treatment (file separation, ledges, perforation, etc.), pregnant women, teeth showing radiographic evidence of internal or external root resorption and patients who showed no interest to participate in the study. A detailed explanation of the treatment procedures, possible outcomes, complications and the desired follow up period was introduced to the patients. The patients were asked to sign a printed informed consent form in Arabic or in English. The patients were asked to keep a copy of the consent form.

2.4. Randomization and blinding

Random sequence of numbers from 1 to 60 was generated online using (www.random.org) equally among 2 groups (n=30). The generated random sequence was then kept by (R.H.). Each number from 1 to 60 was written on a separate piece of paper, which was then folded eight times and placed in an opaque sealed envelope and kept in a box with (H.A.Y.S.). Each patient picked an envelope randomly immediately before obturation and according to the revealed number, a phone call was made to (R.H.) to determine the allocation of this number to either treatment group according to the generated sequence. Owing to the nature of the interventions, the operator (H.A.Y.S.) and the patient could not be blinded. The assigned treatment protocol was revealed to the patient during the obturation step. Data collector (A.E.) and the statistician were blinded.

2.5. Preoperative assessment and data collection

Only one tooth per patient was included in this study. The operator recorded information including demographic data such as patient's age, gender (male/female), the type of tooth to be treated (maxillary

central incisor, maxillary lateral incisor, or maxillary canine), percussion test (positive/negative), and pulp vitality (vital/non vital). Periodontal examination was done to exclude the presences of periodontal pockets, attachment loss or increased mobility of the tooth. All participants were given a Visual Analog Scale (VAS) to record the preoperative and postoperative pain intensity. The patients were instructed on how to use the VAS and trained to use it before recording their preoperative pain.

2.6. Treatment procedures (interventions)

All patients were treated in a single visit including access, cleaning, shaping and obturation. Chlorhexidine mouthwash (Hexitol; Arab Drug Company) was used as an oral rinse. The patient was then anesthetized using 1 carpule of 4% articaine with 1:100,000 epinephrine (Laboratories Inibsa, Barcelona, Spain) by using infiltration technique, no patient needed a second carpule administration. Rubber dam was applied for isolation and the working field was disinfected by a sodium hypochlorite swab. Access cavity was prepared using a carbide bur no. 014 under water coolant. After a straight-line access to the canal orifice was achieved, a stainless-steel manual K-file #10 (Dentsply/Maillefer, Ballaigues, Switzerland) was inserted and connected to an electronic apex locator (Root ZX II; J Morita Corporation, Tokyo, Japan) for working length determination. The Working length was then confirmed by a obtaining a periapical radiograph. A glide path was then established using stainless steel manual K-file size #15. The root canal was then prepared using rotary ProTaper Next files (Dentsply/Maillefer, Ballaigues, Switzerland) connected to an endodontic motor (Endo-Mate TC2; NSK Nakanishi, Tochigi, Japan) at speed of 300 RPM and 4 Ncm torque, according to the manufacturer's instructions. Patency was achieved using manual K-file size #10 (Dentsply/Maillefer, Ballaigues, Switzerland). The final instrumentation file was determined as three sizes larger than the first binding file on working length; therefore, the Master Apical File was either ProTaper Next X4 or X5, depending on the initial apical diameter of the canal. Irrigation with 3ml of 5.25% sodium hypochlorite (NaOCl) (Clorox Co., 10th of Ramadan, Egypt) was always performed between each successive file using a side vented irrigation needle (Ultradent, South Jordan, UT, USA), inserted 2 mm shorter than working length. After instrumentation, a final irrigation protocol of 5ml of 5.25% NaOCl followed by 5 mL saline and 5 mL of 17% EDTA (Cerkamed, Pawłowski, Poland) and a final flush of 5 mL saline was done. The canal was then dried using sterile paper points (Dentsply Sirona, York, Pennsylvania, USA) of the same size of the prepared canal. A master gutta percha cone (Dentsply/Maillefer, Ballaigues, Switzerland) of same size of the prepared canal was inserted and a master cone periapical radiograph was taken for confirmation, obturation was done according to the mentioned groups.

