

The Survival Rate of the Vital Primary Molars when Restored with Stainless Steel Crowns - A Systematic Review

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Abstract

Aim: This systematic review aimed to provide an updated search on the vital primary molars' survival rate when restored with stainless steel crowns (SSC).

Methodology: A meticulous database search was conducted with mesh terms equivalent to PICO format in Pubmed, Cochrane library and Ovid SP. The exploration period was from January 1991-January 2020 and the search was restricted to only the English language. The first search was conducted to retrieve articles from the electronic database and additional data from hand searches. The second search was done to retrieve related articles from abstracts. In the last quest, full-text articles were observed for eligibility.

Results: Of all the searched articles initially, 72 articles from Pubmed and 19 from Cochrane, and three from hand search were selected. After reading abstracts from those articles, 22 from the Pubmed, eight from the Cochrane, and three from the hand search articles were selected. On removing the duplicated articles, ten articles were selected from all total search bases.

Conclusion: Stainless Steel Crowns are the best choice for extensive lesions of primary molars in high caries risk children when the restoration is performed as early as in primary or early mixed dentition. The survival rate of primary molars was high when restored with stainless steel crowns with an expected survival rate of up to 10 years.

Keywords: Children; Hall Technique; Stainless Steel Crowns; Survival Rate; Vital Primary Molars

Introduction

Dental caries in primary teeth are well thought-out the most frequent oral disease of childhood and deliberated in different countries. The prevalence of early childhood caries (ECC) in most developed countries is stuck between 1% and 12%. Nevertheless, in developed countries it is reaching 70% [1]. customary methods of controlling carious primary molars in children comprise of restoration with amalgam, composite resin, compomer, glass ionomer, as well as stainless steel crowns (SSCs) using conventional tooth preparation or extraction. In recent times, silver diamine fluoride (SDF) was worn as a non-invasive treatment alternative [2].

The majority of the methods for management of carious primary molars are completed in secondary care settings or specialists in private clinics. Restorations conceded by general dental practitioners (GDPs) showed less potential results. The high rate of recurrence of caries in primary teeth and its insufficient treatment are measured a significant public health problem all through childhood and could drastically influence children’s life. By the age of eight years old, this proportion amplified to 42%. In addition, many children have to concur to dental pain and attended the general dental practitioners’ clinics for the treatment [2].

Preformed metal crowns (PMCs) are recommended as the most favourable treatment for management of primary molars where caries include two or more surfaces. It is eminent that the pulp-to-crown ratio in primary posterior teeth is big than the proportion of permanent molars, most important to a reduced degree of pulpal protection. Hence, selective caries removal, such as indirect pulp capping, was leaving a layer of carious dentine near the pulp under the restoration or leaving carious dentine under the crown (the Hall technique), helps to safeguard the vital pulp [2]. This systematic review aimed to provide an updated search on the vital primary molar’s survival rate when restored with stainless steel crowns.

Materials and Methods

Research question: What is the survival rate of vital primary molars when restored with stainless steel crowns?

Literature search

A comprehensive and systematic search was carried out using mesh terms equivalent to PICO format in Pubmed, Cochrane library and Ovid SP. The search was limited to January 1991 - January 2020 along with electronic databases, hand searches based on cross-references, citations of relevant articles were also collected. Two researches were participated in the search process and evaluation of retrieved articles. Abstracts and full texts were explored to recognize studies that described the vital primary molar’s survival rate when restored with stainless steel crowns characteristics of PICO format, Mesh terms and alternative terms were represented in **table 1**.

PICO	Population	Intervention	Comparison	Outcome
Characteristics considered	Primary molars	Stainless steel crown	-	Survival rate
Mesh terms	Primary molars, Deciduous molars, Vital teeth,	Stainless steel crowns, SSC, Preformed metal crowns, PMC		Survival rate, maintenance rate, treatment outcome

Table 1: Mesh terms and alternative terms enclosed in a search strategy.

Inclusion criteria

- Articles were published in the English language during January 1991 - January 2020.
- Randomized control trials of survival rate of vital primary molars restored with stainless steel crowns.

