



**ORIGINAL RESEARCH PAPER**

**Paediatric Dentistry**

**HALL TECHNIQUE AND MODIFIED HALL TECHNIQUE IN PEDIATRIC DENTISTRY; A LITERATURE REVIEW**

**KEY WORDS:**

**Dr. Sachin Tomar** Post Graduate Student

**Dr. Seema Thakur** Professor & Head of the Department

**ABSTRACT**

The high frequency of caries in primary teeth and its inadequate treatment are major public health problems during childhood. The common challenge for clinicians and parents is to allow children to experience dental treatment in an atmosphere created to empower the child and maximise their ability to cooperate with, and accept treatment. So, More conservative techniques for managing dental caries including 'partial' and 'no caries removal' have been increasingly of interest. If left unmanaged, dental caries will lead to tooth pain, discomfort, eating impairment, loss of tooth, and delayed language development in children. Nowadays, the Hall technique is one of the methods used for biological sealing in carious lesions in primary molars. Thus, the bacteria will be sealed from oral environment and the caries will be inactive. The purpose of this review is to discuss about the use of stainless steel crown to restore multi surface carious lesion by hall technique and modified hall technique.

**INTRODUCTION**

Dental caries is a biofilm-mediated, sugar-driven, multifactorial, dynamic disease that results in the phasic demineralization and remineralization of dental hard tissues. Caries can occur throughout life, both in primary and permanent dentitions, and can damage the tooth crown. It is one of the most prevalent diseases worldwide and is a most common cause of tooth loss in any geographic location.<sup>(1)</sup> Though, universally found, it tends to go untreated in underserved communities in both developing and industrialised countries.<sup>(2)</sup>

Various therapeutic approaches and materials for restoring primary teeth have continuously been used by dentists all over the world.<sup>(3)</sup> Traditional methods of managing carious primary molars in children through conventional approaches, include restoration with amalgam, composite resin, compomer, glass ionomer, and stainless steel crowns (SSCs) using conventional tooth preparation or extraction.<sup>(4)</sup>

Conventional approach involve the complete removal of carious tooth tissue followed by placement of a restoration, which entail the use of high speed handpiece and burs and it undoubtedly improved the speed and efficiency of cavity preparation but has many inevitable disadvantages, such as perception of unpleasantness by the patients, use of local anesthesia, rubber dam use, deleterious thermal effects, pressure effects on the pulp and this required removal of healthy dentin to attain definite retention and resistance form for restorative cements to adhere to cavity walls, resulting in an excessive loss of sound tooth structure.

Due to these major shortcomings of conventional methods of carious tooth restoration, this technique is highly unlikely to be widely used outside specialist settings and is unlikely to be incorporated in routine care of deprived children from developing countries. Ideally procedure for managing caries should be easier for child to cope up, quicker to complete, relatively non invasive and not preferably requiring local anaesthetic.

Therefore, Non-invasive approaches(NIA) like atraumatic restorative treatment(ART) and Hall technique(HT) are preferred by many dentist to treat carious lesion in pediatric patients. The essential aspects in the management of caries including both preventive strategy as well as the restorative step is fulfilled by ART and HT.

This review will primarily focus on the management of multi surface carious lesion in primary molars by stainless steel

crown placed by Hall and modified Hall technique in paediatric dentistry.

**MATERIALS AND METHODS**

Electronic databases, "Cochrane Database", "PubMed", "Science Direct", and "Google Scholar", were searched to identify relevant studies published in the period from 1991 to 2020. Abstracts and full texts were explored to identify studies that described the Hall technique and its indication, contraindication, advantages, disadvantages, success, and failure in pediatric dentistry.

**Atraumatic restorative treatment**

ART was developed around 1985 by Dr. Jo Frencken mainly for treating caries in children living in under-served areas of the world where resources are limited. ART is defined as a minimally invasive care approach in preventing dental caries and stopping its further progression. It consists of two components: sealing caries-prone pits and fissures and restoring cavitated dentin lesions with sealant-restorations.<sup>(5)</sup> The placement of an ART sealant involves the application of a high-viscosity glass ionomer that is pushed into the pits and fissures under finger pressure. An ART restoration involves the creation of sufficient access to the cavity for the removal of soft, completely demineralised (decomposed) carious tooth tissues with hand instruments. This is followed by restoration of the cavity with an adhesive dental material which simultaneously seals any remaining pits and fissures that remain at risk. ART is a painless procedure, and there is no need for local anaesthesia. However, when using ART to treat multiple surface caries, there is an increased risk of restoration failure as well as a higher risk of secondary caries developing in the treated tooth.<sup>(6)</sup>

