ORIGINAL RESEARCH

Evaluation of the Success of Conventional and Biological Restorative Treatment Approaches for Caries in Primary Molars: An *In Vivo* Study

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Abstract

Background: In order to compare the clinical and radiographic success of three treatment modalities—conventional restoration (CR), nonrestorative caries treatment (NRCT), and Hall technique (HT), with a 3-month to 1 year follow-up in deciduous molars with occlusal or proximal carious lesions.

Design: Children between the ages of 5 and 8 were chosen for the study, having a total of 120 teeth. They were split into three groups, each with 40 participants—CR, HT, and NRCT. Clinical and radiographic evaluation was done at 3, 6, 9, and 12 months. Data were statistically analyzed.

Results: The Chi-squared value and *p*-value were found to be insignificant when comparing clinical and radiographic ratings of all three groups at 3, 6, 9, and 12-month intervals.

Conclusion: Hall technique (HT) performed better than CR. NRCT was more acceptable to patients than CR.

Keywords: Compomer, Hall technique, Nonrestorative cavity control, Primary dentition caries, 38% silver diamine fluoride.

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Introduction

"Dental caries is the disease where an ecologic shift within the dental biofilm environment, driven by frequent access to fermentable dietary carbohydrates, leads to a move from a balanced population of microorganisms of low cariogenicity to a microbiological population of high cariogenicity (more aciduric and acidogenic) and to an increased production of organic acids."[1] The consequent activity shift in the biofilm is linked to an imbalance between demineralization and remineralization, resulting in the net mineral loss within dental hard tissues, with a carious lesion as the sign and symptom.[2] As a result, dental caries is not a contagious disease that must be "cured" by eliminating microbes, or even more specifically, a specific bacterial species dental caries, on the contrary, can be controlled using a behavioral approach by limiting the variables that cause it, such as the availability of fermentable carbohydrates and the existence and maturation of bacterial dental biofilms.[1,3]

The current expert consensus on caries management outlines the following aims or principles—inactivation/control of the disease state; conservation of enamel and dentin; prevention of the restoration process, and as long as possible, maintenance of the tooth. Thus, one must undertake a biological approach toward managing caries rather than the conventional approach, which was solely dictated by the depth of involvement.[1]

The following randomized clinical research was carried out to evaluate the clinical and radiological success of three treatment modalities—children aged 5–8 years who have occlusal or proximal caries in their deciduous molars can receive treatment using the Hall technique (HT), conventional restoration (CR), or nonrestorative caries treatment (NRCT), with a 3-month follow-up period up to 1 year.

Objectives

- To compare the clinical success of CR, NRCT, and HT in occlusal or proximal carious lesions.
- To compare the radiographic success of CR, NRCT, and HT in occlusal or proximal carious lesions.

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Materials and Methods

Materials

Diagnostic Instruments

- X-ray film #0,1 (Carestream Health, Inc., Rochester, New York, United States of America).
- Orthodontic separators (Liberal Traders Pvt Ltd., India).
- Orthodontic separator placement pliers (GDC Fine Crafted Dental Pvt. Ltd., India).
- Round carbide bur #6 (*Strauss & Co,* United States of America).
- Taper diamond bur #247 (*Osung* United States of America).

- Small round spoon excavator (GDC Fine Crafted Dental Pvt. Ltd., India).
- Stainless steel crowns (SSCs) (3M ESPE, United States of America).
- Glass ionomer luting and lining cement (GC Corporation Tokyo, Japan).
- Cotton rolls and gauze.
- Around 37% orthophosphoric acid (Prime Dental, India).
- Bonding agent (Tetric® N-Bond,Ivoclarvivadent, Asia).
- Microbrush.
- Twinky star compomer (VOCO, United States of America).
- Silver diamine fluoride (SDF) 38% (Advantage arrest, Elevate Oral Care, United States of America).
- High-speed handpiece.
- Matrix bands, retainer.

Study Design

The Ethical Committee gave its approval and children aged 5–8 years old who attended the Department of Pediatric and Preventive Dentistry with a total of 120 teeth were chosen, with 40 teeth being considered for each material group.

The parents were informed about the treatment protocols and consent was taken. The teeth that were being investigated for treatment in the study had preoperative periapical radiographs taken of them in standardized conditions. To avoid the teeth being foreshortened or elongated, a consistent bisecting angle technique was used using an intraoral periapical film holder. The preoperative radiographs were repeated in the follow-up periapical radiographs.