Exclusion criteria

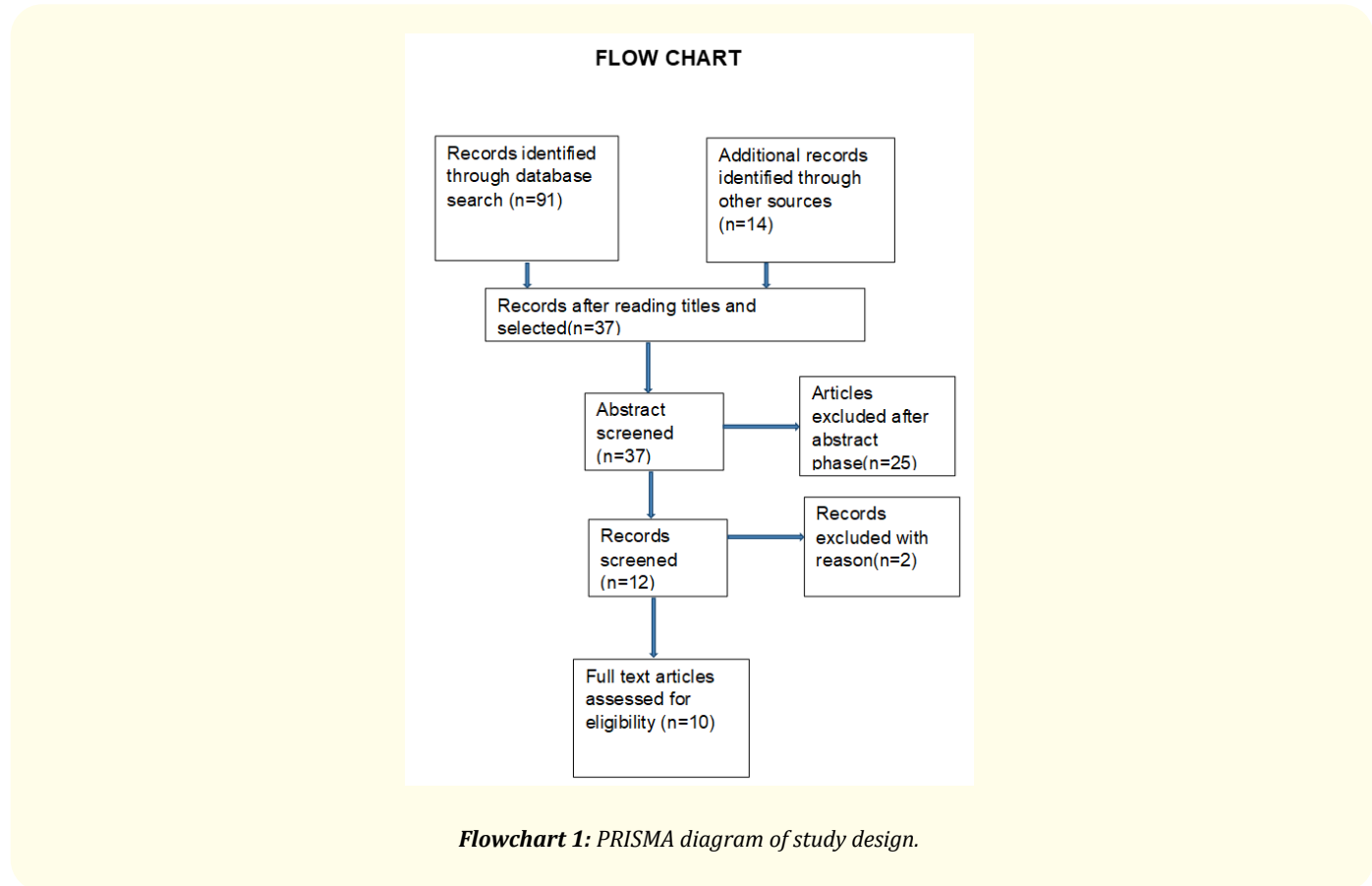
- Articles published in languages other than English,
- Case reports/series,

- Teeth involving pulp,
- Cross-sectional/questionnaire studies, retrospective studies,
- Systematic reviews and *in-vitro* studies, narrative reviews,
- Animal studies, letter to the editor, conference abstracts and review articles.

Research protocol

The search period was from January 1991 - January 2020 and the search was confined to the English language. The first search was conducted to retrieve articles from the electronic database and additional data from hand searches. The second search was done to retrieve related articles from abstracts. In the last search, full-text articles were assessed for eligibility. Finally, articles that met the criteria, such as clinical trials on the survival rate of vital primary molars, were included for the systematic review’s qualitative analysis. Intra and inter-examiner reliability was checked by using kappa statistics ($k = 0.8$).

