



Hall technique versus conventional restorations for carious primary molars: a systematic review

Técnica de Hall frente a restauraciones convencionales en molares primarios cariados: revisión sistemática

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ABSTRACT

Introduction: Untreated caries in primary molars remains a leading cause of pain, infection and treatment need in childhood, and conventional restorations fail frequently in multi-surface lesions. **Methods:** This systematic review followed the PRISMA 2020 statement. OpenAlex, PubMed and Crossref were searched for studies published between 2018 and 2025 that compared the Hall technique with conventional treatments for carious primary molars. Risk of bias was assessed with the RoB 2 and ROBINS-I tools and the evidence was synthesized narratively. **Results:** Ten studies (nine randomized trials and one retrospective cohort) were included. Success and survival of the Hall technique ranged from 84.6 percent at 60 months to 100 percent at shorter follow-up. The Hall technique showed higher survival than resin composite and atraumatic restorative treatment, higher success than compomer and modified atraumatic restorative treatment, similar survival to conventionally placed preformed metal crowns, and similar postoperative pain to pulpotomy. Major complications were infrequent and comparable between groups, minor failures were less common with the Hall technique, and early occlusal changes resolved within weeks to months. **Conclusions:** In carious primary molars without pulpal involvement, the Hall technique achieves success and survival at least equivalent to, and often higher than, conventional treatments, with a low frequency of major complications, although the evidence is limited by small samples and risk of bias.

Keywords: Hall technique; dental caries; primary molars; preformed metal crowns; systematic review.

RESUMEN

Introducción: La caries no tratada en molares primarios sigue causando dolor, infección y necesidad de tratamiento en la infancia, y las restauraciones convencionales fracasan con frecuencia en lesiones de varias superficies. **Métodos:** Esta revisión sistemática siguió la declaración PRISMA 2020. Se buscó en OpenAlex, PubMed y Crossref, estudios publicados entre 2018 y 2025 que compararan la técnica de Hall con tratamientos convencionales en molares primarios cariados. El riesgo de sesgo se evaluó con RoB 2 y ROBINS-I y la evidencia se sintetizó de forma narrativa. **Resultados:** Se incluyeron diez estudios (nueve ensayos aleatorizados y una cohorte retrospectiva). El éxito y la supervivencia de la técnica de Hall variaron de 84,6 por ciento a los 60 meses a 100 por ciento en seguimientos más cortos. La técnica de Hall mostró mayor supervivencia que la resina compuesta y el tratamiento restaurador atraumático, mayor éxito que el compómero y el tratamiento restaurador atraumático modificado, supervivencia similar a las coronas metálicas preformadas convencionales y dolor posoperatorio similar a la pulpotomía. Las complicaciones mayores fueron poco frecuentes, los fracasos menores fueron menos comunes con la técnica de Hall y los cambios oclusales tempranos se resolvieron en semanas o meses. **Conclusiones:** En molares primarios cariados sin compromiso pulpar, la técnica de Hall logra un éxito y una supervivencia al menos equivalentes, y con frecuencia superiores, a los tratamientos convencionales, con baja frecuencia de complicaciones mayores, aunque la evidencia está limitada por muestras pequeñas y riesgo de sesgo.

Palabras clave: técnica de Hall; caries dental; molares primarios; coronas metálicas preformadas; revisión sistemática.

INTRODUCTION

Dental caries is the most prevalent chronic disease of childhood and the single largest cause of preventable treatment need in the primary dentition.⁽¹⁾ Primary molars carry a disproportionate share of that burden because their occlusal and proximal anatomy retains biofilm and because cavitated lesions in these teeth frequently go untreated, evolving into pain, infection, early tooth loss and impairment of oral health-related quality of life.^(1,2) The consequences extend beyond the mouth, since untreated caries in young children disturbs sleep, eating and school attendance and is a leading reason for hospital admission under general anaesthesia in several health systems. Restoring these teeth therefore occupies much of paediatric dental practice, yet the choice of technique remains contentious.

The conventional approach removes all carious tissue with rotary instruments, usually under local anaesthesia, and restores the cavity with an adhesive material or with a prepared preformed metal crown. In multi-surface primary molar lesions this strategy performs poorly: a systematic review of survival and reasons for failure reported high failure rates for intracoronal restorations placed in primary teeth, with recurrent caries and restoration loss driving a repeated restorative cycle that often ends in pulp therapy or extraction.⁽²⁾ Against that background, the Hall technique was developed as a biological alternative in which a preformed metal crown is cemented over the carious molar without local anaesthesia, tooth preparation or caries removal, sealing the lesion from the oral environment.^(3,4) Randomized and observational studies have repeatedly reported high success and survival for the technique,⁽⁵⁻⁷⁾ and clinical guidance documents now endorse it as a standard option for managing carious primary molars, including in situations where aerosol generation or general anaesthesia should be avoided.^(8,9)

The clinical question that remains is comparative rather than descriptive. Single-arm series cannot establish whether the Hall technique's high success reflects an advantage over well-placed conventional restorations or simply the durability of full-coverage crowns in a low-caries-risk sample. Answering the comparative question requires trials and cohort studies that randomize or match teeth to both treatments, and those studies have accumulated rapidly in recent years, spanning high-income and lower-middle-income settings and covering the full range of conventional comparators from resin composite to pulpotomy. Synthesizing that body of work is therefore timely for clinicians who must choose between sealing a lesion under a crown and removing it under anaesthesia.