Inclusion Criteria

- Moderate caries (impacting the outer pulpal two-thirds or three-quarters of the dentin radiographically, or when pulp exposure is not a concern).[4]
- International caries detection and assessment system (ICDAS) codes 3–5.[5]
- Cavitated occlusal or approximal carious lesions.[4]
- Between the carious lesion and the pulp, there is a radiographically "clean" zone of dentin.[4]
- Presence of two-thirds of the root.
- Cooperative patient according to Frankl behavior rating scale (positive and definitely positive).

Exclusion Criteria

- Signs of pulpal involvement or periradicular pathology on clinical or radiographic examination.
- Any patient suffering from a systemic condition.
- Highly uncooperative patient (Frankl behavior rating scale—negative, definitely negative).
- More than one-third of the root is affected by physiologic resorption.
- Parent or child not willing to give consent.

Method

On the basis of inclusion and exclusion criteria, baseline data was gathered. The 120 teeth were separated into three groups of 40 teeth, each random, as follows:

- Group I (CR) (control)—teeth treated with compomer restoration.
- Group II (HT)—teeth treated by the Hall technique.
- Group III (NRCT)—teeth treated with 38% SDF.

Procedure for CR[5]

- Where necessary, local anesthetic was employed, depending on the child's needs and the operator's decision.
- To get access to the lesion, a high-speed handpiece was utilized; peripheral caries were eradicated, and the carious dentin was cleaved away from the pulpal wall with an excavator.
- For proximal lesions, a matrix band was utilized with a wedge to keep it tight on the tooth.
- The cavity was acid etched, a bonding agent was applied, and then the cavity was filled with compomer. Occlusal high points were checked and reduced.

Procedure for HT[6]

- The tooth was selected according to selection criteria.
- Separators were placed for 3–4 days to create interproximal space for the preformed metal crown (PMC).
- Stainless steel crown (SSC) was selected. It's important that the SSC isn't too loose or too tight. The crown should spring back from the contact points when tested on the tooth.
- Cotton rolls and gauze were used to isolate the tooth.
- The crown was filled with luting glass ionomer cement (GIC) and positioned over and on the tooth after crown selection. After that, the patient was asked to bite on a cotton roll to complete the precise alignment.
- The excess GIC was wiped off.

Procedure for NRCT[5,7]

- The tooth was selected according to the selection criteria.
- To make the cavity accessible for plaque removal, proximal carious lesions were opened using a high-speed bur without the use of local anesthesia. This was done to remove the overhanging and weakened enamel.
- Following the removal of any remaining plaque, cotton/gauze isolation was used.
- Air dry (desiccation) the tooth. With the help of a microbrush SDF was applied to the carious lesion.
- After the application of SDF, the treated tooth surfaces were covered with petroleum jelly for longer contact of SDF with the lesion. Instructions on how to brush one's teeth were given to parents and children, both generally for one's entire mouth and specifically for the tooth that had been treated. A blinded clinical examination was performed by an evaluator calibrated to the clinical scoring criteria at 3, 6, 9, and 12-months intervals (Fig. 1). A blinded, calibrated evaluator viewed all radiographs. The restored teeth were reevaluated clinically and radiographically after 3, 6, 9, and 12 months by the outcome criteria (Table 1).[8]

Statistical Data Analysis

Coding and data entry into Microsoft Excel 2013 were completed. In New York, United States of America, the Statistical Package for the Social Sciences software, version 22.0, from IBM Analytics was used to conduct the statistical study. The normality of the distribution of the data was assessed using the Kolmogorov–Smirnov test. Two categories of clinical and radiological cases were created—those that persisted and those that did not. Utilizing the Chi-squared test, the significance test was conducted. All *p*-values under 0.05 were examined to evaluate their statistical significance.

