Original Research Paper

Volume - 16 | Issue - 11 | November - 2026 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Endodontics

POST OPERATIVE SENSITIVITY IN PERMANENT TEETH RESTORED WITH CENTION AND RESION MODIFIED GLASS IONOMERS: A SYSTEMATIC REVIEW

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ABSTRACT Background: Although restorative dentistry has advanced significantly, adhesive restorations may still cause postoperative sensitivity, potentially leading to failure. Aim: This systematic review aims to assess post-operative sensitivity in permanent teeth restored with Materials and Method: Resin-modified glass ionomer cement (RMGI) and Cention through a comprehensive analysis and synthesis of relevant clinical data. A standardized data extraction sheet collected study characteristics, participant details, intervention specifics (Cention or RMGI, adhesive system, cavity class and depth) with comparator details, and primary outcome of post-operative sensitivity Data was managed in Microsoft Excel and analyzed using RevMan. Result: It was found that across four studies, Cention-N showed comparable or superior reduction in post-operative sensitivity compared to RMGIC, particularly within the first week. In Class V restorations, Cention-N consistently demonstrated lower sensitivity. Long-term (12-month) data indicate both materials maintain low sensitivity without major complications. Conclusion: This review concluded that the existing body of evidence supports safe and effective use of both Cention-N and RMGIC, with a clinical preference for Cention-N in cases requiring rapid reduction of post-operative sensitivity and improved patient comfort.

KEYWORDS : Dental Sensitivity; Resin-modified Glass Ionomer Cement; Cention;

INTRODUCTION

Dentin hypersensitivity is a prevalent clinical disease in which exposed dentin produces rapid, intense pain in reaction to thermal, evaporative, tactile, osmotic, or chemical stimuli in the absence of any other dental pathology.[1] Postoperative hypersensitivity (POH) is described as pain in a tooth caused by mastication or contact with hot, cold, sweet, or sour stimuli that occurs one week or longer after treatment.[2] Minimal postoperative sensitivity and effective adhesion influence the success of direct restorative materials.[3,4] It mainly results from microleakage, polymerization shrinkage, poor bonding, and inadequate dentinal sealing, leading to pulpal nerve stimulation.[5] Therefore, choosing materials with strong sealing ability and durability is essential for optimal outcomes.[6]

Resin-modified glass ionomer cement (RMGI) is widely used due to its fluoride release, dentin adhesion, and caries-preventive effects.[7] Its hybrid composition improves mechanical properties and bonding, while its hydrophilic nature aids adaptation in moist conditions.[7] Fluoride release further promotes remineralization and has long-term benefits.[8] However, RMGI can cause post-operative sensitivity due to lower mechanical strength, incomplete dentinal tubule sealing, and reduced resistance to occlusal forces compared to resin composites. Sensitivity varies depending on cavity depth, bonding technique, and individual pulpal response.[9,10]

Cention, an alkasite restorative, demonstrates a bioactive profile with alkaline pH and sustained release of fluoride and calcium ions, promoting remineralization and potentially reducing post-operative sensitivity.[11] Its hydroxyl ion release exerts antibacterial effects, while its self-curing with optional light activation may limit polymerization shrinkage[12] Post-operative sensitivity is multifactorial, influenced by bonding efficacy, cavity preparation, and occlusal loading, with RMGI relying on chemical adhesion and Cention on adhesive systems; however, operator variability necessitates further comparative evaluation.[12-14]

Despite advancement in restorative materials, robust clinical evidence is required to identify the optimal option for minimizing post-operative sensitivity while ensuring longevity and biocompatibility. Although in vitro studies elucidate physicochemical properties, clinical studies remain essential for assessing practical outcomes. A systematic review comparing Cention and RMGI can synthesize evidence on the incidence, severity, and duration of sensitivity, considering factors such as cavity depth, bonding strategy, and operative technique.

In context of the increasing need for enduring, bioactive, and patient-focused restorative materials, a clinical and scientific comparison of Cention and RMGI is essential. This systematic review aims to synthesize clinical evidence to evaluate superior reduction in post-operative sensitivity with Cention compared to RMGI. The findings will support evidence-based material selection and enhance patient outcomes in direct restorations.

