

# Child-Centered Chemomechanical Caries Removal: A Split-Mouth Evaluation of Two Minimally Invasive Agents.

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## Introduction

Minimally invasive dentistry now emphasizes preserving healthy dentin by selectively removing only the denatured, infected layer, addressing limitations of conventional rotary methods that may cause heat, noise, and unnecessary tissue loss.<sup>1</sup> Chemomechanical caries removal (CMCR) offers a conservative alternative by softening infected dentin through proteolytic action, enabling gentle manual excavation while reducing anxiety in pediatric patients.<sup>2</sup>

**OBJECTIVE:** To evaluate minimally invasive, anxiety-friendly approaches to pediatric caries management using chemomechanical caries removal (CMCR) agents that preserve healthy dentin and avoid the discomfort associated with rotary instruments.

**PURPOSE:** To compare the clinical performance, effectiveness in microbial reduction, and child acceptance of two different papain-based CMCR materials.

**RESEARCH QUESTION:** Do these CMCR agents differ in effectiveness and pediatric acceptance?

**HYPOTHESIS:** Papain-based CMCR agents will demonstrate effective caries removal with high acceptance due to their gentle, drill-free, minimally invasive mechanism.

## Methods

**DESIGN:** In vivo comparative study evaluating two papain-based chemomechanical caries removal (CMCR) agents—**Group I-Brix 3000** and **Group II-Carie-Care**—within a minimally invasive pediatric framework in a split-mouth design.

**IRB:** Approved by the Institutional Ethics Committee (IEC No. 15/IEC/LIDS/2021).

**PARTICIPANTS:** Children aged 6–9 with bilateral broad cavitated occlusal lesions in primary molars; informed consent and assent obtained.

**PARAMETERS ASSESSED:**

Caries removal time (in seconds)

Reduction in microbial count, before versus after caries excavation (in CFUs)

Child acceptance towards respective CMCR agents using a Visual Analog Scale (VAS)

**PROTOCOL:** Caries removal performed per manufacturer instructions; all parameters recorded using standardized criteria.

**OPERATORS:** Calibrated pediatric dental clinicians trained in standardized CMCR application.

**STATISTICAL ANALYSIS: (Using SPSS Version 24)** Independent t-test for intergroup comparison of caries removal time. Paired t-test for intragroup comparisons (where applicable). Chi-square test for categorical variables, including child acceptance and clinical effectiveness. Significance level set at  $P = .05$ .