Previous syntheses have addressed this question but are now partly outdated or narrower in scope. The Cochrane review of preformed crowns concluded that the Hall technique probably reduces major failure and pain compared with conventional restorations, although the evidence was graded as moderate quality and the included trials predated 2018.⁽¹⁰⁾ A broader Cochrane review of interventions for cavitated or dentine carious lesions likewise found that biological sealing approaches compare favourably with complete caries removal.⁽¹¹⁾ Subsequent meta-analyses have quantified success and survival for the technique,⁽¹²⁻¹⁵⁾ and an umbrella review of minimal intervention dentistry ranked biological sealing strategies favourably.⁽¹⁶⁾ However, several comparative randomized trials were published between 2018 and 2025, including the FiCTION trial,⁽¹⁷⁾ direct comparisons with atraumatic restorative treatment and resin composite, and longer follow-up cohorts. This systematic review therefore aimed to answer the following PICO question: in children with carious primary molars, does the Hall technique achieve higher success and fewer complications than conventional restorations? The specific objectives were to identify comparative studies published from 2018 to 2025, to estimate the comparative success and survival of the Hall technique, to compare the frequency of complications, and to assess the risk of bias of the included studies.

METHODS

Protocol and registration

This systematic review was designed and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement.⁽¹⁸⁾ The review protocol was not prospectively registered in an international or institutional registry. This absence of registration is explicitly acknowledged as a methodological limitation, particularly regarding the transparency of prespecified procedures and potential deviations during the review process.

Eligibility criteria

Study eligibility was established using the Population, Intervention, Comparison, Outcome and Study Design (PICOS) framework. The target population comprised children with dental caries affecting primary molars. The intervention of interest was the Hall technique, characterized by the placement of a preformed metal crown without local anesthesia, tooth preparation or removal of carious tissue.

Eligible comparators included conventional restorative procedures involving complete or selective caries removal followed by restoration with composite resin, compomer or glass ionomer cement; atraumatic restorative treatment and its modified variants; conventionally prepared preformed metal crowns; and conventional pulp therapies, including pulpotomy and indirect pulp capping for deep carious lesions.

Studies were required to report at least one clinically relevant outcome, including treatment success, restoration or tooth survival, treatment failure, or associated complications. Randomized controlled trials and comparative observational studies were considered eligible. Narrative and systematic reviews, case reports, uncontrolled case series, laboratory investigations and questionnaire-based surveys were excluded. The review was restricted to studies published between January 2018 and December 2025 in English, Spanish or Portuguese.

Information sources and search date

A structured bibliographic search was conducted using OpenAlex, PubMed and Crossref. The publication period was restricted to 2018–2025 to prioritize contemporary comparative evidence concerning the clinical effectiveness and safety of the Hall technique in primary molars.

Search strategy

The search strategy combined controlled concepts and free-text terms related to the intervention, primary dentition and dental caries. The principal search expression was:

("Hall technique" OR "preformed metal crown" OR "stainless steel crown" OR "biological caries management") AND ("primary molar" OR "primary teeth" OR "deciduous molar" OR "primary dentition") AND (caries OR carious OR "dental caries").

Search expressions were adapted to the indexing characteristics and query syntax of each bibliographic source, applying publication-year restrictions from 2018 through 2025.

A supplementary search was undertaken to identify studies explicitly comparing the Hall technique with conventional treatment approaches, using the following expression:

("Hall technique" OR "preformed metal crown") AND (versus OR compared OR comparison OR conventional) AND ("primary molar" OR "primary teeth").

Additional targeted searches were performed to identify relevant reports from the FiCTION trial, the German caries management trial and comparative investigations involving atraumatic restorative treatment. These complementary searches were intended to improve retrieval of eligible studies in which the Hall technique was evaluated without being explicitly identified in the article title.

Study selection process

Records identified through the bibliographic searches were consolidated and duplicates were removed before eligibility assessment. Study selection followed a two-stage procedure.

Initially, titles and abstracts were examined to identify potentially relevant publications according to the predefined eligibility criteria. Subsequently, full-text versions of potentially eligible studies were sought through legitimate open-access sources and evaluated for inclusion.

Data extraction and outcome definitions

Data were systematically extracted from the full texts of included studies using a structured extraction form. The information collected comprised study design, geographical setting, sample size, participant characteristics, intervention and comparator characteristics, outcome measures, principal findings, reported effect estimates and risk-of-bias judgments.

Each extracted item was linked to its corresponding location in the original publication to facilitate verification and maintain traceability between the evidence source and the synthesized findings.

Clinical success was defined according to the criteria applied in each primary study, generally reflecting the absence of both minor and major treatment failures. Treatment survival was

interpreted as the absence of major failure or tooth extraction, consistent with the outcome classification proposed by Innes and colleagues and adopted in several of the included investigations.

When studies reported outcomes at multiple follow-up intervals, the longest available follow-up was selected for the principal descriptive synthesis. Results from intermediate assessment periods were retained when relevant to the evaluation of complications and temporal patterns of treatment failure.