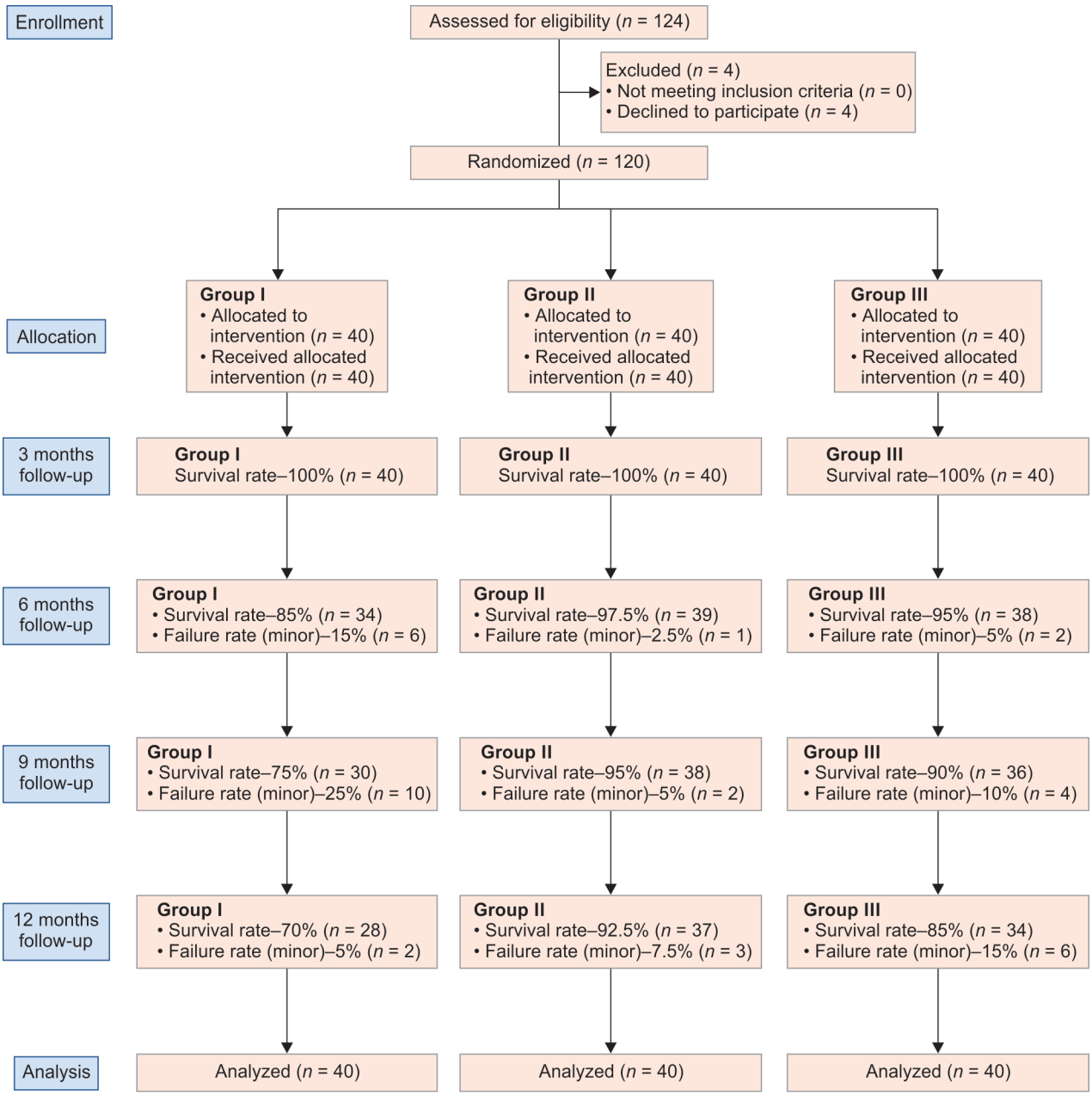

Fig. 1: CONSORT flowchart representing the study

Results

Table 2 depicts the intergroup analysis of survival at 12 months; significantly more survival cases were seen clinically with those cases treated by HT (92.5%) as compared to those treated with NRCT (85.0%). Both HT and NRCT groups showed significantly (p-value = 0.026) higher survival rates as compared to the control group (70.0%) (Chi-squared—7.2).

Table 3 shows a comparative assessment of success and failure rates of HT vs CR group at 12 months. There were significantly more survival cases in the HT group as compared to the CR group at a 12-month time period (p-value = 0.009). Thus, the clinical and radiographical survival rate of HT was better than the CR group.

Table 4 shows a comparative assessment of success and failure rates of NRCT vs CR group at 12 months. Significantly more survival cases were seen with the NRCT group as compared to the CR group at a 12-month time period (p-value = 0.006). Thus, the clinical and radiographical survival rate of the NRCTC was better than the CR group.