METHODOLOGY

Study Design: This systematic review and meta-analysis adheres to PRISMA guidelines and the Cochrane Handbook along with PICOS framework with protocol registration in PROSPERO (CRD42025646454) to ensure methodological rigor and transparency.[15,16] It aims to compare post-operative sensitivity in permanent teeth restored with Cention and RMGI by systematically identifying, evaluating, and synthesizing relevant clinical evidence.

Review Question

This systematic review was designed to address the following research questions:

1. What is the incidence and severity of post-operative sensitivity in permanent teeth restored with Cention compared to RMGI?

2. How does post-operative sensitivity vary over different follow-up periods (immediate, short-term, and long-term)?

3. What are the factors influencing post-operative sensitivity in these restorative materials, such as cavity depth, type of adhesive system used, and operator variability?

4. Are there significant differences in the longevity and clinical performance of Cention and RMGI restorations concerning post-operative sensitivity?

Search strategy: Multiple scholarly databases, including PubMed (MEDLINE), Scopus, CENTRAL, Embase, Web of Science, and Google Scholar, was thoroughly searched. A combination of Medical Subject Headings (MeSH) terms and free-text keywords will be used.[20] ClinicalTrials.gov, OpenGrey, manual searches of pertinent journals and conference proceedings with reference list was scanned to found additional research which was further identified and added.

INCLUSION CRITERIA:

- Population (P): Permanent teeth requiring direct restorative treatment with either Cention or resin-modified glass ionomer.
- Intervention (I): Direct restoration using Cention.
- Comparator (C): Direct restoration using resin-modified glass ionomer.
- Outcome (O): Post-operative sensitivity assessed using patient-reported measures or clinical evaluation over different time intervals.
- Study Design (S): Randomized controlled trials (RCTs), non-randomized clinical trials, and cohort studies.
- Studies evaluating post-operative sensitivity in permanent teeth restored with either Cention or RMGI.
- Randomized controlled trials (RCTs), non-randomized clinical trials, and prospective cohort studies comparing these materials.
- Minimum follow-up period of one week post-restoration.
- Studies measuring post-operative sensitivity using:
- Visual Analog Scale (VAS)[17]
- Numeric Rating Scale (NRS)[18]
- Verbal Pain Scale (VPS)[19]
- Cold/Electric Pulp Testing responses (if reported
- Studies reporting comparative data between Cention and RMGI.

EXCLUSION CRITERIA:

1. Studies involving primary teeth or indirect restorations (e.g., crowns, onlays).
2. In vitro studies, animal studies, case reports, review articles, and systematic reviews.
3. Studies that do not explicitly report post-operative sensitivity outcomes.
4. Studies using Cention or RMGI as liners or base materials rather than primary restorations.

Study Selection Process: Study selection was performed in three phases: (1) title and abstract screening by two independent reviewers, with disagreements resolved by discussion or a third reviewer; (2) full-text screening of eligible studies, with exclusions documented and justified; and (3) final inclusion for data extraction and quality assessment. The process is summarized using a PRISMA flow diagram.[15]Iinter-rater agreement was found to be 0.8.

Data extraction: A standardized data extraction sheet will be used to collect key information, including study characteristics (author, year, country, design, sample size, follow-up), participant details (age, gender, number and type of teeth), and intervention specifics (material used—Cention or RMGI, adhesive system, cavity class and depth). Comparator details such as type of RMGI and bonding protocol will also be recorded. Outcome measures will focus on post-operative sensitivity at various time points, along with additional clinical parameters including longevity, marginal adaptation, secondary caries, and patient satisfaction. Risk of bias data will be extracted from included studies. All data will be managed using Microsoft Excel and analyzed using RevMan for meta-analysis.[21]

Risk of bias: Risk of bias will be assessed using the Cochrane RoB 2 tool for RCTs and ROBINS-I for observational studies.[22,23] Domains evaluated such as random sequence generation, allocation concealment, blinding, completeness of outcome data, selective reporting, and other biases (e.g., funding). Each study will be categorized as low risk, some concerns, or high risk of bias.