Risk of bias assessment

The methodological quality of randomized controlled trials was evaluated using the revised Cochrane Risk of Bias tool (RoB 2).⁽¹⁹⁾ Five domains were considered: bias arising from the randomization process, deviations from intended interventions, missing outcome data, outcome measurement and selection of the reported result.

The retrospective cohort study was assessed using the Risk Of Bias In Non-randomised Studies of Interventions (ROBINS-I) tool.⁽²⁰⁾ The assessment addressed potential bias due to confounding, participant selection, intervention classification, deviations from intended interventions, missing data, outcome measurement and selective reporting.

Risk-of-bias judgments were assigned at the domain level and integrated into an overall assessment for each study, using the categories and decision rules applicable to the respective assessment instrument.

Particular attention was given to outcome ascertainment because the distinctive clinical characteristics of the Hall technique make blinding of participants and treating clinicians impracticable. Consequently, the assessment considered whether clearly defined clinical failure criteria, independent or blinded outcome assessment, appropriate handling of missing data and transparent reporting procedures were sufficient to reduce potential bias.

Overall risk-of-bias judgments were informed by the most consequential domain-level concerns, following the signaling-question frameworks and established decision algorithms of RoB 2 and ROBINS-I.

Data synthesis

A structured narrative synthesis was undertaken to integrate the findings of the included studies. Evidence was organized according to the type of conventional treatment used as the comparator rather than the chronological order of publication.

Treatment success and survival were examined separately from clinical complications, while comparisons involving deep carious lesions and pulp therapy were considered as a distinct subgroup because of their specific clinical characteristics and therapeutic objectives.

A quantitative meta-analysis was not performed because of substantial clinical and methodological heterogeneity across studies, particularly differences in comparator interventions, follow-up duration, outcome definitions and assessment procedures. Under these conditions, statistical pooling was considered unlikely to yield a sufficiently interpretable summary estimate.

The strength and consistency of the available evidence were therefore discussed qualitatively. For each principal outcome, the synthesis distinguished findings supported by multiple studies with concordant results from those based on individual investigations or limited numbers of clinical events.

Consistency was examined by identifying the number of included studies reporting favorable outcomes for the Hall technique, favorable outcomes for conventional treatment, or no statistically significant difference between interventions.

The certainty of evidence was not formally evaluated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework. Accordingly, conclusions were interpreted in relation to the methodological limitations, precision and consistency of the available studies, without assigning formal certainty ratings.

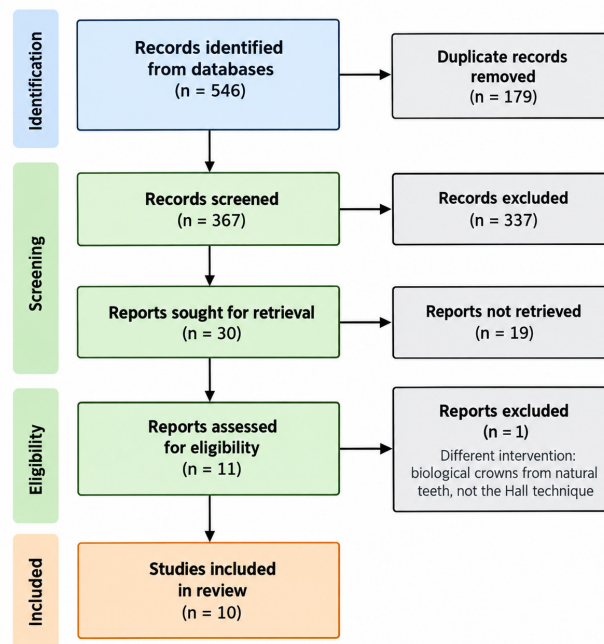
RESULTS

Study selection

The searches identified 546 records across the three databases. After removing 179 duplicate records, 367 records were screened by title and abstract, of which 337 were excluded. Full text was sought for 30 reports, but 19 could not be retrieved through legitimate open-access sources. Of

the 11 reports assessed for eligibility, 1 was excluded because the intervention did not correspond to the Hall technique, and 10 studies were included in the review (Figure 1).

Figure 1. PRISMA 2020 flow diagram of study selection.



Note: Nineteen reports could not be retrieved because their full text was not available through legitimate open-access sources. Source: Prepared by the author based on searches carried out in OpenAlex, PubMed and Crossref.

The ten included studies comprised nine randomized trials and one retrospective cohort published between 2019 and 2025 (Table 1). The studies were conducted in Brazil (two trials), India (four studies), Türkiye (two studies), Sudan (one trial) and Egypt (one trial). Sample sizes ranged from 26 teeth in the cohort to 364 teeth in the largest randomized trial. The comparators were resin composite,(21) compomer,(22,23) atraumatic restorative treatment,(24,25) modified atraumatic restorative treatment,(26) conventionally prepared preformed metal crowns,(27,28) and pulpotomy or indirect pulp capping for deep carious lesions.(29,30)

All ten studies reported a clinical success or survival outcome, and eight also reported radiographic assessment. Follow-up ranged from 10 days in the postoperative pain trial to 60 months in the retrospective cohort, with the randomized trials reporting follow-up between 9 and 36 months. Four studies used split-mouth or multi-arm designs that allowed each child to contribute to more than one intervention group. Eight studies recruited children with occlusal or proximal dentine caries without clinical or radiographic signs of pulpal involvement, whereas two trials specifically enrolled primary molars with deep carious lesions approaching the pulp.

