# A RANDOMISED CLINICAL TRIAL TO ASSESS THE CLINICAL EFFICIENCY OF SEALER-BASED OBTURATION WITH CALCIUM SILICATE SEALERS

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## Abstract

**Introduction:** The clinical efficacy and results of a continuous wave of condensation technique (CWC) with a resin-based sealer and a sealer-based obturation technique (SBO) using calcium silicate sealers were compared in this randomised controlled clinical research.

**Methods:** With the help of rotary tools and 2.5% sodium hypochlorite, root canals were created. On the basis of the obturation procedure, patients were enrolled and randomly divided into 2 groups at the following visit: CWC with AH Plus sealer and SBO with Endoseal TCS. A numerical rating scale was used to evaluate the severity of discomfort following surgery in patients. The extent of root filling, root-filling voids, and sealer extrusion were used to assess the quality of the root canal obturation. After at least six months, the subjects were asked to come back. Healing of the teeth was found as a fall in Periapical Index score and resolution of symptoms. The results were statistically compared by using the $c^2$ test or Fisher exact test, followed by multivariate analysis with logistic regression.

**Results:** The evaluation covered 74 teeth (79% recalls), and the average follow-up time was 17 months (6-29 months). The spectrum of postoperative discomfort was equivalent in both of the groups (P =.973), and the quality of root canal obturation was comparable. Without no discernible differences between the 2 groups, the overall success rates were 93.2% (CWC 92.3%, SBO 94.3%) by loose criteria and 60.8% (CWC 51.3%, SBO 71.4%) by tight criteria. In comparison to teeth lacking sealer extrusion, the success rate by loose criteria was significantly lower in teeth with sealer extrusion (P 5.049**).**

**Conclusions:** SBO employing an Endoseal TCS may be a viable substitute for CWC employing AH.

**Keywords:** Sealer-Based Obturation, Resin-Based Sealer, Condensation Technique

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## 1. Introduction

The quality of root fillings was found to be a significant factor in the success rates of nonsurgical root canal treatment (NSRCT), with the highest odds ratio among numerous affecting factors1. Various types of endodontic sealers and filling techniques have been advocated to accomplish satisfactory root filling, and until now, warm vertical compaction with the epoxy resin-based sealer AH Plus seal has been recognized as the gold standard. [1,2,3] Recently, a sealer-based obturation technique (SBO) using calcium silicate sealers (CSS) has become popular because it is less technique sensitive, requires less armamentarium, and is easier to perform4. CSS has been reported to have hydrophilic properties and a bioactivity similar to that reported for mineral trioxide aggregate (MTA)- type materials. [5,6] According to certain publications, the SBO's filling ability is better than continuous wave of condensation techniques (CWC)[4, 7], not inferior. However, according to other researchers, the SBO may cause larger voids in irregularly shaped canals[8, 9], which could harm the success of initial root canal therapy.[1]

Preclinical and clinical investigations should be used to validate clinical methods or materials. Although CSS are hardly investigated in clinical trials, they have been experimentally assessed in numerous in vitro studies10–15. The EndoSequence Bioceramic Sealer (BC) (Brasseler USA, Savannah, GA) was used in the first clinical investigation of NSRCT employing CSS, which was published in 2018 and demonstrated a favourable success rate of 90.9%16. The investigation lacked a control group and was retrospective, and no other clinical studies on the efficacy of CSS-based treatment have been reported to date. SBOs typically fall short of other compressive methods with conventional sealers1. SBO with CSS, nevertheless, was never contrasted with conventional compaction methods. Thus, the goal of the research was to compare CWC with a resin-based sealer to SBO and assess the clinical efficacy and result of SBO when utilised in combination with CSS.

## 2. Methodology

This study was designed as a randomized controlled clinical trial to compare postoperative pain, quality of root canal obturation, and short-term clinical outcomes. The study was approved by the Institutional Review Board of Institute of Dental Sciences, Bareilly. Patients were enrolled from the outpatient clinic of the Department of Conservative Dentistry and Endodontics, Institute of Dental Sciences, Bareilly, between April and September 2022. All those who participated had teeth with fully developed apices that needed root canal therapy. According to the American Society of Anesthesiologists, all of the participants were over the age of 18 and in good health.

