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**ORIGINAL ARTICLE**

# Is Cavity Lining Really Necessary After Selective Caries Removal in Primary Teeth?

Natalino Lourenço Neto[1], Paula Karine Jorge[2], Eloá Cristina Passucci Ambrosio[2], Luciana Lourenço Ribeiro Vitor[3], Daniela Rios[1], Thiago Cruvinel[1], Maria Aparecida Andrade Moreira Machado[1], Thais Marchini Oliveira[1,2]

[1]Department of Pediatric Dentistry, Orthodontics, and Collective Health, Bauru School of Dentistry, Bauru, SP, Brazil.
[2]Hospital of Rehabilitation of Craniofacial Anomalies, University of São Paulo, Bauru, SP, Brazil.
[3]Center of Science Health, Course of Dentistry, Sacred Heart University Center, Bauru, SP, Brazil.

**Corresponding author:** Thais Marchini Oliveira **E-mail:** marchini@usp.br

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**ABSTRACT**

**Objective:** To evaluate the clinical and radiographic response of pulp-dentin complex after selective caries removal with or without pulp lining in primary teeth. **Material and Methods:** Twenty-four primary molars with deep occlusal caries lesions and without pulpal alterations were selected from children, both genders, aged between 5 and 9 years old. After selective caries removal, the teeth were divided into three groups: without cavity liner (Group I), calcium hydroxide cement – CH (Group II), and Mineral trioxide aggregate – MTA (Group III). The final restoration was performed with resin-modified glass ionomer cement. Clinical and radiographic assessments were conducted at 6-month follow-up. The Kappa test determined intraexaminer reliability. Fisher's exact test evaluated intergroup comparisons ($p<0.05$). **Results:** All teeth showed clinical and radiographic success at the 6-month follow-up without statistically significant differences ($p>0.05$). **Conclusion:** Selective caries removal without cavity lining was acceptable for deep caries lesions in primary teeth.

**Keywords:** Dental Caries; Tooth, Deciduous; Dental Pulp Capping; Pediatric Dentistry.

## Introduction

Deep caries lesions in vital primary teeth are challenging clinical situations in Pediatric Dentistry. Decades ago, the gold-standard treatment was complete caries removal [1]. However, the advancements in Minimal Intervention Dentistry have led to more conservative approaches [2]. Currently, the treatment of choice is indirect pulp capping [3,4].

Indirect pulp capping consists of total removal of the infected dentin in the surrounding walls and selective removal (leaving the leathery affected dentin) in the pulp wall at a single appointment [4,5]. It reduces the operative time and cost, prevents pulp exposure, leads to the remineralization of the affected dentin, and maintains the primary tooth up to exfoliation [1,3,5,6].

Cavity liners have been used after selective caries removal due to their sealing capacity, bacterial reduction, mineral repair, and thermal isolation [2,4,7]. Although selective caries removal followed by pulp lining is effective [3-5], the literature lacks consensus on whether the clinical success is related to the cavity sealing or lining of the affected dentin [7]. Thus, further studies on selective caries removal alone without cavity lining are necessary.

Therefore, this study aimed to evaluate the clinical and radiographic response of the pulp-dentin complex after selective caries removal with or without pulp lining in primary teeth. The null hypothesis was that pulp lining would not be necessary after selective caries removal with favorable clinical and radiographic responses.

## Material and Methods

### Ethical Clearance

This study was submitted and approved by the Institutional Review Board (protocol number #20816913.5.0000.5417). The parents/legal guardians were instructed about the procedure and signed an informed consent.

### Sample Selection

Inclusion criteria included children between 5 and 9 years old, both genders, with primary molar affected by deep caries (more than 2/3 of carious dentin); without sensitivity or spontaneous pain; without pulp exposure; without excessive tooth mobility; without fistula or abscess; without internal or external root resorption of more than 2/3 of the root on a radiograph; without furcal and periapical lesion; and with restorative likelihood. Children with systemic diseases and a history of allergy to latex and local anesthetics were excluded from the study.