The one report excluded at full-text had used natural tooth crowns rather than preformed metal crowns and was therefore judged not to evaluate the Hall technique. The nineteen reports that could not be retrieved included several randomized trials and retrospective comparisons that appeared eligible from their abstracts, such as additional trials of conventional crown placement and atraumatic restorative treatment; their absence from the synthesis is reported as a limitation rather than as evidence that they would have changed the conclusions.

Risk of bias

Nine randomized trials were judged to be at some concerns or high risk of bias, and the retrospective cohort was judged to be at serious risk of bias (Table 2). The main limitation across the randomized trials was the impossibility of blinding operators and participants to the treatment, given that the Hall technique is visually and procedurally distinct from any conventional restoration or pulp therapy. Outcome assessment was also unblinded in most studies, although the survival and failure criteria were objective and reproducible. Randomization was generally adequate, with computer-generated sequences or coin tossing reported in six trials, but four trials were at high risk of bias because randomization, allocation concealment and blinding were incompletely repor-

ted and the follow-up periods were short. Missing outcome data were a lesser concern because follow-up exceeded 75 percent in most trials and dropout was balanced between arms. The cohort study was at serious risk of bias because treatment allocation was retrospective, the selection depended on the availability of records and the two groups were matched only on radiographic caries depth rather than on all prognostic factors.

Table 1. Evidence matrix of the ten included studies comparing the Hall technique with conventional treatments for carious primary molars.

Study (year, country)	Design	Population and sample	Comparison	Main finding	Risk of bias
Elamin et al. (2019, Sudan) (27)	RCT, two-arm	164 children, 212 PMCs, 5-8 years	HT vs conventional PMC	Similar 24-month survival (93.6% vs 94.1%); fewer minor failures with HT	Some concerns
Araujo et al. (2020, Brazil) (24)	RCT, two-arm	131 children, 5-10 years	HT vs ART	Higher 36-month survival with HT (93.4% vs 32.7%, $p < 0.001$)	Some concerns
Undre et al. (2023, India) (22)	RCT, three-arm	120 teeth, 5-8 years	HT vs compomer vs non-restorative	No significant difference; HT descriptively superior to compomer	High
Pascareli-Carlos et al. (2023, Brazil)(21)	RCT, multicenter	364 teeth, 4-9 years	HT vs resin composite	Higher 12-month survival with HT (87.8% vs 75.7%, $p = 0.004$)	Some concerns
Yavuz and Kargul (2023, Türkiye)(23)	Retrospective cohort	26 teeth, 8 children	HT vs compomer	Higher 60-month success with HT (84.6% vs 23.1%, $p < 0.01$); similar survival	Serious
Oz et al. (2023, Türkiye)(25)	RCT, split-mouth	40 children, 80 molars, 5-6 years	HT vs ART	100% success for both at 18 months; statistical comparison not possible	Some concerns
Ahmed et al. (2022, Egypt) (29)	RCT, two-arm	56 molars with deep caries	HT vs formocresol pulpotomy	No significant difference in postoperative pain over 10 days	High
Mittal et al. (2024, India)(28)	RCT, two-arm	50 children, 4-8 years	SDF plus HT vs conventional SSC	Similar major failure-free success (93.5% vs 100%, NS); similar minor failure	Some concerns
Poludasu et al. (2022, India) (30)	RCT, three-arm	60 molars with deep caries, 4-9 years	Modified HT vs IPT (MTA) vs MTA pulpotomy	Highest radiographic success with modified HT (100%), not significant	High
Kumari et al. (2025, India) (26)	RCT, split-mouth	60 teeth, 4-9 years	HT vs mART	Lower restoration loss with HT at 9 months (3.3% vs 63.3%, $p = 0.001$)	Some concerns

Note: HT = Hall technique; RCT = randomized controlled trial; ART = atraumatic restorative treatment; mART = modified atraumatic restorative treatment; PMC = preformed metal crown; SSC = stainless steel crown; SDF = silver diamine fluoride; IPT = indirect pulp therapy; RoB = risk of bias. Source: Elaboración propia a partir de los textos completos de los estudios incluidos.

Success and survival

The Hall technique showed high and consistent restoration success and survival across the included studies, ranging from 84.6 percent at 60 months to 100 percent at shorter follow-up (Table 3). Where a direct estimate against a conventional comparator was available, the Hall technique performed as well as or better than the comparator. Elamin et al. reported 24-month survival above 90 percent in both arms, with no significant difference between the Hall technique (93.6 percent) and conventionally prepared preformed metal crowns (94.1 percent).(27)Against resin composite, Pascareli-Carlos et al. found significantly higher 12-month survival for the Hall technique (87.8 percent versus 75.7 percent, $p = 0.004$) in multi-surface cavities.(21)The largest contrast was reported by Araujo et al., in which 36-month survival was 93.4 percent (95% CI 0.72-0.99) for the Hall technique versus 32.7 percent (95% CI 0.17-0.47) for atraumatic restorative treatment ($p < 0.001$).(24)Yavuz and Kargul found similar 60-month survival for the Hall technique (92.3 percent) and compomer (84.6 percent, log-rank $p = 0.57$), but clinical and radiographic success was significantly higher for the Hall technique (84.6 percent versus 23.1 percent, $p < 0.01$) because most compomer restorations accumulated minor failures.(23)Undre et al. reported no statistically significant difference between the Hall technique, conventional compomer restorations and non-restorative treatment over 12 months, although the Hall technique performed descriptively better than the conventional restoration.(22)

Table 2. Risk-of-bias assessment of the included studies.

