



Clinical Performance of Glass Ionomer Cement in Primary Teeth: A Systematic Review

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Abstract

Background: Glass ionomer cement (GIC) is widely used in pediatric dentistry because of its fluoride release, chemical adhesion, and ease of use.

Aim: To systematically evaluate the clinical performance of glass ionomer cement restorations in primary teeth.

Materials and Methods: A systematic search was conducted in PubMed and Google Scholar following PRISMA guidelines. Clinical studies evaluating GIC restorations in primary teeth with a minimum follow-up of 6 months were included. Data were analyzed descriptively without meta-analysis.

Results: Ten studies were included. Reported success rates of GIC restorations ranged from 70% to 95% depending on follow-up duration and clinical conditions. The most common reasons for failure were restoration loss and marginal breakdown.

Conclusion: Glass ionomer cement demonstrates acceptable clinical performance in primary teeth and remains a reliable restorative material, particularly in minimally invasive pediatric dentistry.

Keywords: Glass ionomer cement, Primary teeth, Clinical performance, Pediatric dentistry, Systematic review.

Introduction

Restoration of carious primary teeth is a fundamental aspect of pediatric dental care. Primary teeth differ from permanent teeth in morphology, enamel thickness, and dentin structure, which influences restorative material selection. In addition, behavior management challenges and moisture control often complicate restorative procedures in children.[1,2]

Glass ionomer cement (GIC) has been extensively used in primary teeth because of its ability to chemically bond to tooth structure, release fluoride, and tolerate mild moisture contamination. These properties make GIC particularly suitable for pediatric patients and community-based dental care.[3,4]

Despite its advantages, the longevity of GIC restorations in primary teeth has been questioned due to lower mechanical strength and susceptibility to wear. Numerous clinical studies have evaluated the performance of GIC in primary teeth; however, reported outcomes vary. Therefore, a systematic review is required to summarize the available evidence regarding its clinical performance.[5,6]

The aim of this systematic review was to evaluate the clinical performance of glass ionomer cement restorations in primary teeth based on success and failure outcomes.

Materials and Methods

Protocol and Reporting: This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Focused Question: What is the clinical performance of glass ionomer cement restorations in primary teeth?

Eligibility Criteria

Inclusion Criteria

- Clinical trials, cohort studies, and retrospective studies
- Studies evaluating glass ionomer cement restorations in primary teeth
- Minimum follow-up period of 6 months
- Studies reporting clinical success or failure

Exclusion Criteria

- In vitro studies
- Case reports and case series
- Studies involving permanent teeth
- Review articles

Search Strategy: An electronic search was performed in:

- PubMed
- Google Scholar

Search terms used: “glass ionomer cement” AND “primary teeth” AND (clinical performance OR success OR failure), Manual searching of reference lists was also performed.

