

Chemomechanical Caries Removal with Papacarie Duo: A Comprehensive Review of an Exciting Alternate Treatment

Sophia Broome, Hope Clark, and Mary Alden Cooper
Dr. Michelle Ziegler, DDS

ABSTRACT

Caries removal has traditionally been achieved using rotary instruments and high-speed handpieces. While effective, this approach is not tolerated by all patients, particularly those with noise and tactile sensitivities. For these populations, the newly FDA-approved product Papacarie Duo offers a promising alternative. This enzymatic gel selectively dissolves infected dentin while preserving healthy tooth structure. Papacarie Duo may be especially beneficial for pediatric and special needs patients due to its rapid mechanism of action and minimally invasive nature. In addition to eliminating the need for a noisy handpiece, the technique typically does not require local anesthetic administration, further enhancing patient comfort and reducing procedural invasiveness.

BACKGROUND

Papacarie Duo is a papain-based enzymatic gel that selectively dissolves decayed collagen and other denatured proteins within carious dentin. Papain, derived from papaya, acts only on infected dentin. Healthy dentin is protected by the presence of α -1-antitrypsin, a natural inhibitor of papain, which prevents degradation of sound tooth structure. The gel also contains chloramine, an antimicrobial disinfectant that aids in further decontamination of the cavity. Papacarie Duo is applied directly to the infected dentin for approximately 30–60 seconds. During enzymatic digestion, oxygen release produces bubbling and a cloudy appearance, indicating softening of the carious dentin. The softened tissue can then be gently removed using a spoon excavator in a pendulum motion. In cases of extensive decay, a second application may be required. Following excavation, the cavity is thoroughly cleaned and rinsed. The remaining dentin should appear shiny, hard, and decontaminated prior to restoration with composite resin or glass ionomer.

Overall, Papacarie Duo provides a less painful, minimally invasive, and less stressful alternative to traditional caries removal techniques. Its use may expand treatment options for a broader range of patient populations, including pediatric patients, pregnant individuals, and patients with special health care needs.

METHODS

A comprehensive literature search was conducted to identify peer-reviewed studies evaluating chemomechanical caries removal using Papacarie Duo enzymatic caries removal. Database searches included Scopus and PubMed. Our research inclusion criteria consisted of clinical trials, peer reviewed journals, those published from 2020 to 2025, involving only human subjects, and written in the English language. Studies were selected if they address clinical efficacy, patient comfort, treatment time, or outcomes involving all patient populations (including pregnant patients, pediatric patients, and patients with special needs). Search words included Papacarie, Papain, Human, and Dental Caries. Seventeen articles were used. Review articles, case reports, and studies involving other chemomechanical agents without separate analysis for Papacarie Duo were excluded. Data extraction focused on study design, sample size, patient population, methodology, and reported clinical outcomes.

RESULTS

Table 1 demonstrates the advantages, disadvantages, and best clinical uses of Papacarie Duo based on our literature review. Papacarie Duo achieves complete caries removal at a level comparable to traditional rotary instrumentation and other atraumatic caries removal methods. It possesses intrinsic antimicrobial activity and has been shown to increase the bond strength of resin restorations when used prior to etching as an enamel pretreatment. Pediatric and pregnant patients report significantly lower pain scores with Papacarie Duo caries excavation compared to rotary instrumentation. Although the procedure time is slightly longer than that of rotary excavation, overall treatment time may be reduced because local anesthetic is often unnecessary, and patient compliance is generally higher. A slight increase in cost is associated with incorporating Papacarie Duo into the treatment regimen. One aspect of concern that warrants further investigation is its cytotoxic effect on pulp cells when in direct contact and at high concentrations.

Advantages	Disadvantages	Best Clinical Uses
Comparable bond strength to rotary excavation	Higher cost than tradition ART and rotary methods	Atraumatic caries removal
Higher energy absorption → more stress-resistant dental bond	Longer procedure time vs rotary instrumentation	Patients with dental anxiety, PTSD, and/or sensory sensitivity
Significantly lowered patient reported pain	Cytotoxic to pulp cells at high concentrations	Pediatric patients
Removes the need for local anesthesia	Increases ROS & decreases pulp cell viability upon contact	Pregnant patients
Intrinsic antimicrobial activity	No reduction to microleakage	Patients unable to tolerate local anesthesia
Achieves complete caries at a level comparable to other caries		Patients with special healthcare needs
Improves enamel surface morphology and roughness		Management of hypomineralized enamel
Increases microshear bond strength when used prior to etch		Deep caries excavation
Improves sealant adhesion		
Natural alternative to sodium hypochlorite		

Table 1. Clinical Overview of Papacarie Duo

Papacarie Duo use protocol

1. Perform a periapical or interproximal diagnostic radiograph.
2. Clean the area to be treated with water.
3. Relative isolation with cotton swabs and suction.
4. Put the gel in a dappen glass or on the glove and carry it to the cavity with the curette.
5. Apply the gel and wait for the cavity to soften (30 to 60 seconds).
6. Scrape the carious dentin using pendular sweeping movements with a blunt curette.
7. Reapply the gel whenever necessary until the complete removal of the carious tissue.
8. Inspection of the remaining dentin texture.
9. Clean the cavity with water.
10. Restoration according to the usual procedure.
11. Perform a check radiograph.