## Figure 1: Study Diagram

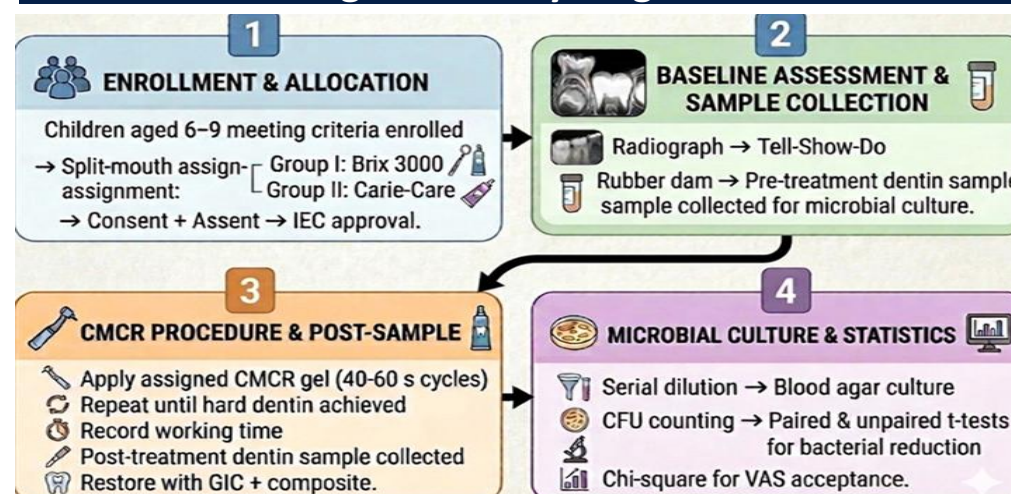


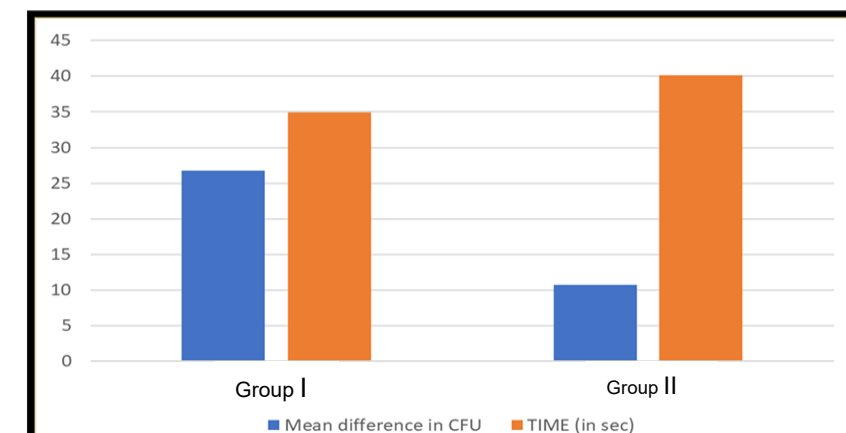
Table 1: Evaluation of the mean CFU before and after caries excavation between the two groups. (Paired t-test)

Group	Before (mean ± SD)	After (mean ± SD)	P value
Group I	61.05 ± 21.498	34.20 ± 14.348	0.000 <sup>a</sup>
Group II	59.60 ± 22.956	43.55 ± 16.259	0.000 <sup>a</sup>

a-statistically significant



Figure 2a. CFUs Before caries excavation versus after caries excavation by Group I



Graph 1: Comparison of the reduction in mean colony forming units (CFU) and time taken for caries removal between the two groups in caries excavation.

## Results

- CFU Reduction - Both materials showed significant CFU reduction after excavation ( $P < .05$ ).
- Bio-encapsulation material (Group I) had lower post-CFU than the blue colored papain endoprotein gel (Group II).
- Working Time – The mean working time was shorter with Group I ( $P < .05$ ).
- Patient satisfaction – Chi-square test revealed higher acceptance and patient satisfaction in Group I ( $P < .05$ ).

Table 2: Evaluation of the mean working time for caries removal between the two groups. (Independent t-test)

Group	TIME (in seconds)
Group I	34.9305 ± 3.07665
Group II	40.1050 ± 2.65124

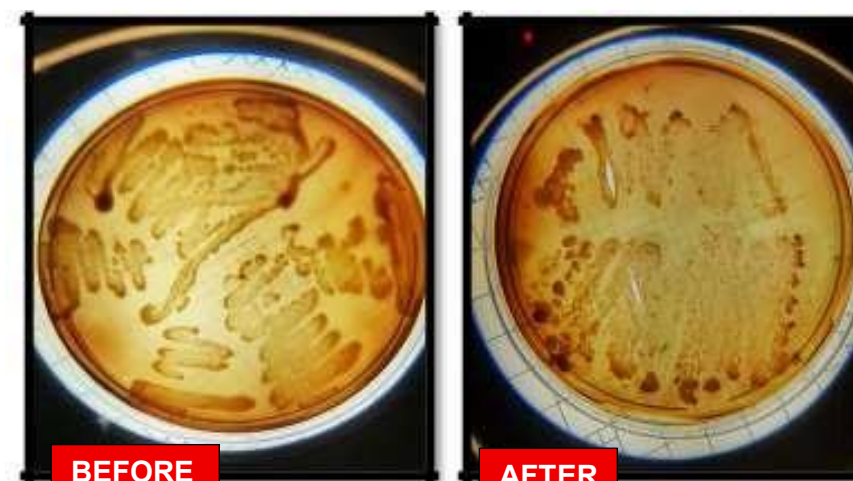
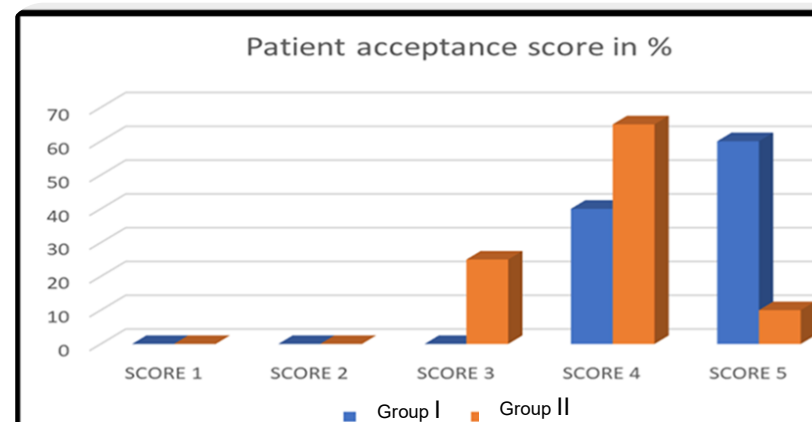
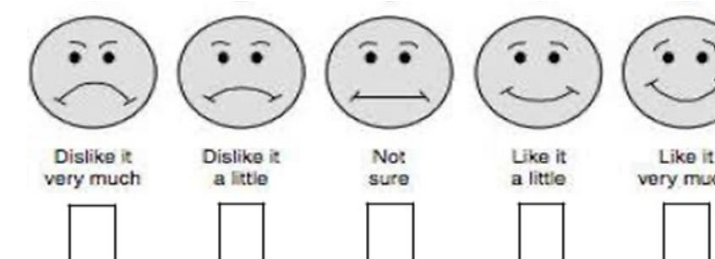