2.6.1. Group I: TotalFill BC Sealer using the single cone technique

Using TotalFill BC Sealer, the tip of the syringe was inserted into the canal and the sealer was dispensed into the root canal as recommended by the manufacturer. A ProTaper Next gutta percha cone (Dentsply/Maillefer, Ballaigues, Switzerland) of the same size of the prepared canal was used for single cone obturation technique and the excess gutta percha was removed by a heated condenser.

2.6.2. Group II: TotalFill BC Sealer HiFlow using warm vertical compaction technique

TotalFill BC Sealer HiFlow was inserted into the canal as in Group I and the master gutta percha cone was placed, warm vertical compaction technique (continuous wave of compaction) was performed. Using Dia Pen (DiaDent, Chungcheongbuk-do, Korea) the heated plugger was adjusted at a depth of 5 mm less than the working length; followed by back filling of thermoplastisized gutta percha using DiaGun (DiaDent, Chungcheongbuk-do, Korea). After obturation of either group, the access cavity was cleaned and sealed with a bonded composite resin restoration (3M, ESPE, St. Paul, MN, USA,) and a postoperative periapical radiograph was taken. In order to reduce interoperator variability, all procedures were done by the same operator (H.A.Y.S.), who has been trained to perform obturation using both techniques.

2.7. Assessment of the postoperative pain

Every participant was given a Visual Analog Scale (VAS) to record the intensity of postoperative pain ranging from 0 to 10. The 0 number was used to indicate no pain, while number 10 used to indicate highest level of severe pain. The intensity of postoperative pain was recorded at 6 hrs., 24 hrs., 48 hrs., 72 hrs., and 1week after treatment. The operator (H.A.Y.S.) contacted patients by telephone at each time point to be checked on and to be reminded of recording their pain. In case of pain sensation after treatment the patients were asked to take Ibuprofen 400 mg every 8-12 hours if needed. Patients were also asked to report the analgesic intake. The patients returned their Visual Analog Scale (VAS) after 1 week and the recorded pain data were collected and statistically analyzed regarding each group.

2.8. Statistical analysis

Categorical data were presented as frequency and percentage values and were compared using chi-square test. Numerical data were presented as mean and standard deviation values. They were tested for normality using Shapiro-Wilk's test. Normally distributed data (age) were analyzed using independent t-test. Non-parametric data were pain score was analyzed using Mann-Whitney U test for intergroup comparisons and Friedman's test followed by Nemenyi post hoc test for intragroup comparisons. The significance level was set at $p<0.05$ within all tests. Statistical analysis was performed with R statistical analysis software version 4.3.1 for Windows (17).

3. Results

Over a period of 10 months, 60 patients were selected as eligible for the study. The follow up period was 1 week postoperatively. The 60 cases participated in the clinical trial were randomly and equally allocated to one of the studied groups (i.e. 30 cases each). The PRIRATE 2020 flow chart shows the flow of participants during the trial (Fig. 1). There was no significant difference between the groups regarding the following baseline characteristics: age, sex distribution, tooth type distribution. In both groups, majority of treated teeth were lateral incisors and the difference was not statistically significant (p=0.528) (Table

1). Only three cases in group (II) took analgesics, while no patients in group (I) took any, however the difference between both groups was not statistically significant (p=0.076) (Table 2). Sealer extrusion occurred in 8(26.7%) cases in group (I) and in half of the cases in group (II) and the difference between both groups was not statistically significant (p=0.063). For both groups, within different intervals, there was no significant association between pain severity and sealer extrusion (p>0.05) (Figure 2). Regarding postoperative pain, at all intervals, there was no significant difference of pain severity between both groups (p>0.05). However, there was a significant difference between values measured at different intervals (p<0.001) within both groups. For group (I), post hoc pairwise comparisons showed measurements taken pre-operatively and after 6 hours to be significantly higher than values of other intervals (p<0.001). In addition, they showed value measured after 24 hours to be significantly higher than values of later intervals (p<0.001). For group (II), post hoc pairwise comparisons showed measurements taken pre-operatively and after 6 hours to be significantly higher than values of other intervals except for 24 hours (p<0.001). In addition, they showed value measured after 24 hours to be significantly higher than values measured after 72 hours and 1 week (p<0.001) (Figure 3).