Table 5 shows a comparative assessment of success and failure rates of NRCT vs HT group at 12 months. Even though the success rates were lower than the HT in the NRCT group at 12 months. It was not determined that the difference was statistically significant (p-value = 1).

Discussion

Good long-term outcomes might occasionally be challenging to achieve when treating occlusal and proximal lesions in young children, especially when caries are persistently prevalent. Additional sedation or even general anesthesia is required to achieve high success rates, which comes with much higher expenses

Table 1: Outcome criteria for the clinical and radiographic assessment of restorations and teeth

	CR	*HT*	*NRCT*
Successful	Treatment appears satisfactory, no intervention required	Crown appears satisfactory, no intervention required	Treatment appears satisfactory, no intervention required
	No clinical signs or symptoms of pulpal pathology	No clinical signs or symptoms of pulpal pathology	No clinical signs or symptoms of pulpal pathology
	No pathology visible on radiographs	No pathology visible on radiographs	No pathology visible on radiographs
"Minor" failure	Secondary caries, or new caries clinically or radiographically; tooth restorable	Crown perforation, new caries (around margins); tooth restorable	Secondary caries, or new caries clinically or radiographically; tooth restorable
	Reversible pulpitis treated without requiring pulpotomy or extraction	Reversible pulpitis treated without requiring pulpotomy or extraction	Reversible pulpitis treated without requiring pulpotomy or extraction
"Major" failure	Irreversible pulpitis or dental abscess requiring pulpotomy or extraction; interradicular radiolucency	Irreversible pulpitis or dental abscess requiring pulpotomy or extraction; interradicular radiolucency; crown loss	Irreversible pulpitis or dental abscess requiring pulpectomy or extraction; interradicular radiolucency
	Tooth unrestorable; internal root resorption	Tooth unrestorable; internal root resorption	Tooth unrestorable; internal root resorption

Table 2: Distribution of the survival of the cases at 12 months among the three different groups

	Survival		*Failure*		*Total*	
Crown type	*Number*	*Percentage*	*Number*	*Percentage*	*Number*	*Percentage*
HT	37	**92.5**	03	07.5	40	33.3
NRCT	34	**85.0**	06	15.0	40	33.3
CR	28	**70.0**	12	30.0	40	33.4
Total	99	82.5	21	17.5	120	100
Intergroup analysis of survival at 12 months						
Chi-square value					**7.273**	
Degree of freedom					02	
p-value					**0.0263**	
Interpretation					Statistically significant	

Significance of bold value is $p < 0.05$

Table 3: Comparative assessment of success and failure rates of HT vs CR group at 12 months

Chi-square value	6.646
Degree of freedom	01
p-value	**0.009**
Interpretation	Statistically significant

Significance of bold value is $p < 0.05$

Table 4: Comparative assessment of success and failure rates of NRCT vs CR group at 12 months

Chi-square value	5.565
Degree of freedom	01
p-value	**0.006**
Interpretation	Statistically significant

Significance of bold value is $p < 0.05$

Table 5: Comparative assessment of success and failure rates of NRCT vs HT group at 12 months

Chi-square value	1.127
Degree of freedom	1
p-value	0.288
Interpretation	Not statistically significant

and professional time.[9] In an attempt to improve the outcomes, this study evaluated less invasive dental procedures that would be easier for young children to accept and adhere to.

To the best of our knowledge, this is the first study that compares NRCT in a randomized control trial and the first study that does so in an Indian community.

When compared to regularly placed SSCs in primary teeth, the HT showed a very high success rate (92. 5%). Additionally, this is in line with the outcomes of additional HT trials[10] and observational studies,[11,12] which found comparable efficacy rates. After 1 year, we found that in 5–8-year-old children, NRCT (85%), and CR (70%) had statistically and clinically lower success rates than HT. The null hypothesis that there are no differences in minor treatment failures across all therapies was thus rejected.

The conventional surgical approach to treating preexisting carious lesions has been tested by developments in the study of cariology, particularly in terms of understanding caries.[13] As in the case of the NRCT, nonoperative techniques such as biofilm destruction (toothbrushing) and remineralization (fluorides) can successfully manage cavitated carious lesions.[5,14,15] By use of

SDF solution,[16] or, as in the case of the HT, by sealing the carious lesion.[17] Although these treatments seem quite distinct from one another, they all aim to manage or arrest the carious lesion without removing the carious dentin tissue, which would weaken the pulp and endanger the tooth's structural integrity.