**classification Ⅰ or Ⅱ) The exclusion criteria were as follows:**

1. Patients with psychological issues or other conditions that prevented them from communicating about their symptoms.
2. The teeth suffered from cracks, significant periodontal bone loss as a result of the chronic periodontitis that accompanied the tooth's mobility, etc.
3. The radiological apex was 2 mm away from the root canal, which could not be negotiated.

In the following appointment, following canal growth due to symptoms and signs, the teeth wasn't prepared to receive a root canal filling.

In order to enable comparison of two experimental groups with a significance level of 5%, statistical power of 80%, equivalence limit of 15%, and effect size of 0.58, the necessary sample size was established via G power 3 software. For each group, a sample size of 50 teeth was chosen.

### Treatment Procedure andRandomization

At the Department of Conservative Dentistry and Endodontics, Institute of Dental Sciences, Bareilly, tooth were cared for by 6 dentists, comprising 5 postgraduate students and 1 professor. At least two trips were required to complete each operation. The working length was established utilising an electronic apex finder on the initial visit following local anaesthesia with 1.8 mL 2% lidocaine with 1:80,000 epinephrine and rubber dam separation. The operator's chosen rotary instrument was used for preparing the canals. The operator used the first apical file size to calculate the master apical file size. Utilising a 27-gauge or 30-gauge side-vented needle, 2.5% sodium hypochlorite was used to irrigate the canals. Passive ultrasonic irrigation was used in some situations to get rid of serious pollution. An operational microscope was used for every endodontic treatment. The patients were invited to take part in the research if, at the subsequent appointment, there were no or very minor signs and symptoms. Participants in the present investigation were those who gave their informed permission and consented to take part in it. A list of random numbers was generated by a computer utilising the Sealed Envelope website, 1:1 allocation, and random block sizes of six by an

assistant who was unaware of the study's goals. The list of participants was put in a filing cabinet, maintained private, and only accessed by the blinded assistants following the subjects had been enrolled in the study and prior to the intervention took place. Everyone who took part received an enrollment number and was then randomly assigned to either the CWC with AH Plus or the SBO with Endoseal TCS group in accordance with the numbers on the list. A periapical radiograph was taken after the fitting of gutta-percha cones to confirm the working length. Paper points were used to dry the canals. A 24-gauge needle tip was used to inject the Endoseal TCS for the SBO sample into the canal's middle section. To aid the sealer's penetration, a single gutta-percha cone was placed into the canal after three up-and-down movements. One or two extra gutta-percha cones were placed in wide canals to improve sealing. The gutta-percha cone was sliced at the orifice level and then vertically compacted using an Obtura S-Kondenser. Gutta-percha cones were put into the pre-prepared root canals for the CWC cohort and then sealed with AH Plus sealer. The master cone was cut and compacted using a heated plugger that can enter the canal 4 to 5 mm short of the working length. Using SuperEndo Beta 2 (B & L Biotech), the canal was backfilled utilising a thermoplastic injection method. A 0–10 numeric rating scale (NRS), with 0 denoting no pain and 10 denoting the worst pain, was used by patients to track their level of discomfort. At the following intervals: 4, 24, and 48 hours after canal obturation, patients were requested to provide feedback on their level of pain via wired or wireless connection in accordance with their preferences. The highest pain score recorded at 3 consecutive time points was selected and then sorted into 4 larger categories:

1. None (NRS 0): The treated tooth was asymptomatic, and the participant had no pain at all.
2. Mild (NRS 1–3): The tooth was slightly painful, but there was no need to takeanalgesics.
3. Moderate (NRS 4–7): The tooth caused discomfort and pain that were somewhat tolerable but sometimes required analgesics.
4. Severe (NRS 8–10): The pain caused by the treated tooth disturbed normal activity or sleep, and analgesics had little or no effect.

In regard to root-filling voids, sealer extrusion, and root-filling stage, the effectiveness of root canal obturation was assessed. The 2 examiners (J. K. and Y. C.) who were blinded and calibrated assessed the periapical radiographs recorded right after canal obturation. Root-filling voids and sealer extrusion were categorised as either present or absent. For multirooted teeth, the existence of root-filling voids or sealer extrusion in at least one root was considered to be the "presence" of such conditions. The degree of the root filling has been noted as "adequate" and "long" since examples with short working lengths were omitted from the current investigation. The fillings that extended past the radiographic apex were classified as long[19], and the remaining ones as sufficient. Any disagreement regarding sealer extrusion, root-filling voids, and level of root filling was resolved by a discussion until final consensus was reached.

