

Longevity of composite restorations in primary molars: A systematic review

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Abstract

Background: *An ideal restorative material for primary molars must have several properties. Moderate to high success rates are reported with glass ionomer cement however, it fails to meet many of the criteria for an ideal restorative material as compare to composite restoration. Because of composites good physical chemical and mechanical propertie they are well recommended for posterior restorations.*

Objective: *The objective of this systematic review is to know about longevity of composite restoration in primary molars and clinical success rate of composite resin as a restorative material.*

Data sources: *Databases used for the search were PubMed and Google scholar from 1st January 2000 to 1st September 2016. In addition, hand-search of dissertations and journals on pediatric dentistry related to the topic of interest was performed in the institutional library. Contact to authors and colleagues working on similar subjects in the field were made through e-mails.*

Articles published between 1st January 2000 and 30th September 2017 in English with in vivo studies that provide information for composite as a restorative material in primary molars reporting follow up period of 6 months or more, clinical success rates were selected for the review.

Participants and Intervention: *Primary molars undergoing restorative treatment with composite as a filling material.*

Results: *647 articles in total were retrieved. After removal of duplicates 25 articles remained which were screened through abstracts. Of these, 10 full text articles were analysed for eligibility; out of which 5 were selected for the systematic review. Each article shows maximum success rate with composite restoration.*

Conclusion: *The longevity of composite restoration and clinical success rate is also higher for composite restoration.*

Keywords : *Pulmonary Molar, Pubmed*

Introduction

Tooth-colored restorative materials are widely used in pediatric dentistry for the restoration of carious primary teeth.¹ Of these materials, resin composites have been gaining increasing popularity over the past few decades because of their favorable esthetic and mechanical properties.^{2,3} Restoring deciduous teeth is not easy. Apart from possible problems related to patient management, the aspect ratio of cavities is often remarkably unfavorable for restorative materials, with relatively shallow, but often quite wide cavities. Coupled with all of these factors are the significant occlusal loads that even young children can inflict on their teeth. It is therefore not surprising that there has been a search to find materials that are simple to use and sufficiently strong to withstand this environment.⁴

Resin-based composite is an esthetic restorative material used for posterior and anterior teeth. There are a variety of resin products on the market, with each having different physical properties and handling characteristics based upon their composition. "Resin-based composites are classified according to their filler size, because filler size affects polish ability/esthetics, polymerization depth, polymerization shrinkage, and physical properties."⁵ Micro filled resins have filler sizes less than 0.1 micron. Mini filled particle sizes range from 0.1 to 1 microns.

Midsized resin particles range from 1 to 10 microns. Macro filled particles range from 10 to 100 microns. The smaller filler particle size allows greater polish ability and esthetics, while larger size provides strength. Hybrid resins combine a mixture of particle sizes for improved strength while retaining esthetics. Flowable resins have a lower volumetric filler percentage than hybrid resins. Highly filled, small particle resins have been shown to have better wear characteristics.^{6,7,8} Resin-based composites allow the practitioner to be conservative in tooth preparation. With minimal pit and fissure caries, the carious tooth structure can be removed and restored while avoiding the traditional

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“extension for prevention” removal of healthy tooth structure. This technique of restoration with preventive sealing of the remaining tooth has been described as a preventive resin restoration.⁹

Adhesive restorative materials have been widely used in primary molars restorations¹⁰ due to their dental structure preservation in cavity¹¹ preparation and the increasing demand from parents to provide esthetic restorations to their children.¹² The superior physical, chemical and mechanical properties of composites makes it a good option for posterior restorations.^{13,14}

Inclusion Criteria

1. Articles in English or those having detailed summary in English.
2. Studies published between 1st January 2000 and 30th September 2017.
3. In vivo studies that provide information for longevity of composite as a restorative material.
4. Randomized controlled trials and Original research stating the outcome of composite as a restorative material in primary molars.
5. Studies reporting follow up period of more than 6 months.
6. Studies reporting clinical success rates.
7. Studies that provide information for age group <12 years.

Exclusion Criteria

1. Reviews, case reports, abstracts, letters to editors, editorials and in vitro studies.
2. Mobile tooth and absence of opposing tooth
3. Patients who are not mentally or physically fit.
4. Studies for permanent teeth.
5. Animal studies.

PIOS:

- P - Participant: Primary molars
- I - Intervention: Composite restoration
- O - Outcome: Longevity
- S - Study design: Clinical trials

Information Sources

Dental literatures on longevity of composite restoration were retrieved. The databases used for the search were PubMed and Google scholar from 1st January 2000 to 30th September 2017.

In addition to the electronic database searching, hand-search of journals on pediatric dentistry related to the topic of interest was performed in the institutional library. Dissertations on similar topics were screened for their references at the institution. All cross references list of the selected studies also screened for

additional papers that could meet the eligibility criteria of the study. Contact to authors and colleagues working on similar subjects in the field were made through e-mails.