**Preformed stainless steel crowns**

Placement of a preformed stainless steel crown is intended to provide a more coverage and durable restoration than a conventional restoration. Preformed metal crowns (PMCs) for primary molar teeth were first described in 1950 by Engel, followed by Humphrey in the same year. Preformed metal crowns are chosen for treating multiple surface carious lesions in primary teeth. Since its introduction, many design modifications have simplified the fitting procedure and improved the morphology of the crown so that it duplicates more accurately the anatomy of primary molar teeth. The morphology of a primary molar tooth differs significantly from its permanent successor, in part by having its greatest convexity at the cervical third of the crown. The thin metal of the preformed crown margin is flexible enough to spring into and be retained by this undercut area.<sup>(8,9)</sup> The enamel and

dentin of the primary molar crown are proportionally much thinner than in the permanent tooth and are relatively susceptible to caries attack.

By separating the tooth from the oral environment, preformed stainless steel crowns protect it from cariogenic microorganisms. As a result, the chances of developing secondary caries are lowered.<sup>(10)</sup> The placement of stainless steel crowns, on the other hand, demands healthy tooth cutting for crown preparation in order to adapt the crown to the tooth surface, weakening the remaining tooth structure. As a result, the Hall technique is widely used to treat multi surface carious lesions in order to reap the benefits of stainless steel crowns while avoiding the disadvantages of crown cutting.

**Hall technique**

The Hall technique using preformed metal crowns (PMCs) was first introduced in the literature in 2006 by Dr. Norna Hall, a general dentist from Scotland. The Hall Technique is a method for using preformed metal (also known as stainless steel) crowns to manage carious primary molar teeth, by seating a correctly sized crown over the tooth and sealing the carious lesion in, using a glass ionomer luting cement. Local anaesthesia is not required, tooth preparation is not carried out, and no carious tissue is removed.<sup>(11)</sup>

When a carious lesion is sealed with in the tooth with the crown placement, the biofilm (the community of microorganisms, their products, and the extracellular polymeric matrix) is physically deprived of nourishment from its main substrate, dietary carbohydrate. This indicates that the cariogenic lesion is no longer active. The dental pulp lays down reparative dentine, effectively retreating in response to the advancing carious lesion. By sealing in the carious lesion, equilibrium shifts in favour of the pulp, with the aim of arresting the lesion before it advances far enough to cause irreversible inflammation of the dental pulp.

There are many ways of controlling the demineralisation process, including (but not limited to): removing the biofilm; increasing saliva (quantity and mineralisation potential); adding fluoride; reducing sugar frequency through diet change; and, also, physically blocking cariogenic biofilm from its substrate.<sup>(12)</sup>

Furthermore, SSCs placed using Hall Technique are extremely durable, typically lasting the lifetime of the restored primary molar, subject to low technique sensitivity, and the crowned molars benefit from complete coronal coverage, lowering the risk of further carious lesion development or structural weakening. The goal of this technique is to promote the child's compliance and the operator's comfort. Apart from caries sealing, the child would have a less stressful dental experience in his early childhood and would be more inclined to return for more complex treatment in the future.<sup>(13)</sup>

**Methodology of Hall technique**

**Selection criteria for hall technique :-**

**Clinical Inclusion Criteria**

1. Cooperative children (according to Frankl behavior rating scale, ratings 3 - positive and 4- definitely positive) [Wright, 2000]
2. Primary molar having no clinical signs or symptoms of pulpal or peri radicular pathology.
3. Primary molar having sufficient sound tissue left to retain the crown.
4. Primary molar with carious lesion involving 2 or more surface.
5. Primary molar with occlusal caries, either cavitated or non cavitated if the patient is unable to accept fissure sealant, partial caries removal or conventional restoration.

6. Primary molar with proximal caries, either cavitated or non cavitated if the patient is unable to accept fissure sealant, partial caries removal or conventional restoration.

**Radiographic Inclusion Criteria**

1. Primary molars having 2/3<sup>rd</sup> of root length intact on radiographic examination.
2. Primary molars having healthy layer of dentin present which is radiographically visible.
3. Primary molars having no radiographic signs of abscess or sinus formation.
4. Primary molars with no pulpal and peri radicular radiolucency.

**Clinical Exclusion Criteria**

1. The patients who are known to be sensitive or allergic to nickel.
2. Primary molars having signs or symptoms of irreversible pulpitis or pulpal necrosis.
3. Primary molars are so broken down, they would be unrestorable with stainless steel crown.
4. Children where airway cannot be managed safely.
5. Primary molars having signs of abscess or sinus formation.
6. Patient having chronic medical conditions requiring long-term specialist care e.g. immunocompromised, cardiovascular and bleeding disorders

**Radiographic Exclusion Criteria**

1. Primary molars having caries extending into pulp on radiographic examination.
2. Primary molars having furcation involvement on radiographic examination.
3. Primary molars having peri radicular radiolucency.
4. Primary molars without 2/3<sup>rd</sup> of root length intact on radiographic examination.