4. Discussion

Postoperative pain in endodontic treatment is a common and undesirable incidence. Although postoperative pain is difficult to be totally avoided, yet clinicians must be aware of materials and techniques that might predispose increased postoperative pain. Postoperative pain after endodontic treatment may result due to several factors [18], which may include mechanical, microbial, and chemical irritants to the periapex. Mechanical injuries may result due to overinstrumentation, however chemical irritants may occur as a result of periapical reaction to intracanal medicaments, irrigants, or endodontic filling materials [19,20]. During obturation, gutta percha acts as the main core filling material, however sealers are used to fill minute spaces within the root canal [21]. Recently, single cone obturation technique using bioceramic sealers was introduced providing easy and time saving obturation method. However, warm vertical obturation techniques utilizes high temperature that allows and facilitate the flow of thermoplasticized gutta percha and sealers into canal irregularities, isthmuses, lateral and accessory canals. Calcium silicate based sealers provide several advantages in endodontic obturation which includes; slight setting expansion, biocompatibility, and hydrophilic property [22,23]. Previous studies reported higher flowability of bioceramic sealers when compared to resin-based sealers [23,24]. Calcium Silicate based sealers have shown to provide superior flowability when compared to epoxy resin based sealers [25]. In addition Calcium Silicate based sealers provide decreased void formation during endodontic obturation [26]. It was demonstrated that TotalFill BC sealer showed less sealer extrusion when compared to AH plus sealer [27]. Calcium Silicate based sealers also have increased pH level, thus providing osteoclastic activity leading to hard tissue formation and enhanced healing [25,28]. A previous study demonstrated that the cytotoxic effect of bioceramic sealers were decreased after 24 hours and showed to be more cyto-compatible when compared to resin-based sealers [29]. Sealer flowability enables easier filling of minute canal anatomies, however increased flowability increases the incidence of sealer extrusion and postoperative pain, as it was reported that root canal sealers release chemical irritants during setting [30]. However previous studies found that sealer extrusion has no effect on the outcome of endodontic treatment [31-33] Although tissue reaction is dependent on the type of sealer [34,35]. A new bioceramic root canal sealer; TotalFill BC Sealer HiFlow was introduced, were the manufacturer claim, it maintains decreased viscosity at high temperatures, making it a suitable bioceramic root canal sealer when used in conjunction with warm vertical obturation techniques, although this obturation technique is known to result in gutta percha shrinkage during cooling. It was found that sealers also shrink during setting, creating gaps between filling materials and canal wall [21,23]. The type of obturation technique, was also found to be associated with sealer extrusion and postoperative pain [27,36]. Postoperative pain following obturation might be a result of periapical inflammation or a foreign body reaction to the root canal filling material. Therefore the type of sealer and obturation technique used, are considered factors that may affect the intensity of postoperative pain. Thus, the purpose of this study was to compare postoperative pain after obturation using Total Fill BC Sealer with single cone technique with that of Total Fill BC Sealer HiFlow using warm vertical compaction technique. In this study root canal treatment was performed in a single visit [16] in order to exclude inter-appointment associated pain due to periapical reaction to intracanal medicaments or bacterial infection [20,36]. Only maxillary anterior teeth with straight single root canals were included in the current study. Previous studies reported that postoperative pain results were higher among teeth with three or more root canals [18,38]. In addition, maxillary anterior teeth facilitate working length measurement, thus avoiding overinstrumentation [37], that might lead to increased postoperative pain as a result of periapical injury, debris, sealer and gutta percha extrusion. In order to avoid postoperative pain related to infection , only teeth with vital pulps were included in this study [7]. A previous study demonstrated that using rotary instrumentation showed less debris extrusion when compared to manual and reciprocation instrumentation systems [39]. In addition, instrumentation using ProTaper Next rotary files has been reported to be associated with significantly less debris extrusion when compared to ProTaper Universal files [40]. All trials have been taken to exclude most of the factors that could lead to post-operative pain. VAS are currently being widely used in endodontic studies for postoperative pain evaluation [41,42]. VAS is an easy, understandable, valid and reproducible method for both young and old patients, in addition it is language independent, making it available for patients who have difficulty in written language [43]. When evaluating endodontic postoperative pain, 4 time points were used; 24h, 48h, 72h, and 1 week [44]. However, in this study, pain assessment started after 6 hours postoperatively, to ensure that pain incidence was recorded immediately after local anesthetic effect has subsided. Since it was reported that the highest incidence of postoperative pain following a root canal treatment was in the first 24 hours, which was then followed by gradual decrease to lower levels [1].