### Sample Size Calculation

The sample size was computed using the 54% difference between experimental and control groups from a previous study [8]. The minimum sample size was eight teeth per group, with a significance level of 5% and power of 80%.

### Clinical Procedures

The primary teeth were divided into three groups: without cavity liner (Group I), calcium hydroxide cement – CH (Group II), and Mineral trioxide aggregate – MTA (Group III). Single-trained and calibrated operators performed the clinical and radiographic procedures.

A periapical radiograph was taken using a film holder for initial diagnosis. The clinical procedure involved the following steps: topical anesthesia, inferior alveolar nerve anesthesia (mandible), or infiltrative anesthesia (maxilla) with local anesthetic (Articaine 4% with 1:100,000 epinephrine); removal of all unsupported enamel with high-speed burs; total caries removal (all demineralized dentin was removed to hard dentin, leaving no softened dentin) from the lateral dentin walls with low-speed round steel or carbide burs (sizes 4, 5 and 6 - KG Sorensen, São Paulo, SP, Brazil); and selective caries removal (infected dentin was removed, maintaining the affected dentin) from the pulpal wall.

The cavity was cleaned with an air-water syringe for all the tested groups and dried with a cotton pellet. The cavity liner material was chosen according to the study group. Then, a definitive restoration was accomplished with resin-modified glass ionomer (Vitremer™ —3M/ESPE, Minnesota, USA). Afterward, an additional periapical radiograph was taken.

Clinical and Radiographic Analysis

All teeth were assessed at six months to evaluate the pulp-dentin complex response through radiographical and clinical exams [9,10]. The apron thy, roid collar, and ultra-high-speed film were used to reduce the risks relating to radiographic shots. The periapical radiographs were developed manually using the time/temperature technique.

During follow-up, successful treatment was clinically characterized as no pain, mobility, sensitivity to percussion, abscess/fistula, and color alteration [11,12]. Radiographic success was determined as no internal and external root resorption, furcal/periapical lesion, and advanced rhizolysis stage [11,12]. Two examiners, specialists in pediatric dentistry, were trained, calibrated, and blinded for performing analyses. All data were registered for posterior analysis.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences software, version 21 (IBM Corp., Armonk, NY, USA). Intraexaminer reproducibility was determined using the Kappa test. Fisher's exact test was used to determine the statistical differences between groups. A level of significance of 5% was adopted.

## Results

Fifty primary molars were evaluated. According to the inclusion criteria, the study sample comprised 24 primary molars from 24 children with a mean age of 74.506 ± 5.721 months. Twenty-six primary molars were excluded. Eight teeth were excluded from the sample during the treatment due to pain and pulp exposure, requiring pulpotomy. Sixteen primary molars were excluded due to fistula, external root resorption of more than 2/3 of the root on the radiograph, and furcal lesion. Thus, 24 teeth were treated, and 24 teeth were clinically and radiographically followed up. The follow-up period was six months.

The intraexaminer agreement was evaluated by the Kappa test, which was 0.85. The data of the clinical and radiographic assessments are described in Tables 1 and 2. All teeth showed clinical success at the 6-month follow-up period. No tooth exhibited pain, mobility, presence of fistula/abscess, or sensitivity to percussion (Table 1). In Table 2, all teeth showed radiographic success. The comparison of the outcomes did not show statistically significant differences for any study criteria ($p>0.05$).

**Table 1. Clinical assessment of the selective caries removal at 6-month follow-up.**

| Groups | Clinical Assessment Criteria (6 Months) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Symptomatology | | Mobility | | Sensitivity to Percussion | | Presence of Fistula/Abscess | | Failure of Restoration | |
| | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No |
| | N | % | N | % | N | % | N | % | N | % |
| I | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) |
| II | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) |
| III | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) |
| Total | 0 | 24 (100.0) | 0 | 24 (100.0) | 0 | 24 (100.0) | 0 | 24 (100.0) | 0 | 24 (100.0) |

G I: Without liner; G II:Calcium Hydroxide; G III: MTA.