Figure 2b. CFUs Before caries excavation versus after caries excavation by Group II



Graph 2: Comparison of mean score values concerning patient acceptance parameter for both the groups.

## Figure 3: Visual Analog Scale



## Discussion

Chemomechanical caries removal supports minimally invasive dentistry by selectively dissolving infected dentin while preserving the protective affected layer, a biologically sound principle described by Flindt<sup>3</sup> and Beeley<sup>4</sup>. In this study, the papain-based agent with higher enzymatic activity (Group I) demonstrated faster excavation and greater microbial reduction than the comparator, consistent with the clinical observations of Inamdar.<sup>5</sup> Both agents significantly reduced cariogenic bacteria, reaffirming the bacteriostatic and bactericidal properties of papain previously reported by Dawkins.<sup>6</sup> The gentle, quiet, anesthesia-sparing nature of chemomechanical techniques contributed to strong child acceptance, reinforcing their value as child-friendly, biologically conservative approaches to caries management.

## Conclusion

Within the limitations of this study, it can be concluded that group I showed higher clinical and microbial efficacy in caries removal, with less chairside working time and better reduction in bacterial load after the caries excavation procedure as compared to group II. The chemomechanical caries removal agents exist owing to a significant decline in the figures of the caries causing microbes, with a preponderance of evidence establishing their antibacterial properties. Patient acceptability was highest in group I, which can be attributed to the atraumatic treatment procedure.



## STRENGTHS:

- + This comparative, split-mouth, in vivo study has challenged conventional aerosol-generating procedures, comparing two CMCR agents with a well-established control group and baseline sample.
- + The standardized caries removal criteria minimized the bias in the sample collection.

## LIMITATIONS:

- No separate investigators were assigned for group allocation or study procedures, and blinding was not implemented, potentially leading to information bias.
- The sample size of this study is somewhat limited. Additional research involving a larger group of participants and an extended follow-up period is advised to confirm and strengthen these findings.



## Clinical Significance

Minimal intervention dentistry has evolved, keeping a bird's eye view, following the principles of maximum tissue preservation by CMCR. This advancement in pediatric dentistry sheds light on the preservation of the healthy dentin and the selective debridement of denatured dentin, which is crucial for supporting the eventual restoration, yielding a better prognosis. **This study supports the adoption of minimal intervention approach as an effective alternative in pediatric dental practice, for caries removal, that preserves healthy tissues and fosters a positive dental attitude, especially in children, by reducing dental fear and anxiety, contrasting with the traditional "drill-fill-bill" practices.**

## References

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