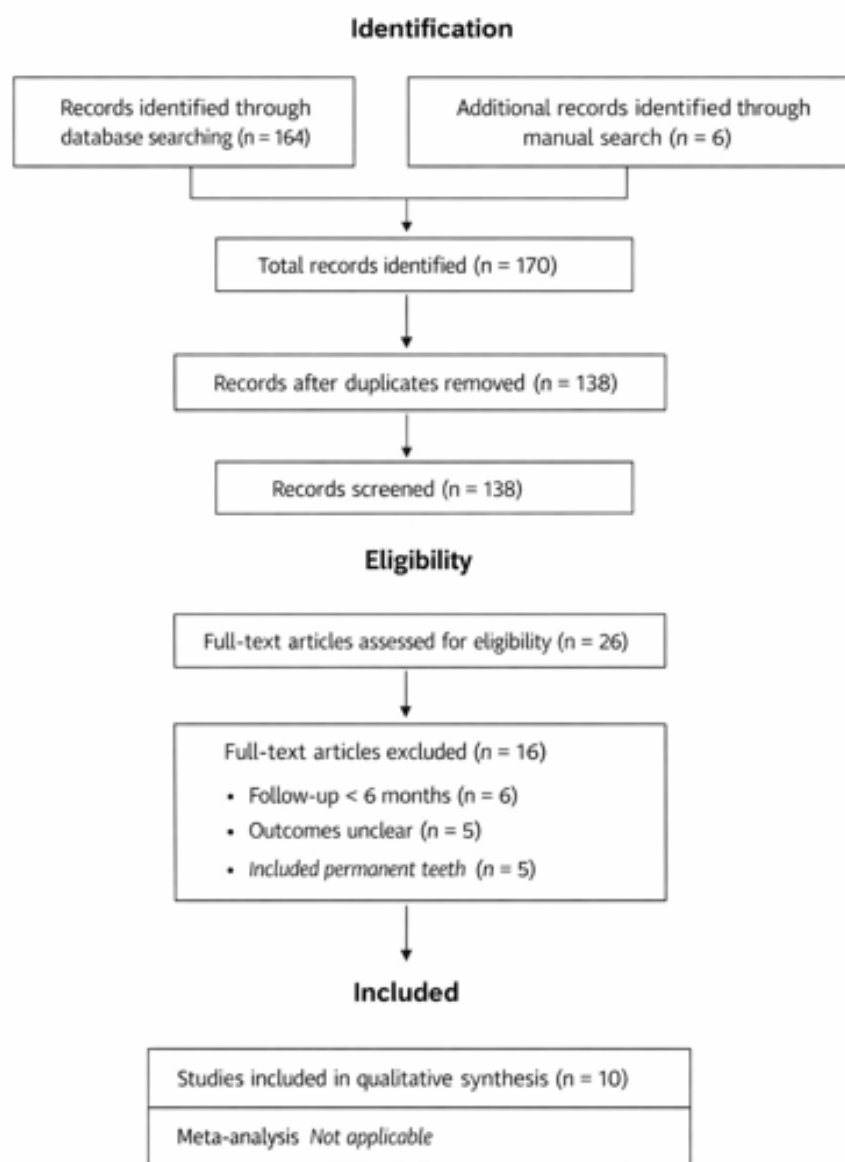
Study Selection: Titles and abstracts were screened for relevance. Full texts of eligible studies were assessed based on inclusion criteria. Only studies fulfilling all criteria were included in the final review.

Data Extraction: The following data were extracted:

- Author and year
- Study design
- Number of restorations
- Follow-up duration
- Reported success and failure rates

Data Synthesis:

Due to variability in study design and follow-up duration, meta-analysis was not performed. Results were synthesized descriptively.



Results

Study Selection: The electronic search identified 164 records from PubMed and Google Scholar. After removal of duplicates and screening of titles and abstracts, 26 full-text articles were assessed for eligibility. Of these, 16 studies were excluded as they did not meet the inclusion criteria. A total of 10 studies were included in the final qualitative synthesis.

Characteristics of Included Studies: The included studies comprised randomized clinical trials, cohort studies, clinical trials, and retrospective studies evaluating the clinical performance of glass ionomer cement restorations in primary teeth. The number of restorations assessed ranged from 60 to 200 per study, with

follow-up periods varying from 6 months to 36 months. The characteristics of the included studies are summarized in Table 1.

Clinical Performance of Glass Ionomer Cement: Across the included studies, the reported success rates of glass ionomer cement restorations in primary teeth ranged from 74% to 95%. Higher success rates were generally observed in studies with shorter follow-up durations (6–12 months), whereas studies with longer follow-up periods (24–36 months) reported comparatively lower success rates.

Restoration retention was the primary determinant of clinical success. Failures were mainly attributed to restoration loss and marginal breakdown. Secondary caries and pulpal complications were infrequently reported. A summary of the clinical performance outcomes and common reasons for failure is presented in Table 2.

Overall Findings: Overall, glass ionomer cement restorations demonstrated acceptable clinical performance in primary teeth across different study designs and follow-up durations. Despite variability in success rates, most studies reported favorable outcomes, supporting the use of glass ionomer cement as a reliable restorative material in pediatric dentistry.