Therefore, in the current study 5 observational time points 1 week.
VAS were set at, 6 hours, 24 hours, 48 hours, 72 hours, and

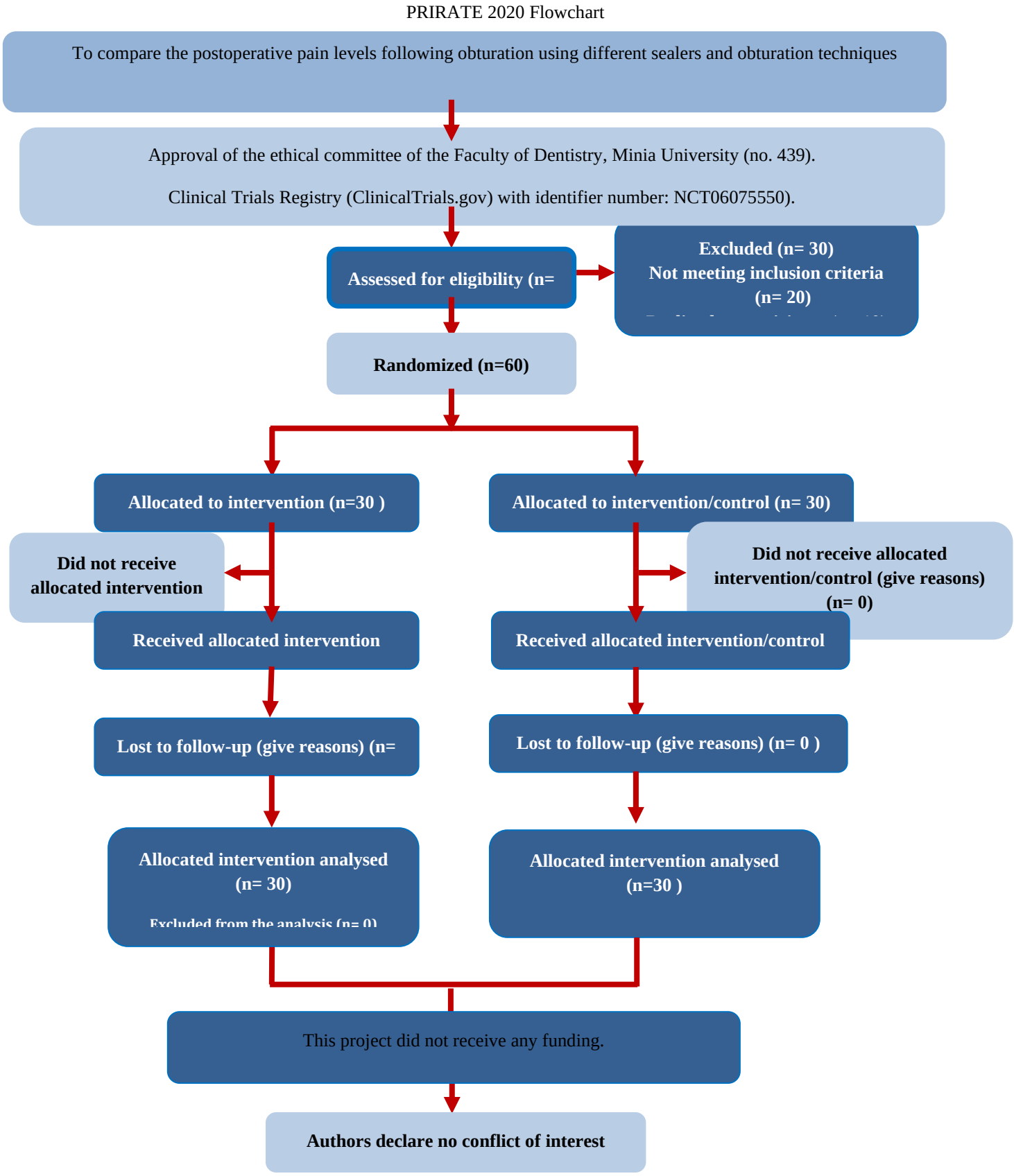

Figure 1: The PRIRATE 2020 Flowchart of participants throughout the trial. PRIRATE, Preferred Reporting Items for Randomized Trials in Endodontics.

Table 1: Summary statistics and results of intergroup comparisons fordemographic data

Parameter			Group (I)	Group (II)	p-value
Sex	Male	n	11	6	0.152ns
		%	36.7%	20.0%	
	Female	n	19	24	
		%	63.3%	80.0%	
Age (years)		Mean±SD	40.93±8.36	38.87±8.20	0.338ns
Tooth	Central incisor	n	7	5	0.528ns
		%	23.3%	16.7%	
	Lateral incisor	n	15	13	
		%	50.0%	43.3%	
	Canine	n	8	12	
		%	26.7%	40.0%	

*; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)

Table 2: Intergroup comparison, frequency and percentage values for analgesic intake

Analgesic intake		Group		p-value
		Group (I)	Group (II)	
No	n	30	27	0.076ns
	%	100.0%	90.0%	
Yes	n	0	3	
	%	0.0%	10.0%	

*; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)