**Procedure**

As per the protocol given by Innes NP et al.<sup>(14)</sup> orthodontic separators were placed during the first visit. This was done after assessing the tooth shape, contact points/areas and the occlusion. The use of orthodontic separators creates space for fitting a Hall crown. In order to protect the airway, the child must be sitting upright. Two lengths of dental floss were threaded through the separator. Then the separator was stretched and floss taught through the contact point briskly and firmly until the leading edge is only felt "popping through" the contact point. The floss is then removed and the patient was recalled after three to five days for the second appointment.

In the second visit, the separator was removed with an excavator. Any loose plaque and food debris was gently removed from the cavity. The child's occlusion was assessed by measuring OVD with a millimeter probe using the distance between the most coronal points of the primary canines. This was done in order to assess the degree of overbite after mounting of the crown. The airway was protected by placing a gauze swab square between the tongue and the tooth to be crowned. The correct crown size was selected with the aim to fit the smallest size of crown which will seat so that it covers all the cusps and approaches the contact points, with a slight feeling of "spring back."

The treatment area was kept free from saliva by isolating the tooth with cotton wool rolls. Then, the inside of the crown was dried with dry cotton pellets. The GIC Fuji I was mixed for 10 seconds, according to the manufacturer's instructions and the crown was generously loaded with GIC (at least two-thirds full). Then the crown was placed over the tooth and seated by finger pressure or by asking the child to bite it into place. Then the crown position was checked, soon after it was fitted. Any excess GIC was wiped away with a cotton wool roll or the

gauze swab used to protect the airway. A cotton wool roll was placed between the crown and the opposing tooth and the child was asked to bite firmly on the crown for another two to three minutes. The excess cement was removed by flossing between the contacts.<sup>(15)</sup>

The buccal relationship of the crowned tooth with its opposing number was noted and if any displacing contact seen, resulting in a cross bite, then removal of entire crown was considered.

**TABLE 1 CLINICAL CRITERIA (INNES et al)<sup>(11)</sup>**

Score	Outcome criteria	Description
1.	Success	-Crown present and appears satisfactory: No intervention is required during follow up. -No clinical signs and symptoms of pulpal pathology occurred.
2.	Minor failure	-New progressive caries, crown perforation, crown loss, but tooth is restorable. -Signs and symptoms of reversible pulpitis (no spontaneous pain)
3.	Major failure	-Signs and symptoms of Irreversible pulpitis (history of spontaneous pain or pain caused by thermal or other stimuli) or dental abscess requiring pulpectomy or extraction. -Crown loss and tooth is unrestorable.

**TABLE 2 RADIOGRAPHIC CRITERIA (INNES et al)<sup>(11)</sup>**

Score	Outcome criteria	Description
1.	Success	- No radiographic signs of pulp and peri-radicular pathology occurred.
2.	Minor failure	- Radiographic signs of new progressive caries -No signs of pupal involvement.
3.	Major failure	- Radiographic Signs of pulp and peri- radicular pathology.

**Modified Hall technique**

Recent modification of hall technique which is intended to improve stainless steel crown longevity. It involves selective removal of carious tooth structure followed by sealing with a prefabricated stainless steel crown without any tooth surface reduction followed by proximal slicing and there is no use of separating elastics in this method. However, caries removal is only confined to the infected dentin, leaving the affected dentin behind, and remaining procedure of placement of crown is similar to standard hall technique.<sup>(16)</sup>

**Concerns regarding hall technique**

- The technique is time consuming, as orthodontic separators are needed, which indicates an additional visit. It does not include occlusal preparation before cementation of the crown. This could lead to premature contacts after crown cementation and increase occlusal vertical dimensions (OVDs). However, adequate occlusal contacts are re-established at the recall visit after 1 year.<sup>(17)</sup>
- Because PMCs are fitted without occlusal tooth preparation, the occlusion might be temporarily opened. However, according to Innes et al., the occlusion would be adequately balanced by the next recall and no patient demonstrated tempo-mandibular-joint (TMJ) problems.<sup>(11)</sup>
- A prospective clinical trial by Innes et al. in a general dental practice also confirmed that the Hall technique would be correlated with premature contacts after the

cementation of crowns and elevations in occlusal vertical dimensions (OVDs). Using the Hall technique on second primary molars can cause slightly more of an increase in OVDs compared to that on first primary molar. Results showed that at one-year-recall, even occlusal contacts were re-established in all cases.