**Healing Outcome**

After at least six months, the subjects were brought back in, and the treated tooth underwent a radiological and clinical assessment. Two blinded, independent, and calibrated examiners (J. K., Y. C.) assigned a Periapical Index (PAI) score20,21 to each pretreatment and recall radiographs of the roots in the following manner:

PAI 1: Normal periapical structure.

PAI 2: Bone structural changes indicating but not pathognomonic for apicalperiodontitis.

PAI 3: Bone structural changes withsome mineral loss characteristic for apical periodontitis.

PAI 4: Well-defined apical radiolucency.

PAI 5: Radiolucency with radiating expansion of bone structural changes.

For any of the roots, multirooted teeth received the highest rating. In alongside efficiency clinical testing looked for the presence or absence of pain, edoema, other symptoms, and nasal tract. A declining PAI score and the absence of symptoms were used to gauge healing. The subsequent classification served as the foundation for grouping the teeth into resultant groups. (Fig. 1):

1. Healed: functional, asymptomatic teeth with PAI $\leq 2$
2. Healing: teeth that are asymptomatic and functional, with a decreased size on radiographic periradicular radiolucency
3. Diseased: nonfunctional, symptomatic teeth with PAI $\geq 3$.

On the basis of arbitrary criteria, the classifications of Healed and Healing were judged to be successes, whereas the category of Diseased was judged to be a failure. Only the Healed category was viewed as a success18, while the Healing and Diseased categories were deemed to be failures.Figure 1 displays examples of each event group. A dialogue was used to settle any differences of opinion regarding radiographic and clinical evaluation until an agreement emerged