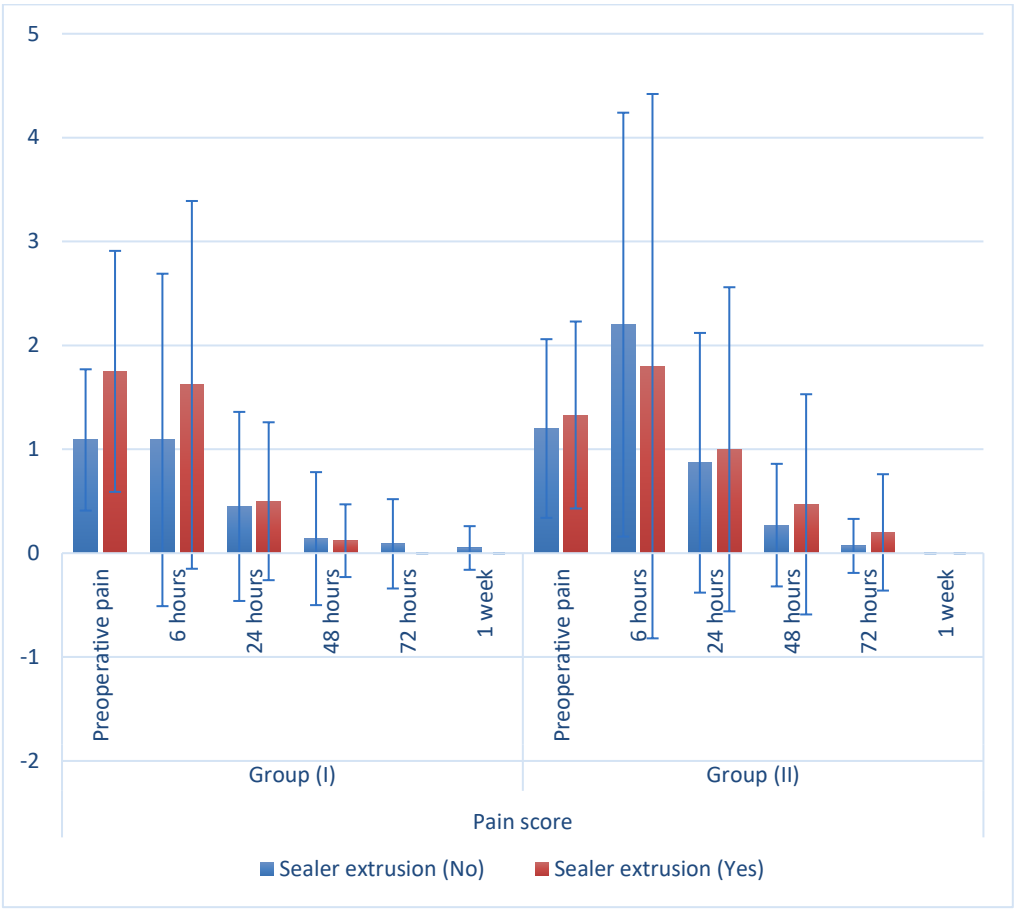

Figure 2: Bar chart showing the association between pain score and sealer extrusion.