- According to Innes et al., the occlusion equilibrates rapidly, usually within few weeks.<sup>(11)</sup> Though it is better to follow up the child two weeks following placement of the crown to evaluate the occlusion, it was not possible due to the limitations of the general dental practice setting. Forming a perfect research design within the general dental practice environment was considered one of the research challenges.

**CONCLUSION**

The Hall technique and modified hall technique can be an effective addition to the clinician's range of treatment options for the carious primary molar. It is strongly supported that crowns placed by the Hall Technique treatment option have promising results, showing high acceptability and longevity; and low failure rate for managing carious primary molars compared to conventional treatment options commonly applied in primary care settings. Both the technique considered as one of the effective restorative treatment for restoring carious primary molars.

**REFERENCES**

1. Veiga N, Aires D, Douglas F, Periera M, Vaz A, Rama L et al. Dental caries: a review. *J Dent Oral Health.* 2016;2(5):01-03.
2. Lopez N, Simpsen-Rafalin S, Berthold P. Atraumatic restorative treatment for prevention and treatment of caries in an underserved community. *Am J Public Health.* 2005;95(8):1338-39.
3. Roberts JF, Attari N, Sherriff M. The survival of resin modified glass ionomer and stainless steel crown restorations in primary molars, placed in a specialist paediatric dental practice. *Br Dent J.* 2005;198(7):427-31.
4. Gao S, Zhao I., Hiraishi N., Duangthip D., Mei M., Lo E., Chu C. Clinical Trials of Silver Diamine Fluoride in Arresting Caries among Children: A Systematic Review. *JDR Clin. Trans. Res.* 2016;1:201-210.
5. Frencken JE. The state.of.the.art of ART restorations. *Dental Update* 2014;14:218-24.
6. Frencken JE, Holmgren CJ. Atraumatic restorative treatment for dental caries. Nijmegen: STI book b.v; 1999.
7. Raggio D P, Hesse D, Lenzi T L, Guglielmi C A, Braga M M . Is atraumatic restorative treatment an option for restoring occlusoproximal caries lesions in primary teeth? A systematic review and meta-analysis. *Int J Paediatr Dent* 2013;23:435-443.
8. Duggal MS, Curzon M, Fayle SA, Toumba KJ, Robertson AJ. Stainless steel crowns for primary molars. In: Robertson AJ, editor. *Robertsons Restorative Techniques in Pediatric Dentistry.* 2<sup>nd</sup> ed. London: Informa Health Care; 2002. p. 75-94.
9. Santamaria RM, Pawlowitz L, Schmoeckel J, Alkilyz M, Splieth CH. Use of stainless steel crowns to restore primary molars in Germany: Questionnaire-based cross-sectional analysis. *Int J Paediatr Dent.* 2018;28(6):587-594.
10. Full CA, Walker JD, Pinkham JR. Stainless steel crowns for deciduous molars. *J Am Dent Assoc* 1974;89:360-4.
11. Innes NP, Stirrups DR, Evans DJ, Hall N, Leggate M: A novel technique using pre-formed metal crowns for managing carious primary molars in general practice- a retrospective analysis. *Br Dent J* 2006;200:451-454, discussion 444.
12. Fejerskov O, Nyvad B, Kidd E A M. Dental caries: the disease and its clinical management. Chichester Ames, Iowa: John Wiley & Sons Inc., 2015.
13. Clark W D, Geneser M K, Owais A I, Kanellis M J, Qian F. Success Rates of Hall Technique Crowns in Primary Molars: A Retrospective Pilot Study. *J Dent Res* 2016;93:1430.
14. Innes NP, Evans D, Stewart M, Keightley A. The Hall technique: a minimal intervention, child centred approach to managing the carious primary molar. *A Users Manual, Version 4,* 2015.
15. Lakshmi, Siragam & Sahana, Suzan & Vasa, Aron & Ghana Shyam Prasad, Madu & Bezawada, Sushma & Deepika, Mamidi. (2018). Atraumatic Restorative Treatment vs. Hall Technique for Occlusoproximal Lesions in Primary Dentition-An In vivo Study. *Journal of Clinical and Diagnostic Research.* 12. ZC09-ZC13. 10.7860/JCDR/2018/29576.11186.
16. Midani R, Splieth CH, Mustafa Ali M, Schmoeckel J, Mourad SM, Santamaria RM. Success rates of preformed metal crowns placed with the modified and standard hall technique in a paediatric dentistry setting. *Int J Paediatr Dent.* 2019 Sep;29(5):550-556.
17. Rosenblatt A. The Hall technique is an effective treatment option for carious primary molar teeth. *Evid.-Based Dent.* 2008;9:44-45. doi: 10.1038/sj.ebd.6400579.