Primary molars with occlusal/proximal dentin caries were treated with NRCT. The majority of proximal lesions were "not cleansable" at the time of diagnosis; thus, the lesions were opened up to allow patients or carers to remove biofilm. Oral hygiene practices such as thorough brushing with fluoride toothpaste according to age and healthy eating habits were also advised. These results are comparable to the CR = 70% (p-value = 0.006), which involved complete caries removal and restoration implantation, despite the fact that the NRCT only had an 85% success rate. Since NRCT requires less dexterity than a more invasive conventional filling, dentists prefer it over the more invasive procedure.[5] However, a major challenge and specialized concept of competence for this technique is maintaining parents'/caregivers' motivation as the key individuals accountable for eliminating biofilm from the lesion and managing its progression. Recent prospective case studies evaluating the effectiveness of NRCT for the treatment of cavitated approximal carious lesions found that failures were mostly brought on by poor compliance with brushing lesions and/or the lesion/patient not being appropriate for this method.[18] Without a doubt, NRCT must be an essential part of a complete caries management approach that actively incorporates parents and carers. Two recommended tactics are counseling and motivational interviewing.[19,20] Clinicians can utilize it to help people change their habits for the better. These strategies are especially useful for controlling chronic diseases that are mostly preventable, such as dental caries, where behavior modification is critical and patient motivation is a common difficulty. There isn't a defined treatment plan for the NRCT that specifies how frequently follow-up appointments should be made. To allow for lesion activity monitoring and, if necessary, the installation of another treatment strategy, short-term recalls should be standardized depending on child/parent motivation, caries risk, and other considerations.

An annual application of a 38% SDF solution was found to be more effective in hardening or arresting dentin caries in upper anterior primary teeth that were easily cleansable than the application of a 5% sodium fluoride varnish at 3-month intervals or a placebo in a study carried out in China in 2002. In our study, 38% SDF was used for NRCT, and it was applied once.[21] The use of SDF in community-based programs without the goal of eliminating caries has the advantage of being simple and simple to get young children to participate well. In conclusion, NRCT and CR appear to have failure rates that are equivalent, with NRCT being less invasive and quicker and hence having some advantages over conventional fillings.

The HT has received a lot of attention recently, but some pediatric dentistry communities have been very critical of it as well. This technique eliminates the requirement for conventional caries removal and tooth preparation, a well-known, frequently used, and successful treatment with scant supporting data.[4,22] In addition, it raises questions regarding a more invasive method of treating primary molars that requires local anesthetic, extensive caries removal, and tooth preparation in order to place a stainless-steel crown.[10] Last but not least, the HT questions the entire surgical approach to treating carious lesions, which was formerly regarded as the "gold standard."

But this "aberrant" method, which does not entail tooth preparation, caries removal, or even the use of local anesthesia, has proven to be effective in treating carious primary molars and has a number of advantages over the conventional restorative approach. In this study, traditional restorations had a minor failure rate of 60%, primarily because of secondary caries, while HT had a failure rate of only 6% after 1 year. Similar findings from the first randomized controlled experiment on the HT, which evaluated its efficacy only against glass ionomer fillings, suggested that the HT had a high risk of failure.[3–24] After 23 months, the HT experienced fewer failures (minor = 5%, major = 2%) than the CR (minor = 46%, major = 15%),[8] and after a 5-year follow-up, similar success rates for HT (minor = 5%, major = 3%) against CR (minor = 42%, major = 17%)[17] were in our study.

A third of the fillings in the CR failed, which was a clinically significant failure rate. Similar results were seen after 2 years (33.3%) in a study that examined the clinical success of class II composite fillings in primary teeth.[25,26] The majority of the lesions in this group (including pain) were large cavities (ICDAS code 5; distinct cavity with visible dentin) but without any signs or symptoms of pulpal pathology.

In this study, the majority of failures (60.1%) were minor failures with unharmed pulp viability. Biological problems such as secondary caries (n = 12; 42.9%), restoration loss (n = 3; 10.7%), and fracture (n = 3; 10.7%) were present in the CR group but were unrelated to dentists or material performance.

There isn't a single best treatment for primary molars with carious lesions developing into dentin in terms of disease prevention and restorative longevity. There is no ideal course of action that ensures the tooth will remain symptom-free until it spontaneously exfoliates, is well-tolerated by patients, and does not put the child through any stress or discomfort.