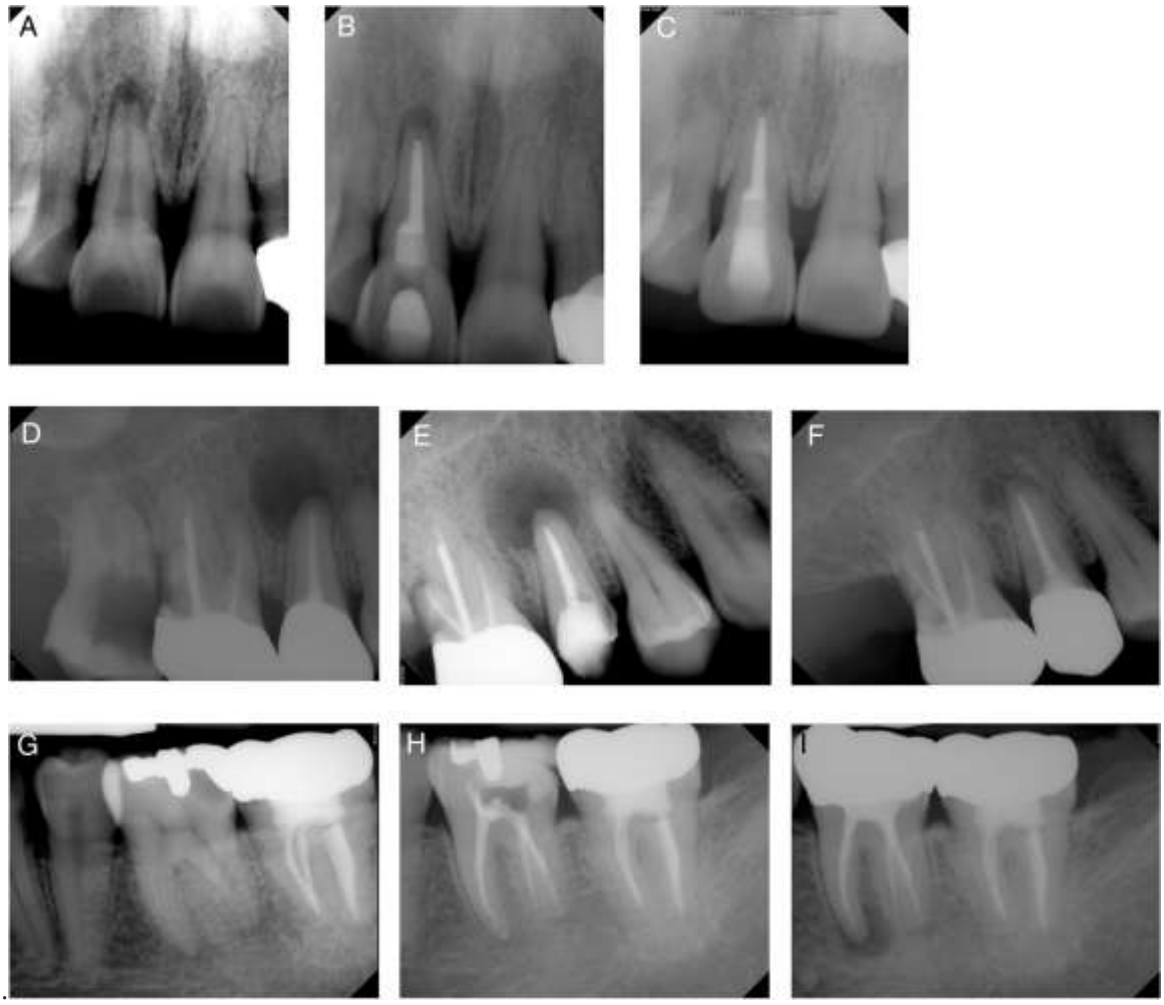


**FIGURE 1 – Representative Images for Healed (*a, b, c*), Healing (*d, e, f*), and Diseased (*g, h, i*) cases.**

**Statistical Analysis**

The c2 test or Fisher exact test were used to analyse postoperative discomfort and the degree of root canal obturation according to each procedure. Depending on the variables, the c2 test or Fisher exact test was used for assessing the results statistically, and then multivariate analysis with logistic regression was performed. The statistical analysis was done with SPSS version 21.

## 3. Results

90 patients participated in the study; 3 were disqualified due to advanced periodontitis in 2 patients and an unrepairable fracture in 1 patient, and 19 patients failed to follow-up within 6 months. As a result, the final analysis included 68 patients and 74 teeth (79% recall), and the mean follow-up time was 17 months (6-29 months). When the first radiographic examination was completed, the interexaminer agreement kappa score was 0.8, and the intraexaminer agreement kappa score was 0.9 when the second radiographic evaluation was completed one week later.[22] Following root canal obturation, 66 of the 74 teeth (89.2%) displayed little or minimal pain, whereas 8 teeth (10.8%) produced moderate to severe pain (Table 1). The two groups displayed the same spectrum of postoperative discomfort (P 5.973). The CWC group exhibited sealer extrusion and lengthy filling length more often compared to the SBO group (41.0% vs. 28.6%, 5.1% vs. 0%, respectively), although these differences were not statistically significant. Two thirds of the cases had voids, which were comparable in both groups (Table 1).

**TABLE 1 - Distribution of Postoperative Pain and Quality of Root Canal Obturation and Bivariate Associations with Filling Techniques**

| | | Total (*n* 5 74) | | CWC (*n* 5 39) | | SBO (*n* 5 35) | *P* value |
|---|---|---|---|---|---|---|---|
| Index | N | % | N | % | N | % | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Postoperative pain | | | | | | | .973 |
| None | 22 | 29.7 | 12 | 30.8 | 10 | 28.6 | |
| Mild | 44 | 59.5 | 22 | 56.4 | 22 | 62.9 | |
| Moderate | 3 | 4.0 | 2 | 5.1 | 1 | 2.9 | |
| Severe | 5 | 6.8 | 3 | 7.7 | 2 | 5.7 | |
| Sealer extrusion | | | | | | | .263 |
| Absent | 48 | 64.9 | 23 | 59.0 | 25 | 71.4 | |
| Present | 26 | 35.1 | 16 | 41.0 | 10 | 28.6 | |
| Void | | | | | | | .563 |
| Absent | 49 | 66.2 | 27 | 69.2 | 22 | 62.9 | |
| Present | 25 | 33.8 | 12 | 30.8 | 13 | 37.1 | |
| Filling length | | | | | | | .495 |
| Normal | 72 | 97.3 | 37 | 94.9 | 35 | 100 | |
| Long | 2 | 2.7 | 2 | 5.1 | 0 | 0 | |