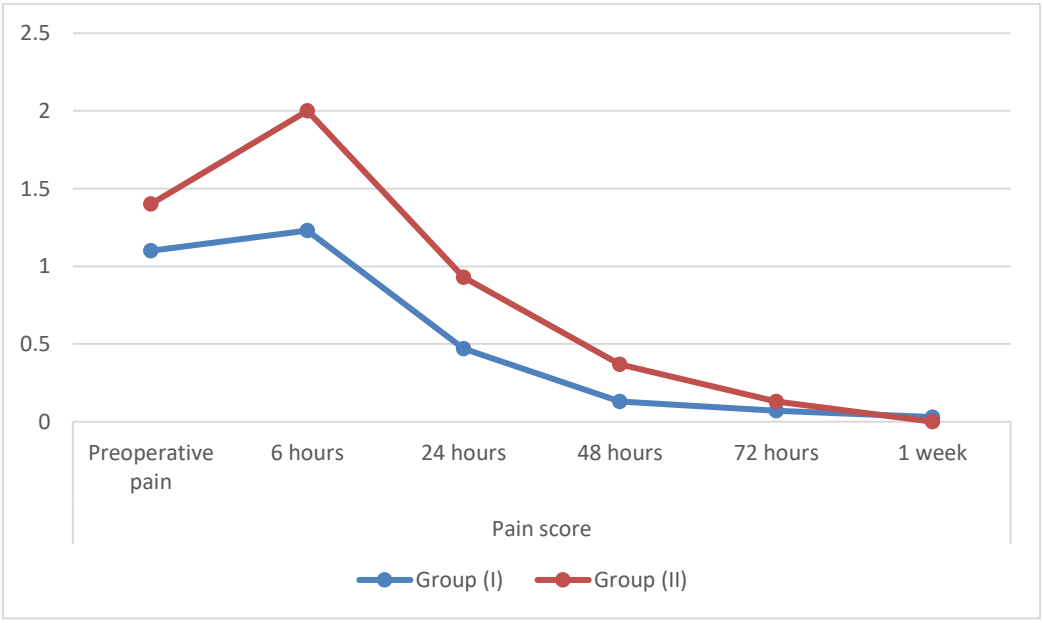

Figure 3: Line chart showing mean values for post-operative pain

Patients were informed about the purpose of the study only after pain records were submitted; in order to avoid the Hawthorne effect, where people may modify their behavior as they are being observed [45]. Preoperative pain is a determinant factor to postoperative pain [5,46,47] and that preoperative pain was known to have a strong correlation with postoperative pain [44,48]. Therefore in the current study, only patients with asymptomatic or mild preoperative pain scores ranging from 0 to 3 on the VAS were included [7]. Patient's age was also found to affect pain incidence, as preoperative and postoperative pain results showed to be lower in older patients [49], as pulp tissue recession among age is a common physiologic finding. Pulps of young aged permanent teeth showed increased innervation when compared with that of older age [50,51]. Therefore, higher neural element is found in younger teeth, making it more sensitive when compared with older patients. In the present study all root canal treatment cases were performed by a single operator (H.A.Y.S.) to unify the treatment procedure. It is suggested, to prescribe a suitable non-narcotic analgesic of proper dose as the first option in postoperative pain control [52]. Previous studies reported the use of NSAIDs, as effective analgesics to control pain after endodontic treatment [53,54]. An oral dose of Ibuprofen 400 mg was reported to be an effective analgesic in postoperative pain management [55]. In this study one capsule of Ibuprofen (400mg) was prescribed, only when required in case of postoperative pain [56]. The incidence of analgesic intake was also recorded in the study. In this study removal of smear layer was done using EDTA and NaOCl. Results showed that, the age, gender and type of tooth treated showed no significant difference, creating a proper randomization of the study. In the present study, the highest pain levels occurred at six hours postoperatively regarding both groups, this result was in agreement with Alonso-Ezpeleta LO et al [7] and Attar S et al [57], showing also maximum pain levels occurred after six hours postoperatively after the anesthetic effect has subsided. Postoperative pain was reduced significantly during the first 48 hours post treatment. This was also in agreement with Pak JG et al. who found that endodontic postoperative pain is significantly reduced during the first 48 hours [1]. In the present study there was no statistically significant difference at all pain intervals between the two groups, yet results of group (II) showed higher mean pain levels than group (I) at all pain intervals except for the 1 week score were the pain level was negligible at both groups. In addition three patients