**Table 2. Radiographic assessment of the selective caries removal at 6-month follow-up.**

| Groups | Radiographic Assessment Criteria (6 Months) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Internal Resorption | | External Resorption | | Furcation Lesion | | Advanced Rhizolysis | | Failure of Restoration | |
| | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No |
| | N | % | N | % | N | % | N | % | N | % |
| I | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) |
| II | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) |
| III | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) | 0 | 8 (100.0) |
| Total | 0 | 24 (100.0) | 0 | 24 (100.0) | 0 | 24 (100.0) | 0 | 24 (100.0) | 0 | 24 (100.0) |

## Discussion

This study aimed to evaluate the clinical and radiographic response of the pulp-dentin complex of primary teeth after selective caries removal with or without cavity liners. The study results showed statistical similarity between groups, so the null hypothesis was accepted. All groups showed favorable clinical and radiographic responses, which agrees with Gurcan et al.'s previous study [13].

Over time, caries lesion treatment was complete removal, which resulted in pulp exposures and treatment complications [14]. Minimal Intervention Dentistry maintains pulp vitality and sound dental tissue, increasing tooth longevity and helping the patient [3,15,16]. Selective caries removal outcome is a complex interplay between the residual bacteria and the pulp immune response, resulting in the formation of tertiary dentin, thus contributing to tooth integrity [17,18]. Clinically, this treatment leads to less pulp exposure and symptoms [19,20].

Indirect pulp capping after selective caries removal has advantages and disadvantages. A systematic review showed a tendency towards more failure in teeth lined with calcium hydroxide [21]. However, one-step selective caries removal benefits are reparative dentin formation and tooth maintenance related to cavity liners [1,2]. Although cavity liners exhibit highly satisfactory characteristics for decreasing bacteria and promoting dentin repair [22], the literature suggests that affected dentin alone is biocompatible [6]. The rationale behind this fact would be the clinical and radiographic success provided by the restorative material sealing [21-25].

The hermetic sealing of the cavity is vital in the long term. Restorative treatment goals are to aid in biofilm control, protect the dentin-pulp complex, maintain sound, remineralizable dental tissue, maintain pulp vitality, and seal the cavity [21]. This study used resin-modified glass ionomer cement for restoration, and glass ionomer cement has undergone many improvements over recent years. These materials have been indicated because of their biocompatibility, fluoride-releasing, and bonding to caries-affected dentin with less likelihood of pulp failure [26,27]. In this study, selective caries removal without cavity liner was a reasonable approach for

deep caries lesion treatment in primary teeth after resin-modified glass ionomer cement restoration. Further studies are necessary to verify these results with different restorative materials.

## Conclusion

Selective caries removal without cavity lining was acceptable for deep caries lesions in primary teeth.

## Authors' Contributions


| | | |
|---|---|---|
| NLN | https://orcid.org/0000-0003-0227-0349 | Conceptualization, Methodology, Formal Analysis and Writing - Review and Editing. |
| PKJ | https://orcid.org/0000-0002-9221-8052 | Validation, Curation, Writing - Original Draft and Project Administration. |
| ECPA | https://orcid.org/0000-0003-2322-3832 | Investigation, Writing - Original Draft, Writing - Review and Editing and Visualization. |
| LLRV | https://orcid.org/0000-0003-1671-0851 | Conceptualization, Investigation, Writing - Review and Editing and Supervision. |
| DR | https://orcid.org/0000-0002-9162-3654 | Methodology, Investigation, Data Curation and Visualization. |
| TC | https://orcid.org/0000-0001-7095-908X | Investigation, Writing - Original Draft, Supervision and Project Administration. |
| MAMM | https://orcid.org/0000-0003-3778-7444 | Conceptualization, Formal Analysis, Data Curation and Writing - Review and Editing. |
| TMO | https://orcid.org/0000-0003-3460-3144 | Formal Analysis, Data Curation, Writing - Original Draft, Writing - Review and Editing and Supervision. |

All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.


## Financial Support

None.

## Conflict of Interest

The authors declare no conflicts of interest.

## Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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