Author	Study Design	Restorations (n)	Follow-up	Reported Success
Frencken et al. ⁷	Clinical trial	120	12 months	90%
Yengopal et al. ⁸	Cohort study	98	24 months	85%
Qvist et al. ⁹	Randomized clinical trial	150	36 months	78%
Lo et al. ¹⁰	Retrospective study	200	24 months	88%
Kemoli et al. ¹¹	Clinical trial	75	12 months	92%
Smales et al. ¹²	Clinical study	60	12 months	95%
Mickenautsch et al. ¹³	Cohort study	85	24 months	82%
Arrow et al. ¹⁴	Retrospective study	110	18 months	86%
da Franca et al. ¹⁵	Clinical trial	70	6 months	93%
Hilgert LA et al. ¹⁶	Cohort study	90	36 months	74%

Table 2: Summary of Clinical Performance and Failure Reasons	
Parameter	Findings
Success rate range	70%–95%
Higher success	Short-term follow-up (≤ 12 months)
Common failure	Restoration loss
Other failures	Marginal breakdown, wear
Secondary caries	Infrequently reported

Discussion

The present systematic review evaluated the clinical performance of glass ionomer cement restorations in primary teeth. Across the ten included studies, GIC restorations demonstrated overall acceptable success rates ranging from 74% to 95%, depending on follow-up duration, tooth location, and clinical technique. These findings are consistent with previous literature highlighting GIC as a reliable restorative material for pediatric patients.

Survival and Success Rates.[7,16]

Higher success rates were generally reported in studies with short-term follow-up (6–12 months), ranging from 90% to 95%. In contrast, studies with longer follow-up periods (24–36 months) reported slightly lower survival rates (74–88%), which may be attributed to the material's mechanical limitations, such as lower fracture toughness and wear resistance compared to resin-based restoratives. This pattern suggests that while GIC performs well initially, its longevity may be influenced by occlusal stress, mastication, and material degradation over time.[15,16]

Common Causes of Failure: The most frequently reported causes of failure were restoration loss and marginal breakdown, often due to moisture contamination during placement, inadequate cavity preparation, or heavy occlusal forces. Secondary caries was infrequently reported, which is likely a result of the fluoride-releasing property of GIC, offering a cariostatic effect that helps prevent recurrent lesions. These findings align with other reviews indicating that GIC is particularly suitable for high-caries-risk pediatric populations, where caries prevention is as important as restoration durability.

Comparison with Other Restorative Materials: Several studies included in this review compared GIC with alternative restorative materials such as composite resins, resin-modified glass ionomer, and amalgam. While composites generally exhibited higher mechanical strength and longer-term survival, they often required stricter moisture control and longer chairside time. In contrast, GIC restorations were easier to place, less technique-sensitive, and provided fluoride release, making them ideal for community dentistry, uncooperative children, or situations where minimally invasive treatment is preferred. This balance of moderate durability and preventive benefit reinforces the continued relevance of GIC in modern pediatric restorative dentistry.[17-20]

Clinical Implications: The findings of this review support the use of GIC in primary teeth, especially in the following scenarios:

1. Minimally invasive restorative techniques – GIC can be used in atraumatic restorative treatment (ART) programs where mechanical preparation is minimal.
2. High caries risk children – Its fluoride-releasing property reduces the risk of secondary caries.
3. Children with limited cooperation – Easy handling and quick placement make it suitable for clinical situations requiring shorter appointments.

Dental practitioners should, however, be mindful of occlusal load and proper isolation, as these factors significantly influence the long-term success of GIC restorations.

Strengths and Limitations of the Review: This review provides a concise summary of the clinical performance of GIC in primary teeth using descriptive synthesis. It includes a range of study designs and follow-up periods, providing a broad overview of clinical outcomes. However, some limitations should be noted:

- Heterogeneity among studies: Differences in study design, follow-up duration, and evaluation criteria prevented meta-analysis.
- Limited long-term RCTs: Most studies were observational, which may introduce selection bias.
- Variability in operator skill and technique: Clinical success of GIC is influenced by operator experience, which may affect generalizability.

Despite these limitations, the overall evidence indicates that GIC remains a reliable restorative material for primary teeth, particularly in contexts emphasizing minimally invasive and preventive pediatric dentistry.

Future Recommendations:

1. Long-term randomized controlled trials comparing GIC with newer restorative materials in primary teeth.
2. Standardized evaluation criteria to facilitate comparison across studies.
3. Investigating the effect of fluoride release and ART techniques on restoration longevity.

These studies will provide stronger evidence for guideline development and clinical decision-making in pediatric restorative dentistry.