The titles and abstracts of all reports identified through the electronic searches were evaluated independently by authors. Studies that appear to meet inclusion criteria and studies with insufficient or partial information at the title and abstract stage were included for a full-text review in four databases separately (PubMed, Cochrane, Ovid SP and EBSCOhost). Duplicates were excluded. The systematic review was reported adhering to the preferred reporting items for systematic review and meta-analysis protocols (PRISMAP) statement [3] (Flowchart 1).



Flowchart 1: PRISMA diagram of study design.

Results

Of all the searched articles initially, 72 articles from Pubmed and 19 from Cochrane, and three from hand search were selected. After reading abstracts from articles 22 from Pubmed, eight from Cochrane and three from the hand search articles were selected. On removing the duplicated articles, ten articles were selected from all total search bases.

Risk of bias

The Cochrane Collaboration’s tool was used for assessing the risk of bias [3].

	Randomization	Allocation concealment	Blinding	Attrition Bias	Reporting bias	Other bias
Anastasios, <i>et al.</i> (1994) [4]						
Einwag, <i>et al.</i> (1996) [5]						
Innes, <i>et al.</i> (2007) [6]						
Innes, <i>et al.</i> (2011) [7]						
Santamaria, <i>et al.</i> (2014) [8]						
Innes, <i>et al.</i> (2015) [9]						
Santamaria, <i>et al.</i> (2017) [10]						
Boyd, <i>et al.</i> (2018) [11]						
Tseveenjav, <i>et al.</i> (2018) [12]						
Kevin J Donly, <i>et al.</i> (2018) [13]						

Table 2: Assessing the risk of bias of included articles according to the Cochrane collaboration’s tool.

Author (year)	Judged risk
Anastasios, <i>et al.</i> (1994) [4]	Low risk
Einwag, <i>et al.</i> (1996) [5]	High risk
Innes, <i>et al.</i> (2007) [6]	Low risk
Innes, <i>et al.</i> (2011) [7]	Low risk
Santamaria, <i>et al.</i> (2014) [8]	Low risk
Innes, <i>et al.</i> (2015) [9]	Low risk
Santamaria, <i>et al.</i> (2017) [10]	Low risk
Boyd, <i>et al.</i> (2018) [11]	High risk
Tseveenjav, <i>et al.</i> (2018) [12]	Low risk
Kevin J Donly, <i>et al.</i> (2018) [13]	Low risk

Table 3: Judged risk of bias for included articles.

Discussion

Dental caries is one of the most widespread chronic conditions regardless of age. Extensively decayed teeth hurt children’s mental, physical and social well-being and quality of life [11]. Based on the existing knowledge on caries etiology, development and therapy, caries control should be principally focus on behavior change and biofilm executive to prevent caries disease manifestations at the macroscopic level and deliberate down lesion development apparent. Consequently, independent of treatment choice at the tooth level, hard work have to be made to educate parents/carers, with training in plaque removal by means of a fluoride-containing toothpaste and encourage them that their efforts will give to their child’s oral health in the extended term [9].

PMCs are suggested as of their cost-effectiveness, simplicity of placement and durability. PMCs were the mainly ideal material for primary molars or children with special health care needs. Even though PMCs are long-lasting, comparatively inexpensive, subject to minimal technique sensitivity and cemented with biocompatible luting agent, the placement seems to be not a practice for General Dentist [11]. To rendezvous, there is no single perfect therapy for managing primary molars with carious lesions extending into dentine, for restoration longevity.

The ultimate treatment option that would assurance the tooth would remain symptomless until it exfoliated naturally and that would be acceptable to patients causing the child no stressor. On the other hand, the well-known advantage of the HT including its high clinical success rate, easiness of use, receiving, and cost-effectiveness etc., create it striking for treatment of carious deciduous molars, mainly for young children, with restricted cooperative abilities and has the added benefit of being independent of parental attachment, in oral home care. There were no statistically or clinically pertinent differences in the failures among the NRCT and CRs with the majority caries progression going on within the first year after treatment, and due to recurrent caries [9].

Innes, *et al.* (2007) [5] reported that for the period of 0 to 36 months, significant failures were 19 Control restoration and three for Hall PMCs (mean time for first failure was seventeen months; range was between 3 - 31 months; median is seventeen months). Minor failures were 57 Control restoration and six Hall PMCs (mean time to first failure - 18 months; range - six to 29 months; median - 18 months). The survival rate of vital primary molars was 36 months.