**TABLE 2 - Characteristics of Included Patients and Bivariate Associations between the Investigated Variables and Outcomes Based on Loose and Strict Criteria**

| | | | Loose criteria | | | | | Strict criteria | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Success (*n* 5 69) | | Failure (*n* 5 5) | | | Success | | Failure | | |
| Variables | N | *n* 5 74 | N | % | N | % | *P* value | N | % | N | % | *P* value |
| Age (y) | | | | | | | .499 | | | | | .210 |
| ≤50 | | 66.2 | 45 | 91.8 | 4 | 8.2 | | 27 | 55.1 | 22 | 44.9 | |
| 49 | | | | | | | | | | | | |
| ˗50 | 25 | 33.8 | 24 | 96.0 | 1 | 4.0 | | 18 | 72.0 | 7 | 28.0 | |
| Sex | | | | | | | .183 | | | | | .343 |
| Female | 35 | 47.3 | 31 | 88.6 | 4 | 11.4 | | 19 | 54.3 | 16 | 45.7 | |
| Male | 39 | 52.7 | 38 | 97.4 | 1 | 2.6 | | 26 | 66.7 | 13 | 33.3 | |
| Tooth type | | | | | | | .403 | | | | | .720 |
| Anterior | 16 | 21.6 | 15 | 93.8 | 1 | 6.3 | | 9 | 56.3 | 7 | 43.7 | |
| Premolar | 19 | 25.7 | 19 | 100.0 | 0 | 0.0 | | 13 | 68.4 | 6 | 31.6 | |
| Molar | 38 | 52.7 | 35 | 92.1 | 4 | 10.5 | | 23 | 59.0 | 16 | 41.0 | |
| Vitality | | | | | | | .034 | | | | | .464 |
| Necrotic | 29 | 39.2 | 29 | 100.0 | 0 | 0.0 | | 19 | 65.5 | 10 | 34.5 | |
| Vital | 23 | 31.1 | 19 | 82.6 | 4 | 17.4 | | 15 | 65.2 | 8 | 34.8 | |
| Retreatment | 22 | 29.7 | 21 | 95.5 | 1 | 4.5 | | 11 | 50.0 | 11 | 50.0 | |
| Preoperative PAI | | | | | | | .512 | | | | | .435 |
| 1 | 18 | 24.3 | 15 | 83.3 | 3 | 16.7 | | 11 | 61.1 | 7 | 39.8 | |
| 2 | 14 | 18.9 | 13 | 92.9 | 1 | 7.1 | | 11 | 78.6 | 3 | 21.4 | |
| 3 | 8 | 10.8 | 8 | 100.0 | 0 | 0.0 | | 5 | 62.5 | 3 | 37.5 | |
| 4 | 26 | 35.1 | 25 | 96.2 | 1 | 3.8 | | 15 | 57.7 | 11 | 42.3 | |
| 5 | 8 | 10.8 | 8 | 100.0 | 0 | 0.0 | | 3 | 37.5 | 5 | 62.5 | |
| Preoperative pain | | | | | | | .390 | | | | | .630 |
| Absent | 44 | 59.5 | 42 | 95.5 | 2 | 4.5 | | 28 | 63.6 | 16 | 36.4 | |
| Present | 30 | 40.5 | 27 | 90.0 | 3 | 10.0 | | 17 | 56.7 | 13 | 43.3 | |
| Preoperative sensitivity | | | | | | | ˗.999 | | | | | .056 |
| Absent | 37 | 50.0 | 34 | 91.9 | 3 | 8.1 | | 27 | 73.0 | 10 | 27.0 | |
| Present | 37 | 50.0 | 35 | 94.6 | 2 | 5.4 | | 18 | 48.6 | 19 | 51.4 | |
| Treatment type | | | | | | | ˗.999 | | | | | .298 |
| Initial | 52 | 70.3 | 48 | 92.3 | 4 | 7.7 | | 34 | 65.4 | 18 | 34.6 | |
| Retreatment | 22 | 29.7 | 21 | 95.5 | 1 | 4.5 | | 11 | 50.0 | 11 | 50.0 | |
| Apical patency | | | | | | | .651 | | | | | .473 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absent | 41 | 55.4 | 39 | 95.1 | 2 | 4.9 | | 23 | 56.1 | 18 | 43.9 | |
| Present | 33 | 44.6 | 30 | 90.9 | 3 | 9.1 | | 22 | 66.7 | 11 | 33.3 | |
| Filling technique | | | | | | | -.999 | | | | | .097 |
| CWC | 39 | 52.7 | 36 | 92.3 | 3 | 7.7 | | 20 | 51.3 | 19 | 48.7 | |
| SBO | 35 | 47.3 | 33 | 94.3 | 2 | 5.7 | | 25 | 71.4 | 10 | 28.6 | |
| Sealer extrusion | | | | | | | .049 | | | | | .081 |
| Absent | 48 | 64.9 | 47 | 97.9 | 1 | 2.1 | | 33 | 68.8 | 15 | 31.3 | |
| Present | 26 | 35.1 | 22 | 84.6 | 4 | 15.4 | | 12 | 46.2 | 14 | 53.8 | |
| Void | | | | | | | -.999 | | | | | .454 |
| Absent | 49 | 66.2 | 46 | 93.9 | 3 | 6.1 | | 28 | 57.1 | 21 | 42.9 | |
| Present | 25 | 33.8 | 23 | 92.0 | 2 | 8.0 | | 17 | 68.0 | 8 | 32.0 | |
| Filling length | | | | | | | .131 | | | | | .150 |
| Normal | 72 | 97.3 | 68 | 94.4 | 4 | 5.6 | | 45 | 62.5 | 27 | 37.5 | |
| Long | 2 | 2.7 | 1 | 50.0 | 1 | 50.0 | | 0 | 0.0 | 2 | 100.0 | |
| Postoperative pain | | | | | | | .012 | | | | | .500 |
| None | 22 | 29.7 | 22 | 100.0 | 0 | 0.0 | | 13 | 59.1 | 9 | 40.9 | |
| Mild | 44 | 59.5 | 42 | 95.5 | 2 | 4.5 | | 29 | 65.9 | 15 | 34.1 | |
| Moderate | 3 | 4.0 | 2 | 66.7 | 1 | 33.3 | | 1 | 33.3 | 2 | 66.7 | |
| Severe | 5 | 6.8 | 3 | 60.0 | 2 | 40.0 | | 2 | 40.0 | 3 | 60.0 | |