Study	Tool	D1	D2	D3	D4	D5	Overall
Elamin et al. (2019)(27)	RoB 2	Low	Some concerns	Some concerns	Low	Some concerns	Some concerns
Araujo et al. (2020)(24)	RoB 2	Low	Some concerns	Low	Some concerns	Low	Some concerns
Undre et al. (2023)(22)	RoB 2	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns	High
Pascareli-Carlos et al. (2023)(21)	RoB 2	Low	Some concerns	Low	Some concerns	Low	Some concerns
Yavuz and Kargul (2023) (23)	ROBINS-I	Serious	Serious	Low	Moderate	Low	Serious
Oz et al. (2023)(25)	RoB 2	Low	Some concerns	Low	Some concerns	Low	Some concerns
Ahmed et al. (2022)(29)	RoB 2	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns	High
Mittal et al. (2024)(28)	RoB 2	Low	Some concerns	Low	Low	Low	Some concerns
Poludasu et al. (2022)(30)	RoB 2	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns	High
Kumari et al. (2025)(26)	RoB 2	Low	Some concerns	Low	Some concerns	Low	Some concerns

Note: Randomized trials were assessed with RoB 2 (domains D1-D5); the cohort was assessed with ROBINS-I. D1 = randomization or confounding; D2 = deviations from intended interventions; D3 = missing outcome data; D4 = outcome measurement; D5 = selective reporting. Source: Elaboración propia con las herramientas RoB 2 y ROBINS-I.

Two split-mouth trials compared the Hall technique with minimally invasive glass ionomer restorations. Oz et al. observed 100 percent clinical and radiographic success for both the Hall technique and atraumatic restorative treatment at 18 months, which precluded statistical comparison.(25) Kumari et al. found significantly lower restoration loss with the Hall technique than with modified atraumatic restorative treatment at 9 months (3.3 percent versus 63.3 percent, $p = 0.001$), together with less gingival inflammation.(26)

The precision of the estimates varied with sample size. The two largest trials, with 131 and 364 participants, provided the narrowest confidence intervals and reached statistical significance, whereas the split-mouth and single-centre trials reported point estimates without confidence intervals or with wide intervals. The survival estimate of 93.4 percent for the Hall technique in the school-based trial was reported with a 95% CI of 0.72 to 0.99, which is wide despite the large point estimate because the number of events was small. The cohort study reported a mean follow-up of 59.8 months but included only 26 teeth, so its success estimates of 84.6 percent and 23.1 percent should be interpreted as exploratory rather than precise.

Taken together, the pattern of results was monotonic across comparators. The Hall technique was at least equivalent to every conventional restoration it was tested against, and it was significantly superior to the intracoronal comparators in four of the ten studies, with no study reporting a conventional restoration to be significantly superior. The two comparisons that found equivalence were those against conventionally prepared metal crowns and against atraumatic restorative treatment for single-surface lesions. No statistically significant result in any included study favoured a conventional restoration over the Hall technique, and the direction of every point estimate was consistent with this overall pattern.

Complications

Major complications, defined as irreversible pulpal involvement, abscess or the need for extraction or pulp therapy, were infrequent and generally similar between groups. Elamin et al. reported major failures in 6.4 percent of Hall crowns and 5.8 percent of conventional crowns (not significant), while minor failures were significantly less frequent with the Hall technique (2.7 percent versus 5.8 percent, $p < 0.05$). (27) Yavuz and Kargul observed major failures in 7.7 percent of Hall crowns versus 15.4 percent of compomer restorations at 60 months, and minor failures in 7.7 percent versus 61.5 percent.(23) Anxiety was lower after the Hall technique than after conventional crown placement at 12 months in the Sudan trial ($p < 0.001$), although immediate postoperative

complications such as lip biting were uncommon and similar between arms.(27)In the school-based trial, child-reported treatment discomfort was higher for the Hall technique than for atraumatic restorative treatment ($p = 0.018$), but acceptability exceeded 70 percent in both groups.(24)Occlusal changes were the most consistent early finding: nearly all Hall crowns produced a transient increase in the occlusal vertical dimension, which returned to baseline within four weeks in the Brazilian trial and within 12 months in the Sudan trial.(24,27)

For deep carious lesions, two randomized trials compared the Hall technique with conventional pulp therapy. Ahmed et al. found no statistically significant difference in postoperative pain over 10 days between the Hall technique and formocresol pulpotomy.(29)Poludasu et al. reported the highest radiographic success (100 percent) for the modified Hall technique compared with indirect pulp therapy using mineral trioxide aggregate and mineral trioxide aggregate pulpotomy, although the differences were not statistically significant.(30)

Periodontal and occlusal outcomes were reassuring in the studies that measured them. Elamin et al. found plaque and gingival indices improved over time in both the Hall and conventional crown groups, with no significant difference between them, and the raised occlusion present in all Hall crowns immediately after placement had returned to normal by 12 months.(27)Kumari et al. reported less gingival inflammation around Hall crowns than around modified atraumatic restorative treatment restorations at 6 and 9 months.(26)In the school-based trial, teeth restored with the Hall technique exfoliated earlier than those treated with atraumatic restorative treatment ($p = 0.007$), a finding the authors interpreted as consistent with the natural exfoliation of sealed teeth rather than as a complication.(24)No included study reported persistent temporomandibular symptoms, and the two trials that measured occlusal vertical dimension found it had returned to baseline by the final assessment, indicating that the transient occlusal disturbance does not translate into measurable harm.