Innes, *et al.* (2011) [6] reported that in a 48-month minimum follow-up, 92% success rate in Hall technique with Three 'Major' failures (3%) were in the Hall Technique arm, with failure at 3, 17 and 31 months and 4 'Minor' failures in the Hall technique arm (5%), ranging from 3 - 31 months, mean 17.6 months. The mean survival rate of primary molars was 17.6 months. In comparison, the durability of GDPs' control restorations was deprived. Sequential screening of all potentially suitable patients was not a requisite, and this may have introduced a degree of selection bias. Nonetheless, this was the first RCT in general dental practice in Scotland relating a novel intervention. This meant outstanding a balance between methodological integrity and generalizability.

Santamaria, *et al.* (2014) [7] showed that after a minimum of 11 months, 87.6% participants returned for follow-up (CR: n = 56 of 65, 86%; HT: n = 44 of 52, 85%; NRCT: n = 48 of 52, 92%) and there was no statistical difference amid arm allocation ($p = .47$). Minor failures were CR = 7%, NRCT = 5%, HT = 1% ($p = .002$, 95% CI = 0.001 to 0.003) with no major failures in the HT arm ($p = .002$, 95% CI = 0.001 to 0.003). The survival rate of primary molars was 15 months. This highest success rate may be due to crown durability give absolute isolation of the plaque biofilm from the oral environment, slowing the lesion progression.

Innes, *et al.* (2015) [8] showed that in Phase 1 and Phase 2 data pooled (n = 193 teeth), 96 CR, 97 HT in 101 participants, 50% CR teeth and 91% HT teeth effectively exfoliated over the lifetime of the teeth. In the HT arm, two of the initial major failures occurred in Phase 1. There were two major failures in the HT arm that occurred later (41 and 86 months). All of the initial minor failures in the CR and HT arms seen during Phase 1 of the trial. Nevertheless, there was one more minor failure observed in the CR (at 49 months) in a tooth that, at the end of Phase 1, had already skilled minor failures on four occasions (12, 20, 26 and 35 months). Therefore, showing a mean survival rate of primary molars was 49 months.

Santamaria, *et al.* (2017) [9] concluded that the overall cumulative survival rates were 92.5% for the HT, 70.5% for the NRCT, and 67.2% for CR, with statistically significant differences between the arms ($p = 0.012$). In this study, after 2.5 years, only 3 teeth with the HT presented a failure (2 minor failures = 5% and only 1 major failure = 3%), whilst the conventional restorations exhibited a 24% minor failure rate, mostly due to secondary caries and a higher rate with major problems of irreversible pulpitis or abscess (9%). The majority of failures were minor failures (73.7%) with pulp vitality preserved. Consequently, showing the mean survival rate of vital primary molars was 2.5 years. Even the parental participation in the 3 arms was pretty different, with participants attending every 3 months for follow-up in the NRCT arm to participants who only came for an annual assessment. in spite of these fundamental differences, each treatment was well thought-out an option with probable advantages at the tooth or patient level. Thus, showing the follow-up bias.

Boyd, *et al.* (2018) [10] reported that proximal carious lesions in primary molars. After 1 year, there were significant differences among the groups, with 11% combined minor and major failures in the compomers, and 0.7% minor failures (and no major failures) in the HT. The survival rate of primary molars when restored with SSC was 12 months. There was no endeavour at random allocation, as dental therapists selected children for treatment and teeth meeting inclusion criteria.

Tseveenjav, *et al.* (2018) [11] preferred that Preformed metal crowns were most regularly used for restoring extensive lesions; 97% of PMCs and 86% of GIC/PAMRC/RMGIC being placed in the primary and early mixed dentition periods ($P < 0.001$), whereas 91% of the RC restorations in children aged 9 years or older. The use of PMCs was highest in the year 2004, followed with the year 2016. approximate survival time of vital deciduous molars restored with PMCs (n = 264) was in average of 125 months (CI 95% 122 - 128) and of GIC/PAMRC/RMGIC group 116 months (CI 95% 111 - 120; n = 293; $P = 0.001$). For PMCs, the mean annual failure rate was 1.4% compared to 3.0% for GIC/PAMRC/RMGIC.

SSCs are the best choice for extensive lesions of primary molars in high caries risk children, when the restoration is performed as early as in primary or early mixed dentition. The use of PMCs in primary care could be encouraged so that severely affected primary teeth could

be managed better to optimize the use of the resources. The survival rate of primary molars was high when restored with stainless steel crowns with an expected survival rate of up to 10 years [13].

Conclusion

The survival rate of vital primary molars was high when restored with Stainless steel crowns. PMCs have longer survival time and lower annual failure rate, both in short- and long-term, compared to other restorative materials used in extensive lesions.

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