RESULT

Four clinical studies published between 2018 and 2023 met the inclusion criteria.[24-27] Three were conducted in India (Hirani et al.[24], Mushtaq et al.[25], Bharate et al.[26]) and one in Egypt (Attia et al.).[27] All were clinical trials, including three randomized controlled trials and one in vivo randomized comparative study, evaluating post-operative sensitivity in permanent teeth restored with Cention-N versus RMGIC. Sample sizes ranged from 36 to 160 participants, with a total of 400 teeth restored (one per participant). All studies included adults (≥18 years), with detailed age ranges reported in three studies. Gender distribution was provided in two studies: Attia et al.[27] (13 males, 17 females) and Bharate et al.[26] (Cention-N: 8 males, 10 females; RMGIC: 11 males, 7 females), while the remaining studies did not report gender data.[26,27]

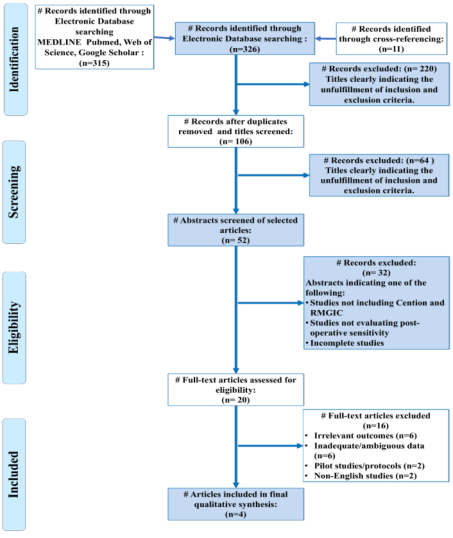


Figure 1: PRISMA Flow diagram indicating the selection process of the articles in the present systematic review

Tooth Type and Cavity Classification

Tooth type and cavity classification varied across studies. Hirani et al., Mushtaq et al., and Attia et al. evaluated Class I cavities in maxillary and mandibular molars and premolars, while Bharate et al. assessed Class V cervical lesions associated with NCCLs.[24,25,27] Cavity depths were moderate to deep: Hirani et al. used a standardized depth of 1.5 mm, Mushtaq et al.[25] and Bharate et al.[26] prepared 3 mm cavities, and Attia et al.[27] included lesions with isthmus width exceeding one-third of the intercuspal distance.

Restorative Materials and Adhesive Protocols

All studies compared Cention-N with RMGIC (Equia Forte or GC Fuji IX; unspecified in one study).[24-27] Adhesive protocols varied, with some using bonding agents and surface treatments, while others relied on self-adhesive properties. These variations may have influenced sensitivity outcomes.

Follow-Up Duration and Sensitivity Assessment Tools

Follow-up periods ranged from short-term (1–30 days) to long-term (12 months), with varying assessment intervals across studies.[26-28] Sensitivity was evaluated using different tools, including VAS, modified USPHS criteria, and the Schiff Scale. Despite methodological differences, all studies consistently quantified post-operative hypersensitivity.

Outcomes: Post-operative Sensitivity

All studies showed a progressive reduction in post-operative sensitivity for both materials over time.[24-27] Initial differences diminished with follow-up, with minimal or no sensitivity observed later. Bharate et al.[26] reported significantly lower early sensitivity with Cention-N, indicating better immediate outcomes.

Additional Clinical Parameters

Only Attia et al.[27] evaluated additional clinical parameters using modified USPHS criteria, including marginal adaptation, colour match, surface texture, and secondary caries.[27] Both materials showed good performance over 12 months, with no secondary caries or sensitivity and only minor, non-significant changes. Other studies assessed only sensitivity and did not report long-term clinical outcomes.