Table 3. Success, survival and complication estimates reported by the included studies.

Study	Comparison	Follow-up	Success or survival, HT	Success or survival, comparator	p	Complication finding
Elamin et al. (2019) (27)	HT vs conventional PMC	24 months	Survival 93.6%	94.1%	NS	Minor failures 2.7% vs 5.8% ($p < 0.05$); major 6.4% vs 5.8% (NS); lower anxiety with HT
Araujo et al. (2020) (24)	HT vs ART	36 months	Survival 93.4% (95% CI 0.72-0.99)	32.7% (95% CI 0.17-0.47)	< 0.001	Higher treatment discomfort with HT ($p = 0.018$); occlusal change resolved within 4 weeks
Undre et al. (2023) (22)	HT vs compomer vs non-restorative	12 months	NR	NR	NS	No significant difference between groups
Pascareli-Carlos et al. (2023)(21)	HT vs resin composite	12 months	Survival 87.8%	75.7%	0.004	NR
Yavuz and Kargul (2023)(23)	HT vs compomer	60 months	Success 84.6%; survival 92.3%	Success 23.1%; survival 84.6%	< 0.01 ; NS	Minor failures 7.7% vs 61.5%; major 7.7% vs 15.4%
Oz et al. (2023)(25)	HT vs ART	18 months	Success 100%	Success 100%	Not computable	No pain or symptoms in HT; gums healthy
Ahmed et al. (2022) (29)	HT vs formocresol pulpotomy	10 days	NR	NR	NS	No significant difference in postoperative pain
Mittal et al. (2024) (28)	SDF plus HT vs conventional SSC	30 months	Major failure-free 93.5%	100%	NS	Minor failure (crown loss) 84.2% vs 91.3% (NS)
Poludasu et al. (2022)(30)	Modified HT vs IPT (MTA) vs MTA pulpotomy	9 months	Radiographic success 100%	IPT and pulpotomy lower	NS	No clinical signs in the HT group
Kumari et al. (2025) (26)	HT vs mART	9 months	Restoration loss 3.3%	63.3%	0.001	Less gingival inflammation with HT

Note: HT = Hall technique; CI = confidence interval; NS = not significant; NR = not reported. Percentages are reported as published. Source: Elaboración propia a partir de los textos completos de los estudios incluidos.

Consistency of the evidence by outcome

The findings were consistent across studies despite the diversity of comparators and settings. Nine of the ten studies reported numerically higher success or survival for the Hall technique than for its comparator, and the tenth found equivalence against conventionally prepared preformed metal crowns. Four studies reported a statistically significant advantage for the Hall technique, and no study reported a statistically significant advantage for a conventional restoration over the Hall technique. For major complications, all studies that reported the outcome found the Hall technique to be at least as safe as the comparator, with no study describing an excess of pulpal or infective complications. For minor failures, the three studies that reported the outcome separately all found fewer minor failures with the Hall technique than with compomer, conventional crowns or modified atraumatic restorative treatment. The only outcomes in which the Hall technique performed less favourably were immediate treatment discomfort relative to atraumatic restorative treatment and the transient occlusal change observed in nearly all Hall-treated teeth; both resolved during the follow-up periods of the included studies.

DISCUSSION

The main finding of this review is that, in carious primary molars without pulpal involvement, the Hall technique delivers restoration success and survival that are at least equivalent to, and in most direct comparisons higher than, those of conventional restorations, while major complications remain uncommon and comparable between approaches. The evidence is internally consistent despite clinical heterogeneity, but it rests on a small number of studies that are mostly at some concerns of bias, so the comparative estimates should be read with caution.

The level of evidence differs across the findings. The claim that the Hall technique outperforms adhesive intracoronal restorations is supported by two large randomized trials with consistent, statistically significant results and by a retrospective cohort, and is further corroborated by earlier trials outside the review window; this finding carries the highest confidence. The claim of equivalence with conventionally prepared preformed metal crowns rests on a single randomized trial plus one trial of a silver diamine fluoride variant and retrospective data, so it is plausible but less secure. The claims about major complications rest on sparse events across small samples and should be treated as imprecise. The deep-lesion comparisons rest on two small trials that were not powered to detect differences, so the absence of excess postoperative pain or pulpal complications should be read as reassuring but not definitive.