Figure 1. Papacarie Duo Use Protocol

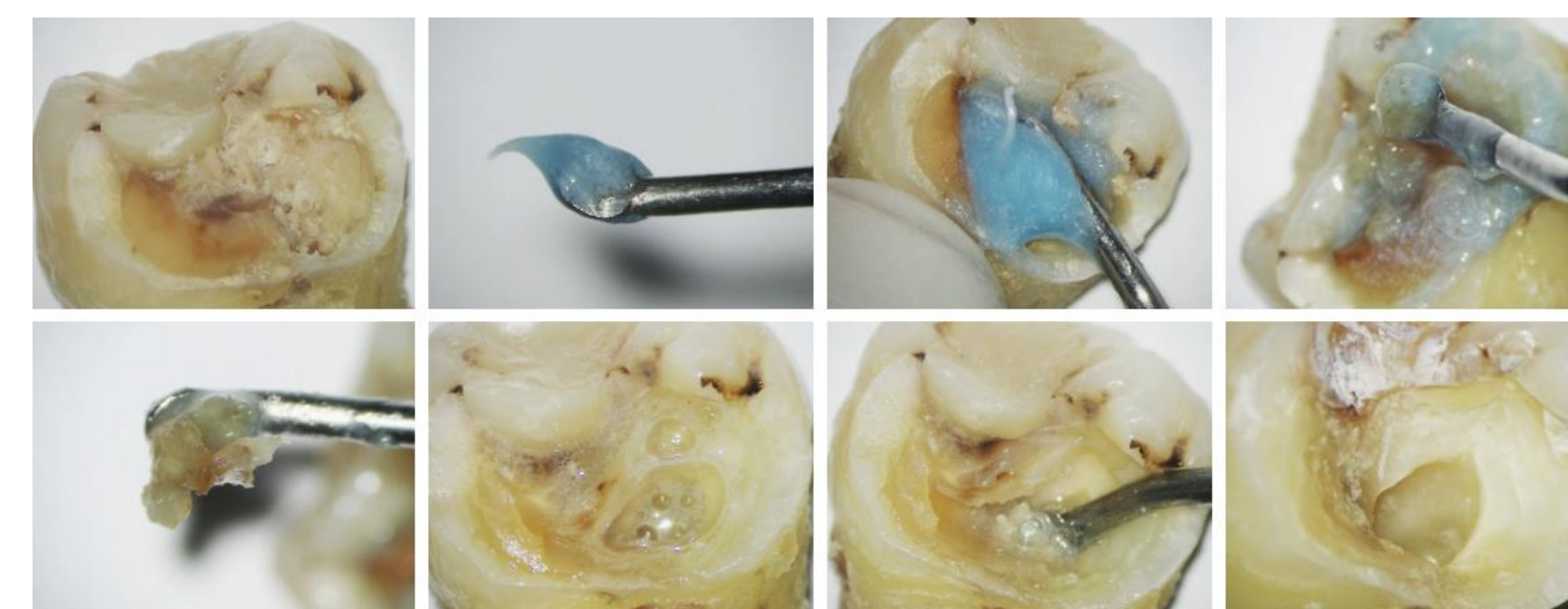


Figure 2. Clinical Example of Application of Papacarie Duo

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DISCUSSION

The findings of this literature review support Papacarie Duo as an effective, minimally invasive alternative to rotary instrumentation for caries removal in selected clinical situations. Across the included studies, Papacarie Duo demonstrated efficacy comparable to traditional methods, with increased patient compliance and satisfaction, particularly among pediatric patients, pregnant individuals, and patients with special health care needs. This represents a significant advantage, as these populations often experience sensory and tactile sensitivities that can complicate conventional operative treatment. In addition, the intrinsic antimicrobial properties of Papacarie Duo, combined with its ability to enhance resin bond strength when used as an enamel pretreatment, demonstrate clinical utility beyond chemomechanical caries removal alone. Despite these advantages, several limitations must be considered. Procedure time and material cost were reported to be slightly increased; however, the elimination of local anesthetic administration may offset these factors, potentially resulting in comparable or reduced overall treatment time depending on patient cooperation. Further investigation is needed to clarify this balance. The primary contraindication identified in the literature is the potential cytotoxicity to pulpal cells when Papacarie Duo comes into direct contact with the pulp at high concentrations. Therefore, careful case selection is essential, with clinicians favoring lesions that present a low risk of pulpal exposure. Overall, the results of this literature review support the viability of Papacarie Duo as an effective alternative for caries removal; however, additional long-term clinical studies are warranted to further evaluate its safety and efficacy.

CONCLUSIONS

Papacarie Duo is an effective alternative to rotary caries removal in many clinical situations. It is particularly indicated for use in pediatric patients, pregnant individuals, and patients with special health care needs or sensory sensitivities. Additionally, Papacarie Duo may be used for deep caries excavation and as a pretreatment for hypomineralized enamel.

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