Despite being complete in their own right, the three approaches we studied were empirically distinct in a variety of ways. Two single-component therapies were included in them—a surgical strategy including complete caries removal (CR group) and a less invasive strategy concentrating on controlling caries lesion by sealing the lesion (HT group). The third intervention, which was multidimensional and tried to stop the spread of lesions (NRCT group), included SDF therapy, parental behavior modification, and toothbrushing.

Despite these obvious differences, each therapy was considered a respectable substitute with the ability to help the tooth or the patient. It is frequently discovered that traditional restorative therapy is ineffectual,[20] time-consuming, difficult for kids,[7] etc. On the contrary, CR is a treatment option for noncleansable cavitated dentin carious lesions and when esthetics, function, or occlusion must be restored.[1] in children who cooperate. Instead, asymptomatic dentin carious lesions that can be transformed into cleansable lesions can be treated with NRCT. This approach has the power to naturally control caries development while defending tooth hard tissue and delaying the start of the restorative cycle.

Additionally, NRCT is popular with children, especially those who are uneasy, because it treats carious lesions while also allowing for the gradual introduction of therapeutic components.[5,20]These young children, on the contrary, are unable to perform adequate oral hygiene procedures on their own in order to improve their dental health. As a result, the key issue of this strategy is obtaining sufficient parental participation to minimize the lesion(s).[18] This depends on the clinician's ability to

motivate carers and youngsters to brush the lesion(s) and inspire them to do so.

On the contrary, the benefits of HT are widely established, including its high rate of clinical success, simplicity, and acceptance.[5,7] It is appealing for the treatment of (multisurface) carious primary molars, especially in young children with limited collaboration abilities. It also has the advantage of not requiring parental participation in oral home care, which makes it more cost-effective and appealing.[1] The main issue with the HT is that, like the CR, it masks the disease process and only treats a single tooth, with no impact on caries activity and risk at the patient level. This is in addition to the potential esthetic challenges of using an SSC to restore a tooth that has already sustained damage. Based on the current understanding of caries etiology, development, and therapy, caries control must primarily concentrate on behavior modification and biofilm management to prevent caries disease symptoms at the macroscopic level and to slow down lesion progression once it becomes obvious.[1,2]

Conclusion

The following conclusions can be drawn based on the findings of the above study:

- When compared to traditional restoration, caries management options like the HT and NRCT, which focus on reducing biofilm on primary molars, showed promising results.
- Hall technique (HT) and NRCT are viable options that can be used in mild to moderate, occlusal, and proximal carious lesions.
- To evaluate how well HT and NRCT perform in broadening the spectrum of pediatric restorative dentistry, long-term studies are required.

Why is this article important to pediatric dentists?

- For a treatment to be successful, accurate caries and pulpal diagnosis, skillful patient care, and exceptional parental involvement in their children's toothbrushing are essential requirements.
- All factors of the tooth, patient, and family should be taken into account when determining if a restoration, lesion sealing, or lesion inactivation without caries removal is necessary and/or advantageous for the patient.
- Parents and other carers must be encouraged and persuaded that their efforts will benefit their child's oral health in the future, regardless of the treatment option chosen at the tooth level, through education that includes instruction in the removal of plaque using fluoride-containing toothpaste.
- Create awareness of available biologic restoration.
- Management of anxious and young patients without local anesthesia can be done.