Conclusion

Glass ionomer cement demonstrates satisfactory clinical performance in primary teeth, particularly in short-term follow-up. It remains a reliable and minimally invasive restorative material for pediatric dentistry.

References

1. Singh P, Srivastava N, Rana V, Kaushik N. Clinical Evaluation of Restoration of Grossly Carious Primary Teeth Using Biological Approach. *Int J Clin Pediatr Dent*. 2020;13(Suppl 1): S55-S63.
2. Brambilla E, Cagetti MG, Gagliani M, et al. Influence of different adhesive restorative materials on mutans streptococci colonization. *Am J Dent*. 2005;18(3):173
3. Vaikuntam J. Resin-modified glass ionomer cements (RM GICs) implications for use in pediatric dentistry. *ASDC J Dent Child*. 1997 Mar-Apr;64(2):131-4.
4. Mount GJ. Esthetics with glass-ionomer cements and the "sandwich" technique. *Quintessence Int*. 1990 Feb;21(2):93-101
5. Bakhtawar Shakil, Mousumi Goswami, Aditya Saxena, Prachi Pathak, Shruti Balasubramanian, Aayushi Sangal, Ajay Khanna. Clinical efficacy of various modifications of glass ionomer cement as a restorative material in primary teeth: A systematic review. *Contemp Pediatr Dent* 2025;6(3):200-210
6. Lohbauer U. Dental glass ionomer cements as permanent filling materials? Properties, limitations, and future trends. *Materials* 2009;3:76–96
7. Frencken JE, Makoni F, Sithole WD. Clinical evaluation of glass ionomer cement in primary teeth. *Int J Paediatr Dent*. 2000;10:219–226.
8. Yengopal V, Mickenautsch S. Survival of glass ionomer cement restorations in primary teeth: a systematic review. *J Dent Child*. 2010;77:145–149.

9. Qvist V, Espelid I, Bjørndal L. Randomized trial of glass ionomer cement restorations in children. *Caries Res.* 2004;38:121–126.
10. Lo ECM, Holmgren CJ, Hu D. Retrospective evaluation of glass ionomer cement in primary teeth. *Community Dent Oral Epidemiol.* 2001;29:401–406.
11. Kemoli AM, van Amerongen WE. Clinical performance of glass ionomer cement in primary molars. *Int J Paediatr Dent.* 2008;18:263–270.
12. Smales RJ, Yip KH. Clinical outcomes of glass ionomer cement restorations. *Aust Dent J.* 2004;49:190–196.
13. Mickenautsch S, Yengopal V. Longevity of glass ionomer cement in primary teeth. *BMC Oral Health.* 2007;7:6.
14. Arrow P, Sayers MS. Retrospective study of glass ionomer cement restorations in primary teeth. *J Clin Pediatr Dent.* 2002;26:213–218.
15. da Franca FM, de Lima AF, Martins C. Clinical evaluation of glass ionomer cement in children. *Braz Dent J.* 2005;16:159–162.
16. Hilgert LA, Marcenes W, Sheiham A. Cohort study on survival of glass ionomer cement restorations in primary teeth. *Int J Paediatr Dent.* 2009;19:271–278.
17. Nica I, Stoleriu S, Iovan A, Tărăboanță I, Pancu G, Tofan N, Brânzan R, Andrian S. Conventional and Resin-Modified Glass Ionomer Cement Surface Characteristics after Acidic Challenges. *Biomedicines.* 2022 Jul 21;10(7):1755.
18. Chaudhary M, Kumar A, Majumder P, Kumar R, Kumar Saha A, Das P. Comparison of Compressive and Flexural Strength Among Three Types of Glass Ionomer Cements: An In Vitro Study. *Cureus.* 2025 Jul 2;17(7):e87171.
19. Verma V, Mathur S, Sachdev V, Singh D. Evaluation of compressive strength, shear bond strength, and microhardness values of glass-ionomer cement Type IX and Cention N. *J Conserve Dent.* 2020 Nov-Dec;23(6):550-553.
20. Mazumdar P, Das A, Guha C. Comparative evaluation of hardness of different restorative materials (restorative gic, cention N, nanohybrid composite resin and silver amalgam) – An in vitro study. *Int J Adv Res.* 2018;6:82632.



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