**TABLE 3 Multivariate Logistic Regression Model Identifying Predictors of Treatment Failures Based on Loose Criteria**

| **Variables** | **OR** | **95% CI** | ***P* value** |
|---|---|---|---|
| Vitality | | | |
| Necrotic | 1 | | |
| Vital | 5.258 | 0.283–97.659 | .266 |
| Retreatment | 3.332 | 0.165–67.4 | .433 |
| Sealer extrusion | | | |
| Absent | 1 | | |
| Present | 5.697 | 0.826–39.303 | .078 |
| Postoperative painNone | 1 | | |
| Mild | 2.457 | 0.131–46.129 | .548 |
| Moderate | 13.777 | 0.244–778.807 | .203 |
| Severe | 21.531 | 0.62–747.751 | .090 |

## 4. Discussion

This clinical experiment aimed to contrast the efficacy of CWC with resin-based sealer and SBO with CSS. We believe that this is the first ever prospective research that contrasts the results of an NSRCT that included both SBO and CSS. The overall success rate of this study utilising loose criteria was 93.2%, which was higher than the success rates of the first study employing BC sealer and single-cone approach (90.9%)16 and a well-designed systematic review (85.2%). The assessment criteria utilised in the present research were comparable to the flexible radiography criteria in the systematic review, which is a decrease in the extent of apical radiolucency instead of the rigorous criteria's requirement for an absence of apical radiolucency.[23] The research's overall achievement rate under tight criteria was 60.8%, which is lower than the pooled weighed effectiveness rate under rigorous standards for systematic reviews (18,23), which was 74.7% and 76.7 percent respectively. Given that the systematic review found that success rates rose with longer follow-ups23, one of the research's constraints in terms of assessing the outcome is its short follow-up period, with an average of 17 months (6-29 months), which may include more healing cases than possible healed instances. In 2007, the first bioceramic root canal sealer was released, and several CSS have been studied for a considerable amount of time.[24] Because of this, clinical investigations with bioceramic root canal sealer are uncommon, and the follow-up time for these research is short. Based on arbitrary criteria, the obturation strategies had success rates of 92.3% in the CWC group and 94.3% in the SBO group, which were both encouraging and statistically inconsequential. Root canal sealer is not known to be a significant factor, and there are many other factors that influence the result of NSRCT. According to sealers, a systematic review indicated