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References

1. Schwendicke F, Frencken JE, Bjørndal L, et al. Managing carious lesions: consensus recommendations on carious tissue removal. Adv Dent Res 2016;28(2):58–67. DOI: 10.1177/0022034516639271
2. Kidd E, Fejerskov O. Changing concepts in cariology: forty years on. Dent Update 2013;40(4):277–286, 280–282, 285–286. DOI: 10.12968/denu.2013.40.4.277
3. BaniHani A, Duggal M, Toumba J, et al. Outcomes of the conventional and biological treatment approaches for the management of caries in the primary dentition. Int J Paediatr Dent 2018;28(1):12–22. DOI: 10.1111/ipd.12314
4. Managing carious lesions; consensus recommendations on terminology. Br Dent J 2016;220(10):514. DOI: 10.1038/sj.bdj.2016.372
5. Santamaria RM, Innes NP, Machiulskiene V, et al. Acceptability of different caries management methods for primary molars in a RCT. Int J Paediatr Dent 2015;25(1):9–17. DOI: 10.1111/ipd.12097
6. Manual AU. The Hall Technique A minimal intervention, child centred approach to managing the carious primary molar University of Dundee.
7. Horst JA, Ellenikiotis H, Milgrom PL. UCSF Silver Caries Arrest Committee. UCSF protocol for caries arrest using silver diamine fluoride: rationale, indications, and consent. J Calif Dent Assoc 2016;44(1):16–28.
8. Innes NP, Evans DJ, Stirrups DR. The hall technique; a randomized controlled clinical trial of a novel method of managing carious primary molars in general dental practice: acceptability of the technique and outcomes at 23 months. BMC Oral Health 2007;7:18. DOI: 10.1186/1472-6831-7-18
9. Jameson K, Averley PA, Shackley P, et al. A comparison of the "cost per child treated" at a primary care-based sedation referral service, compared to a general anaesthetic in hospital. Br Dent J 2007;203(6):E13. DOI: 10.1038/bdj.2007.631
10. Innes NP, Ricketts D, Chong LY, et al. Preformed crowns for decayed primary molar teeth. Cochrane Database Syst Rev 2015;2015(12):CD005512. DOI: 10.1002/14651858.CD005512.pub3.
11. Schüler IM, Hiller M, Roloff T, et al. Clinical success of stainless steel crowns placed under general anaesthesia in primary molars: An observational follow up study. J Dent 2014;42(11):1396–1403. DOI: 10.1016/j.jdent.2014.06.009
12. Randall RC. Preformed metal crowns for primary and permanent molar teeth: review of the literature. Pediatr Dent 2002;24(5):489–500.
13. Ricketts D, Lamont T, Innes NP, et al. Operative caries management in adults and children. Cochrane Database Syst Rev 2013;(3):CD003808. DOI: 10.1002/14651858.CD003808.pub3
14. Gruythuysen RJM. Niet-restauratieve caviteitsbehandeling. Cariës activiteit beteugelen in plaats van maskeren. Ned TijdschrTandheelkd 2010;117(3):173–180.
15. Mijan M, de Amorim RG, Leal SC, et al. The 3.5-year survival rates of primary molars treated according to three treatment protocols: a controlled clinical trial. Clin Oral Investig 2014;18(4):1061–1069. DOI: 10.1007/s00784-013-1077-1
16. Chu CH, Lo EC. Promoting caries arrest in children with silver diamine fluoride: a review. Oral Health Prev Dent 2008;6(4):315–321.
17. Innes NP, Evans DJ, Stirrups DR. Sealing caries in primary molars: randomized control trial, 5-year results. J Dent Res 2011;90(12):1405–1410. DOI: 10.1177/0022034511422064
18. Hansen NV, Nyvad B. Non-operative control of cavitated approximal caries lesions in primary molars: a prospective evaluation of cases. J Oral Rehabil 2017;44(7):537–544.
19. Rollnick S, Miller WR, Butler C. *Motivational interviewing in health care: helping patients change behavior*. 2nd ed. Guilford Press; 2008.
20. Kidd E. Should deciduous teeth be restored? reflections of a cariologist. Dent Update 2012;39(3):159–162, 165–166. DOI: 10.12968/denu.2012.39.3.159
21. Chu CH, Lo EC, Lin HC. Effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentin caries in Chinese pre-school children. J Dent Res 2002;81(11):767–770. DOI: 10.1177/0810767
22. Nainar SMH. Success of Hall Technique Crowns Questioned.:1.
23. Chadwick BL, Evans DJ. Restoration of class II cavities in primary molar teeth with conventional and resin modified glass ionomer

cements: a systematic review of the literature. Eur Arch Paediatr Dent 2007;8(1):14–21. DOI: 10.1007/BF03262565
24. Qvist V, Laurberg L, Poulsen A, et al. Class II restorations in primary teeth: 7-year study on three resin-modified glass ionomer cements and a compomer. Eur J Oral Sci 2004;112(2):188–196. DOI: 10.1111/j.1600-0722.2004.00117.x
25. Qvist V, Manscher E, Teglers PT. Resin-modified and conventional glass ionomer restorations in primary teeth: 8-year results. J Dent 2004;32(4):285–294. DOI: 10.1111/j.1600-0722.2004.00117.x
26. Wotman - 2007 - Recurrence of Early. Childhood Caries after Compreh. pdf.