SEARCH STRATEGY used for PubMed database

LONGEVITY	Durability OR lastingness OR success
COMPOSITE RESTORATION	Tooth coloured restoration OR resin filled restoration
PRIMARY MOLARS	Deciduous molar OR primary dentition OR primary teeth

Combinations of the following keywords were used to develop search strategies applied for the PubMed database search up to 30th September 2017:

SEARCH STRATEGY used for PubMed database

Combinations of the following keywords were used to develop search strategies applied for the PubMed database search up to 30th September 2017:

Sr. No	Search Strategy	Total Number of Articles Found	Selected Article
1	Longevity AND composite restoration AND primary molars	10	5
2	Longevity AND tooth coloured restoration OR resin filled restoration AND deciduous molar	1	0
3	Longevity AND tooth coloured restoration OR resin filled restoration AND primary dentition OR primary teeth	621	9
4	Durability OR lastingness OR success AND composite restoration AND primary molars	12	9
5	Durability AND tooth coloured restoration AND deciduous molar	0	0
6	Lastingness AND resin filled restoration AND deciduous molar	0	0
7	Success AND tooth coloured restoration AND deciduous molar	0	0
8	Durability OR lastingness AND resin filled restoration AND primary dentition	1	0
9	Lastingness OR success AND tooth coloured restoration AND primary teeth	1	1
10	Longevity AND composite restoration AND deciduous molar	1	1
	Total	647	25

Study Selection

Selection of studies was done initially by reading the title and abstract of the articles obtained from each database. Only those articles that were relevant to the review were collected and put for further evaluation. Articles reporting information based on composite restoration of permanent teeth and animal studies were excluded. Also, studies reporting composite restoration, those with less than six months of follow up period for composite restoration on primary molars were excluded. Case reports, case series, review articles, abstracts, editorials, and in vitro studies were not included. Clinical trials and retrospective studies fulfilling the inclusion criteria were assessed further for the review.

Data Collection Process

The data was collected and analyzed from each article on discussion by the same investigators that selected them and a standard pilot data extraction sheet was prepared in consult with the evaluator as an expert.

Discussion

The aim of composite restoration for primary molars is mainly to restore the function and general health of the child. Caries in the primary dentition is highly predictive of caries occurring in the permanent dentitions.

Following are the 5 studies considered for this systematic review with comprehended clinical study design, results, analysis and interpretation aiding readers to understand easily.

Pascon et al 2005 did clinical evaluation of composite and compomer restorations in primary teeth with 24-month result. He did the split mouth blind study evaluated the clinical performance of dyract AP F2000 and heliomolar placed Primary molars from 30 healthy subjects between 4 and 9 years of age (median age, 6 years and 2 months) were identified by clinical and bitewing radiographs examination as having at least two first and/or second primary molars with detected caries for Class I or II restorations. The children were selected from those attending public schools in Piracicaba city, Sao Paulo State, Brazil. They did not receive any kind of preventive health care before the study. The population studied only included children requiring active caries treatment. Teeth were selected based on the following criteria: radiographic (bitewing radiograph) evidence of caries; proximal contact with adjacent healthy or restored teeth; no indication for pulp therapy or other restorative treatment; no periodontal involvement and/or with no cuspal involvement; with no caries lesions extending below the gingival wall of the cavity preparation; and a predicted survival of at least 2 years until normal exfoliation. The purpose and clinical procedure of the study were explained and a signed informed consent was obtained from the children's parents. The Ethical Committee in Human Research of Piracicaba Dental School/University of Campinas approved the study. In addition, the children were submitted to oral hygiene instructions and additional dental treatment, during the study. Prior to the onset of the study, each restorative material was

randomly assigned to teeth requiring treatment. The results of the present investigation showed that the success clinical of the restorations as measured by color match, marginal adaptation, marginal discoloration, anatomic form and secondary caries was acceptable. In this study, it was noticed that the success clinical ranged from 69 to 81% for Dyract AP restorations at the 24-month recall. These percentages are similar to those of other studies reporting success rates ranging from 78 19 to 96%.²³

R. R. Welbury et al 2000 The durability of the restorations was assessed during a 42-month follow-up period using modified United States Public Health Service criteria. Survival analysis and the McNemar paired test were used to compare the performance of the two restorative materials. The compomer restorations had a higher mean survival time (42 months, SE 1.40) compared with 37 months (SE 1.90) for the glass ionomer restorations and this was significant at the 5% level. The compomer also performed significantly better in terms of anatomical form, marginal integrity, cavo surface discoloration and maintenance of interproximal contact. The present trial demonstrated that Dyract compomer performed significantly better than Chemfil Superior a glass ionomer cement for all modified United States Public Health Service criteria over a period of 42 months.⁴