that the results of NSRCT were similar for resin- and zinc oxide-based sealers, with success rates of 86.5% and 87.3%, respectively. The glass ionomer-based sealer had the greatest rate of achievement, at 94.4%, however only one study's data was used to compile the findings. Vertical compaction and root canal filling technique were reported to be important factors in the outcome of NSRCT3, in contrast to the root canal sealers that were utilised.[3,25]. It must be emphasised that not a single comparison of filling techniques utilising a CSS and other sealers has been recorded, and all data on filling techniques and consequences have been confined to conventional sealers such zinc oxide- or resin-based sealers. According to both loose and tight criteria, voids were shown to have no bearing on the outcome, which is consistent with earlier studies[19,25.] Significant success rates between teeth with excellent and unsuitable root fillings were found in a systematic analysis, however the criteria also included a weak seal and the appearance of radiographic voids with high heterogeneity.[1] In a systematic review1, teeth with apical disruption had a 15.6% lower success rate following root canal therapy than teeth without apical disturbance (72.6% vs. 88.2%), which is defined as instrumentation beyond the apical foramen or extrusion of calcium hydroxide or root canal sealer. Sealer extrusion was shown to be 1 of 2 potential predictors in multivariate regression analysis in our investigation, despite several prior individual studies showing that it did not significantly alter the outcome. [16,26] The success rate of teeth with sealer extrusion and PAR was 94.4% [17,18], and that with sealer extrusion and no PAR was 93.6%. This is interesting since in our study, 4 of the total 5 teeth of failure showed sealer extrusion, and 3 had viable pulp lacking preoperative apical radiolucency (PAR). No study has yet analyzed the effect and relation of sealer extrusion on the outcome of NSRCT. Yet it is important to take into account that overfilling had a worse impact on the outcome of NSRCT1 in teeth lacking PAR (odds ratio: 53.72) than in teeth with PAR (odds ratio: 51.74). Apical granuloma may be more effective at resisting extruded foreign substances like sealer and gutta-percha than normal apical tissue without up-regulated proinflammatory and anti-inflammatory cytokines like tumour necrosis alpha, interleukin 6, transforming growth factor b, and interleukin 4 [27,28] and activated macrophages29,30. As a temporary phenomena with an opportunity to remove contaminated material before root canal obturation, acute flare-up throughout treatments is reported to have no effect on therapeutic outcome. [19,31] However, a more current prospective investigation found that interappointment pain or swelling occurred in 18% of cases and significantly decreased treatment success25. It is thought that this is because the flare-up was brought on by the extrusion of infected material, which may cause a foreign body reaction or extraradicular infection and lead to treatment failure. Thus, we assessed postoperative discomfort following root canal obturation, which significantly decreased the treatment's success rate. Although interappointment pain or swelling may be an indication of temporary inflammation, a foreign body reaction, or extraradicular infection, postoperative pain may have a greater impact on the course of therapy since there is no longer a way to eliminate the source of the infection. Since pain is a subjective indicator and each patient's sensitivity to pain differs, it is important to be very careful when incorporating pain-related criteria and drawing conclusions from the results. Only the patients reporting no or minimal signs and symptoms were selected for the current research after we interviewed them about their signs and symptoms following their initial visit. The enrolled patients' sensitivity to pain may be standardised as a result of this approach.

## 5. Conclusion

It was discovered that SBO utilising Endoseal TCS can be a potential substitute for CWC using AH Plus within the constraints of this investigation. Root canal treatment results are significantly impacted by sealer extrusion and postoperative discomfort. For more reliability, additional research and investigations with higher sample numbers are required.

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