Risk of Bias Assessment

Low risk in randomization was observed in Mushtaq et al.[25] and Attia et al.[27], while Hirani et al. and Bharate et al.[26] showed some concerns due to unclear methods.[24-27] All studies demonstrated low risk for deviations from interventions and missing outcome data. However, outcome measurement showed some concerns in three studies due to lack of assessor blinding, increasing the potential for detection bias.[18,24-26]

Risk of Bias Assessment

Low risk in randomization was reported in Mushtaq et al. and Attia et al., while Hirani et al. and Bharate et al. showed some concerns due to unclear methods.[24-27] All studies demonstrated low risk for deviations from interventions, missing data, and selective reporting. Outcome measurement showed some concerns in three studies due to lack of assessor blinding, while Attia et al. maintained low risk with blinded evaluation.[18,24-27] Overall, all studies were considered low risk of bias, with minor methodological limitations.

According to the GRADE approach, the overall quality of evidence was rated as moderate. Downgrading was due to inconsistency (study heterogeneity) and imprecision (small sample size and moderate confidence intervals), while no serious concerns were identified for risk of bias, indirectness, or publication bias.

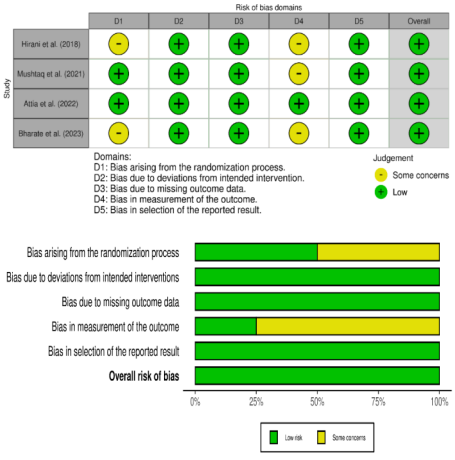


Figure 3: Collective overall summary of risk of bias of the studies included in the review

DISCUSSION

The included studies consistently showed that both Cention-N and RMGIC effectively reduce post-operative sensitivity in permanent teeth.[24-27] However, Cention-N exhibited slightly higher sensitivity in the initial 24-hour period, possibly due to polymerization shrinkage causing microgaps and fluid movement in dentinal tubules. Operator-related factors and material handling may also contribute to this early sensitivity.[28,29]

Despite initial sensitivity, all studies showed a rapid decline within one week, with both materials exhibiting similar levels and negligible differences by one month. This indicates that early polymerization effects of Cention-N are offset over time by its bioactive ion release, promoting remineralization and dentinal tubule sealing.[30] The alkaline nature of Cention-N elevates local pH, inhibiting bacterial growth and promoting mineral deposition within microgaps.[12] This supports a self-sealing effect that restores marginal integrity over time, highlighting its durability, biocompatibility, and long-term therapeutic potential.[31,32]

The advantage of Cention-N was more evident in deeper lesions, especially Class V cervical cavities, where thinner enamel and exposed dentinal tubules increase sensitivity risk.[33] Bharate et al.[26] reported significantly lower Schiff sensitivity scores with Cention-N compared to RMGIC at Days 1, 2, and 7. These findings are clinically important, as Class V lesions are highly prone to sensitivity.[33] Cention-N's superior performance is attributed to its release of hydroxide, calcium, and fluoride ions, which promote rapid dentinal tubule occlusion and reduce fluid movement. Its alkaline pH also inhibits matrix metalloproteinase activity, limiting collagen degradation and enhancing hybrid layer stability.[34]

Clinically, Cention-N may be preferable in deep cervical lesions or patients with dentinal hypersensitivity. Its rapid pH neutralization and tubule-sealing action reduce fluid movement and pulpal stimulation, leading to improved immediate comfort and less need for analgesics or desensitizing agents.[33,34] Cention-N's sustained low sensitivity may enhance patient satisfaction, improve recall compliance, and support better long-term outcomes. Its therapeutic effects on dentinal hypersensitivity position it as both a restorative material and a biologically active adjunct for managing sensitivity-prone lesions.