Pinto et al 2014 The aim of this retrospective study was to evaluate the longevity of restorations in the posterior primary teeth of children attending to a public paediatric dental clinic and to test the factors associated with failures. Patient records of 329 children (162 boys and 166 girls) were used for collecting and analyzing data. A total of 565 restorations in primary teeth were included in the study. All children enrolled in the study were classified as high caries risk. The longevity of restorations from their placement until failure (up to 4 years of follow-up) was assessed using the Kaplan–Meier survival curves with log-rank test. Multivariate Cox regression analysis with shared frailty ($p < 0.05$) was used to assess the factors associated with failures. Up to 4 years of follow-up, the annual failure rates were 9.5% for composite fillings, 12.2% for light-cured glass ionomer restorations, and 12.9% for conventional glass ionomer restorations with statistical difference between the materials ($p = 0.014$). Glass ionomer restorations had a higher risk of failure over time compared with composites (HR 1.86, 95% CI 1.17–2.97). In crude analysis, Class II restorations showed lower survival rate than Class I restorations ($p = 0.031$) but lost significance after adjustments. His findings suggested that the material influenced the survival rate of primary posterior restorations, with composite presenting the best performance. Differences were observed between restorative materials with different properties in primary teeth up to 4 years of follow-up. This study provides valuable information regarding the primary teeth posterior restoration longevity in a paediatric population with restorations performed under daily life clinical environment.²⁴

Ersin et al 2006 evaluated the 24-month performance of a packable resin-based composite/dentin bonding system and a high-viscosity glass ionomer cement (GIC) in restorations placed in primary molars with atraumatic restorative treatment (ART) ap-

proach. Three dentists placed 419 restorations in 219 children aged 6 through 10 years who had bilateral matched pairs of carious posterior Class I and II primary teeth. They used a split-mouth design to place the two materials, which were assigned randomly to contralateral sides. The authors evaluated the restorations according to U.S. Public Health Service Ryge criteria. After 24 months, 96.7 percent of the Class I GIC restorations and 91 percent of the resin-based composite restorations survived, while the success rates for the Class II restorations were 76.1 percent and 82 percent for the GIC and resin-based composite restorations, respectively. The survival rate of the Class II resin-based composite restorations was 5.9 percent higher than that of the GIC restorations at the 24-month evaluation, but this difference was not statistically significant. However, the study results showed a statistically significant difference in survival rates between Class I and II restorations for both materials. Conclusion and Clinical Implications of the two-year clinical performance of both materials was satisfactory for the restoration of Class I and II primary molars using the ART approach.²⁵

R Franzon et al 2015 did randomized clinical trial aimed to compare the 24-months survival of composite restorations in primary molars after partial caries removal (PCR) and total caries removal (TCR). Forty-eight children aged 3–8 years with at least one molar with a deep carious lesion were included (PCR; n=66; TCR; n=54). For PCR, excavation was stopped when dentin with a leathery consistency was achieved; in the TCR group, total absence of carious tissue was confirmed using a blunt-tipped probe. Pulpotomy was performed in cases of pulp exposure. Success was assessed by modified USPHS criteria with Alpha and Bravo scores recorded as success. Pulp exposure occurred in 1 and 15 of the teeth treated with PCR and TCR respectively ($p < 0.01$). The restorations survival rate after 24 months was 66% (PCR) and 86% (TCR) ($p = 0.03$). When teeth that received pulpotomy were analyzed separately, the survival rate was 92% ($p = 0.09$). PCR performed in occluso proximal restorations demonstrated the lowest success rate ($p = 0.002$). PCR increases 2.90 times the probability of having a restorative failure compared to TCR ($p = 0.03$), after adjusting for cavity type.

outcome, there was no significant difference between the two groups ($p = 0.10$) with success rates of 64% (PCR) and 61% (TCR).³

Limitation

Short periods of evaluation should not be indicated to compare filling materials and the exclusion of short-term follow-ups thus occurred in this systematic review. Also, early evaluations indicated a positive outcome for all material groups with no significant difference that changed at the later follow up.

Also, data searched for this systematic review was limited to fewer number of electronic databases and articles published in English language only.

Conclusion

According to study the composite restorations have maximum survival rate as compare to other restorative material. survival

rate for composite restoration is 75% to 96% according to different study. But all study shows the minimum success rate of composite restoration is 75% which is better than any other restoration so composite restoration is good choice as a restorative material. The longevity of composite restoration and clinical success rate is also higher for composite restoration.

Future Implication:

More number of randomized controlled clinical trials with at least 60 months follow up period and placement of composite restoration as final restoration need to be carried out for testing the newer materials in comparison with composite restoration to conclude a suitable alternative for composite material for primary molars.

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