The superiority of the Hall technique over adhesive intracoronal restorations is the finding most strongly supported by the data. The two randomized trials with the largest samples reported significantly higher survival for the Hall technique than for resin composite and atraumatic restorative treatment in multi-surface lesions, and a retrospective cohort found markedly higher clinical success than compomer at 60 months. These results agree with the Cochrane review of preformed crowns, which concluded that the Hall technique probably carries a lower risk of major failure and pain than conventional restorations, with moderate-quality evidence.⁽¹⁰⁾ They also align with the German trial data in which the Hall technique outperformed conventional compomer and non-restorative cavity control at 2.5 years,^(31,32) and with more recent meta-analyses that pooled high success rates for the technique.⁽¹²⁻¹⁵⁾ The mechanism is biologically plausible: sealing the lesion under a preformed crown deprives the biofilm of substrate, arrests caries progression and avoids the marginal breakdown that recurrent caries produces in adhesive restorations.^(4,8,33) Three complementary mechanisms explain the pattern. First, the full-coverage crown removes the marginal interface that is the site of most secondary caries in intracoronal restorations, so the most common failure mode of composite and compomer is eliminated. Second, the glass ionomer cement used to lute the crown releases fluoride and can support remineralization of the sealed dentine, which maintains the arrested lesion in a stable state. Third, the technique requires no local anaesthesia or rotary instrumentation, so the procedure itself is shorter and less aversive, which translates into the lower anxiety and higher acceptance reported in the included studies.

The magnitude of the advantage reported here is consistent with the pooled estimates of earlier syntheses. Meta-analyses of the Hall technique have reported success rates above 90 percent at follow-up periods between one and five years,^(12,13,15) and a meta-analysis comparing placement methods found that the Hall technique matched the conventional technique for crown survival while avoiding tooth preparation.⁽¹⁴⁾ The present review reproduces those pooled patterns at the level of individual studies published after 2018, and it adds the direct comparisons with resin composite and with modified atraumatic restorative treatment that those syntheses did not

include. The convergence between pooled estimates from different eras and the individual trials included here strengthens confidence that the Hall technique's advantage is a stable property of the treatment rather than an artefact of any single study.

The comparison against conventionally prepared preformed metal crowns is more balanced. The single randomized trial that made this direct comparison found no significant difference in survival, and the trial that combined silver diamine fluoride with the Hall technique also reported success similar to that of conventionally placed stainless steel crowns. These findings are consistent with retrospective evidence on crown placement technique.⁽³⁴⁾ This is expected, because both arms use the same full-coverage crown and differ mainly in preparation and anaesthesia rather than in the sealing mechanism. The advantage of the Hall technique in this comparison lies therefore in process and patient experience rather than in restoration survival.

The complication profile favours the Hall technique for minor failures and anxiety but not uniformly for discomfort. Lower minor failure rates were reported in two studies, and children had lower anxiety after Hall crown placement than after conventional preparation in the Sudan trial. These observations are consistent with trial data showing that children find the Hall technique acceptable and that procedural pain is similar to or lower than with conventional crowns,^(35,36) and with cost-effectiveness analyses that report shorter treatment time and lower cost for the Hall technique.^(37,38) However, one school-based trial reported higher child-reported treatment discomfort for the Hall technique than for atraumatic restorative treatment, and the transient increase in occlusal vertical dimension that follows Hall crown placement was documented in nearly all Hall-treated teeth. That occlusal change resolves within weeks to months, as reported in the included studies and in earlier longitudinal work, and no persistent temporomandibular or periodontal harm has been demonstrated.^(7,8)

For deep carious lesions, the two included trials suggest that the Hall technique does not increase postoperative pain or pulpal complications relative to pulpotomy or indirect pulp therapy, although neither trial had sufficient power to detect small differences. This is clinically relevant because the technique extends the biological rationale from moderate lesions toward lesions that would otherwise receive pulp therapy, provided there are no clinical or radiographic signs of irreversible pulpitis. The largest apparently discrepant external result is the FiCTION trial, which found no evidence that a biological strategy including the Hall technique differed from conventional management for the co-primary outcome of dental pain or infection over three years.⁽¹⁷⁾ The discrepancy is partly explained by design: FiCTION compared packages of care rather than the Hall technique in isolation, the biological arm combined prevention with sealing and silver diamine fluoride, and the primary outcome captured pain and infection, which were rare events across all arms. The present review, by contrast, focuses on restoration survival and success, outcomes on which the Hall technique shows its clearest advantage. A two-year randomized trial of three management approaches likewise reported higher success for the Hall technique than for conventional restoration and non-restorative treatment, supporting the direction of the present findings,⁽³⁹⁾ as do smaller comparative trials and cohort studies in high-carries-risk populations.⁽⁴⁰⁻⁴³⁾

Process and economic outcomes reinforce the clinical case. The Sudan trial measured a mean procedure time of 9.1 minutes for the Hall technique against 33.9 minutes for conventional crown placement, and a per-unit cost roughly one third of the conventional approach, with the crown placed by a dental therapist. Cost-effectiveness analyses of the German trial reached the same conclusion, showing that the Hall technique dominated conventional restoration and non-restorative cavity control in economic terms.^(37,38) These process advantages matter for the question posed by this review because a treatment that is faster, cheaper and less aversive while achieving equivalent or better survival offers a net benefit to children, families and services even where the biological outcome is the same.