Attia et al.[27] reported that both Cention-N and RMGIC showed no postoperative sensitivity throughout 12 months in a split-mouth trial. This highlights their durable performance despite ongoing mechanical, thermal, enzymatic, and microbial challenges in the oral environment. Both Cention-N and RMGIC effectively maintain marginal seal and minimize sensitivity under oral stresses, reflecting strong durability and biocompatibility. These results support the role of bioactive materials in promoting biological sealing and tissue repair when used with proper clinical techniques.

The negligible long-term sensitivity likely reflects effective bonding protocols. In Attia et al.,[27] phosphoric acid etching with an adhesive system enhanced hybrid layer formation and resin infiltration for Cention-N, while polyacrylic acid conditioning improved chemical bonding of RMGIC to tooth calcium, ensuring strong adhesion and minimal sensitivity.[27] These bonding strategies improve marginal adaptation and reduce microleakage, limiting fluid and bacterial ingress into dentinal tubules—key causes of sensitivity and secondary caries. Their long-term effectiveness under functional and thermal stresses highlights the combined importance of material properties and precise clinical technique for durable outcomes.[27]

Variations in study design and technique influenced sensitivity outcomes. Attia et al.[27] used strict isolation and adhesive protocols, achieving excellent, consistent results with minimal sensitivity. In contrast, Mushtaq et al.[25] and Bharate et al.[26] used simplified, self-adhesive approaches, which increased microleakage risk and led to slight early sensitivity differences. Overall, outcomes depend strongly on technique as well as material choice.

Sensitivity assessment methods varied, contributing to heterogeneity. Hirani et al.[24] and Mushtaq et al.[25] used the VAS, enabling sensitive, time-based evaluation of pain (24 hours to 1 month),[24,25] while Bharate et al.[26] used the Schiff scale, a categorical tool focused on short-term evaporative sensitivity in Class V lesions. Although each method has strengths, lack of standardization limits direct comparison and pooled analysis.

Attia et al.[27] used modified USPHS criteria, assessing sensitivity within broader clinical parameters rather than as a standalone outcome. While comprehensive, this limits sensitivity-specific conclusions. Overall, variability in assessment methods highlights the need for standardized, validated tools and consistent follow-up intervals to enable reliable comparisons and stronger evidence synthesis.

Clinically, these findings support Cention-N as an effective restorative material, especially when immediate postoperative comfort is important.[24-27] Its bioactive ion release (hydroxide, calcium, fluoride) helps neutralize acidity and promote dentin remineralization, making it particularly beneficial for patients with high caries risk, thin dentin, or dentinal hypersensitivity.[24,33] Cention-N's bioactivity promotes rapid dentinal tubule occlusion, reducing fluid movement and hypersensitivity as per Brännström's theory.[28,32] This is especially beneficial in deep cervical restorations, where dentin exposure increases sensitivity risk.[33]

Material selection between Cention-N and RMGIC should be based on clinical conditions, lesion characteristics, and patient factors rather than preference alone. RMGIC is preferred when fluoride release and caries prevention are priorities, whereas Cention-N may be advantageous for rapid tubule sealing and reduced early sensitivity. Proper clinician training and technique are essential to optimize outcomes.

Despite favorable findings, heterogeneity in cavity types, techniques, follow-up periods, and sensitivity assessment methods limits definitive recommendations.[35] Clinical success depends on proper

protocols, moisture control, and operator skill. Future trials should use standardized designs and evaluate long-term outcomes, including retention, marginal integrity, secondary caries, and patient satisfaction. Current evidence supports both materials, with Cention-N showing potential advantages for reducing early sensitivity and improving comfort.

CONCLUSION

Present review revealed that based on four clinical trials, RMGIC and Cention-N both successfully lower post-operative sensitivity; however, Cention-N exhibits superior early sensitivity management because of its bioactive tubule-sealing qualities, especially in deep Class V lesions. Protocols, operator technique, and material selection all affect clinical results. Although both are dependable, RMGIC is still useful in situations with significant caries risk and moisture difficulties, while Cention-N might be chosen for quick sensitivity decrease.

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