in group (II) took analgesics once, while no patient in group (I) has taken analgesics, however the difference between both groups was also not statistically significant (p=0.076). This higher pain incidence regarding group (II) may be attributed to the use of warm obturation technique, this was in agreement with Koçer A et al [58], who found higher levels of pain in the thermoplasticised solid core group when compared to cold lateral compaction and cold free flow compaction groups. This high pain incidence may be attributed due to the application of increased heat during such obturation techniques. In the present investigation, Group (I) had a female population of 63.3% while Group (II) had 80.0% females. Although the gender distribution did not vary significantly between the two groups, the high female representation in Group (II) may have contributed to the higher incidence of pain in that group. This finding is consistent with previous studies by Robinson ME et al [59] and Liddell A et al [60] , which demonstrated that gender can impact pain reporting due to sociocultural and biological factors. Specifically, male patients exhibited greater pain tolerance and lower pain ratings than female patients. Sealer extrusion occurred in 26.7% of group (I) and 50% in group (II); however, there was no significant difference between the two groups (p=0.063). One possibility for the higher occurrence of sealer extrusion in group (II) could be attributed to the TotalFill BC sealer Hiflow's high flowability, combined with the vertical pressure created through the warm vertical compaction technique. Previous studies conducted by Kandemir Demirci G et al [61], Da Silva D et al [62], and Tennert C et al [63] have also found that thermoplasticised carrier based obturation systems can increase the risk of gutta percha and sealer extrusion in in vitro trials. In both groups, within different pain intervals, there was no correlation between pain severity and with sealer extrusion (p>0.05). Riccuci et al, reported that calcium silicate based sealers have biocompatible components with no resin ingredient, showing no foreign body or inflammatory reaction in histological section [35]. The limitations of the current study were the reduced number of participants and challenges in evaluating pain perception due to a multitude of factors that can impact the result, such as gender, age, personality, psychological and social elements.

5. Conclusions

Postoperative pain levels following root canal therapy were not affected by the obturation technique. There was no significant difference in the incidences of post-operative pain after using TotalFill BC Sealer using single cone technique and TotalFill BC Sealer HiFlow using warm vertical compaction technique.

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