The applicability of these findings is broad but not unlimited. The included studies enrolled cooperative children with cavitated dentine lesions, mostly in primary care, school and university settings, and excluded teeth with signs of irreversible pulpitis, so the results should not be extrapolated to symptomatic teeth with pulpal involvement or to children who cannot tolerate crown seating. Within those limits, the technique is attractive for high-carries-risk children and for settings with limited access to rotary equipment, radiography or general anaesthesia, because it can be delivered by trained dental therapists and does not generate aerosols. This is consistent with guidance that elevated the Hall technique during the coronavirus pandemic and with its inclusion in European best-practice documents for deep carious lesions in primary teeth.^(8,9) Parental counselling about the transient occlusal change and the metal appearance remains essential, since crown aesthetics concerned roughly a quarter of parents in one included trial.

The age range of the included samples, from 4 to 10 years, covers the period in which the

primary molars are most at risk and in which behaviour management is most difficult, so the findings apply directly to the population in which the decision is clinically most pressing. The inclusion of trials from Brazil, India, Türkiye, Sudan and Egypt, alongside the European and British evidence cited in the discussion, indicates that the technique performs consistently across health systems with very different levels of resources, which is itself an argument for its wider adoption. The main caveat is that most studies were conducted or supervised by specialist paediatric dentists or researchers, so the results may overstate what a general practitioner would achieve without the same training and case selection discipline.

Heterogeneity across the included studies limits quantitative pooling. Comparators ranged from resin composite, compomer and glass ionomer restorations to conventionally prepared crowns and pulp therapy, follow-up ranged from 10 days to 60 months, outcome definitions differed for survival versus success and minor versus major failure, and settings spanned school programmes, general practice and university clinics. Even the definition of the Hall technique varied slightly, with one trial adding silver diamine fluoride before crown cementation and two trials using a modified version for deep lesions. This heterogeneity, together with the small number of studies, is why a meta-analysis was not performed. Network meta-analyses and umbrella reviews that have aggregated this literature reach conclusions consistent with ours, ranking biological sealing strategies among the most effective options for cavitated primary molars.^(16,44,45)

A further source of heterogeneity is the age and caries-risk profile of the samples. The Sudan and Brazil school-based trials enrolled children with high caries experience and limited access to care, where the contrast between the Hall technique and conventional restoration was largest, whereas the Türkiye cohort and the Indian trials drew from clinic populations with a different risk profile. The superiority of the Hall technique appeared most pronounced in high-caries-risk and multi-surface lesions, which is exactly the clinical situation in which adhesive restorations fail most often, and less pronounced in single-surface lesions, where atraumatic restorative treatment performed as well as the Hall technique in one trial. This interaction between lesion complexity and treatment effect deserves explicit testing in future trials with stratified randomization by lesion surface.

For research, three priorities follow from these findings. Trials should adopt a common core outcome set that distinguishes success, survival, minor failure and major failure with the same thresholds, so that future updates can pool effect estimates rather than describe them qualitatively. The comparison between the Hall technique and conventionally prepared preformed metal crowns deserves a second adequately powered trial, because the current equivalence estimate rests on a single study and the process advantages of the Hall technique would be decisive if equivalence were confirmed. Finally, longer follow-up to natural exfoliation is needed to confirm that sealing, rather than merely postponing restoration failure, preserves the tooth without late pulpal or periodontal consequences, since the longest included follow-up was 60 months and most trials stopped earlier.

The strengths of this review should be weighed against these limitations. The search spanned three complementary databases, the inclusion window was restricted and applied consistently, the extraction was anchored to the full text of every included study, and each randomized trial was judged with the current RoB 2 instrument rather than with ad hoc quality checklists. By restricting the included studies to those whose full text was legitimately accessible, the review avoided the common error of extracting outcome data from abstracts alone, at the cost of excluding several otherwise eligible reports. The result is a smaller but more verifiable evidence base, which is appropriate for a question whose answer depends on precise success and failure estimates.

For clinical practice, the findings support the Hall technique as a first-line biological option for carious primary molars without clinical or radiographic signs of pulpal involvement, particularly in multi-surface lesions, in children with high caries risk, and in settings where general anaesthesia or rotary instrumentation is not available.^(2,8,9) Case selection matters: the included trials excluded teeth with spontaneous pain, fistulae or radiographic signs of irreversible pulpitis, and the technique should not be presented as a substitute for pulp therapy once those signs are present, even though the two deep-lesion trials were reassuring. Clinicians should inform parents that the crown changes the occlusion temporarily, that the metal appearance is visible and that the restoration is intended to remain until natural exfoliation. When the child is anxious, the avoidance of local anaesthesia and rotary instruments is itself a therapeutic benefit, and the shorter procedure time observed in the Sudan trial supports the feasibility of delivering the technique through trained dental therapists in low-resource settings.

CONCLUSIONS

Ten comparative studies published between 2019 and 2025, nine randomized trials and one retrospective cohort, provided evidence on the Hall technique versus conventional treatments for carious primary molars. In children with carious primary molars without pulpal involvement, the Hall technique achieves restoration success and survival at least equivalent to, and in most comparisons higher than, conventional restorations, and it performs comparably to conventional pulp therapy for deep carious lesions. Major complications were infrequent and similar between the techniques, while minor failures were less common with the Hall technique and the early occlusal change was transient. The evidence is limited by a small number of studies, predominantly with some concerns of risk of bias, so the certainty of the comparative estimates is moderate at best, and adequately powered trials with standardized outcome definitions are still required to confirm these conclusions.

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