

Comparison Of Papacarie & Carisolv In Effective Chemomechanical Removal Of Dental Caries – A Systematic Review

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Abstract

Background: The trend in dentistry for carious lesion removal is changing from conventional methods involving extension for prevention to modern techniques dealing with minimal invasion.

Aim: To compare the Chemomechanical Caries removal property of Carisolv and Papacarie regarding efficiency and effectiveness.

Study design: A systematic review of research articles was performed. Electronic and hand search retrieved 85 records; 58 was screened. The intervention and outcomes were assessed in the study included for the review.

Results: Seven studies were included in this systematic review. These studies compared the chemomechanical caries removal by Carisolv and Papacarie in terms of efficiency and effectiveness.

Conclusion: Out of the seven reviewed studies, it is evident that Papacarie is superior to carisolv in terms of chemomechanical caries removal potency with five supportive studies, less pain and discomfort with two evidence-based in vivo trials.

Keywords: Papacarie, Carisolv, Chemomechanical caries removal, Dental caries, Minimal invasive dentistry

INTRODUCTION:

Dental caries is a disease that affects the hard dental structure and is one of the most prevalent chronic oral disease in the world ^[1,2]. It is usually characterised by cavitation of the tooth due to softening of hard tooth structure ^[3, 4]. Despite substantial reduction in the prevalence of dental caries, it still poses to be widespread throughout the world ^[5].

This is usually treated using the conventional caries removal method, which primarily uses mechanical means such as rotary instruments and hand excavators to remove the carious tooth structure ^[1, 5]. Unfortunately, these often lead to overextension of the cavity, removal of adjacent healthy tooth structure, thermal irritation to the pulp, noise, vibration, pain & discomfort, occasionally requiring the use of local anaesthesia ^[5].

Over the years, dentistry has shown a paradigm shift towards ‘minimal invasive dentistry’ from the ‘extension for prevention’ concept ^[6]. Minimal invasive dentistry is a concept that aims at tissue preservation with precise excision of infected tissue without causing any damage to the healthy adjacent tissue ^[7]. Minimal invasive caries removal techniques commonly include caries removal using Laser ablation, Air abrasion, Sono-abrasion and Chemomechanical caries removal ^[5, 8]. This technique leads to selective removal of caries-infected tissue and leaves intact caries-affected tissues ^[8, 9].

Chemomechanical caries removal is a non-invasive technique that removes infected carious tissues and preserves healthy tooth structure minimising any pulpal irritation and patient discomfort ^[10]. It eliminates caries via dissolution using a chemical agent along with atraumatic mechanical force to remove the soft carious lesion ^[11]. These agents can be broadly classified into Sodium hypochlorite based and Enzyme based ^[8, 12]. The most commonly used gels include Carisolv (hypochlorite based) and Papacarie (Enzyme based). As existing literature is inadequate regarding the most potent agent for dental caries removal

through chemomechanical techniques, this systematic review was carried out to compare the chemomechanical caries removal by the most commonly used gels Carisolv and Papacarie, in terms of efficiency and effectiveness.

MATERIALS AND METHODS:

OBJECTIVE: To compare the Chemomechanical Caries removal property of Carisolv and Papacarie in terms of efficiency and effectiveness.

SEARCH WORDS:

Specific keywords used for each electronic database can be found in Table/Fig 1.

Table/Fig 1: Search Database

S no	Database	Search terms	Articles found
1	PubMed central (Advanced search)	(Papacarie AND Carisolv) AND Caries removal	32
2	Cochrane	(Papacarie AND Carisolv) AND Caries removal	6
3	Google Scholar	"Papacarie AND Carisolv" AND Caries removal AND In vitro AND In vivo	16
4	Science Direct	(Papacarie AND Carisolv) AND Caries removal	10
5	Wiley Online library	(Papacarie AND Carisolv) AND Caries removal	11
6	Ovid Medline	(Papacarie AND Carisolv) AND Caries removal	10
7	LILACS	(Papacarie AND Carisolv) AND Caries removal	0

ELIGIBILITY CRITERIA:

INCLUSION CRITERIA:

The articles that were included in this review were included based on the following criteria:

- Articles comparing Papacarie and Carisolv in terms of chemomechanical caries removal
- Articles published in English
- Full-text articles were included

- In vitro studies, In vivo studies were included

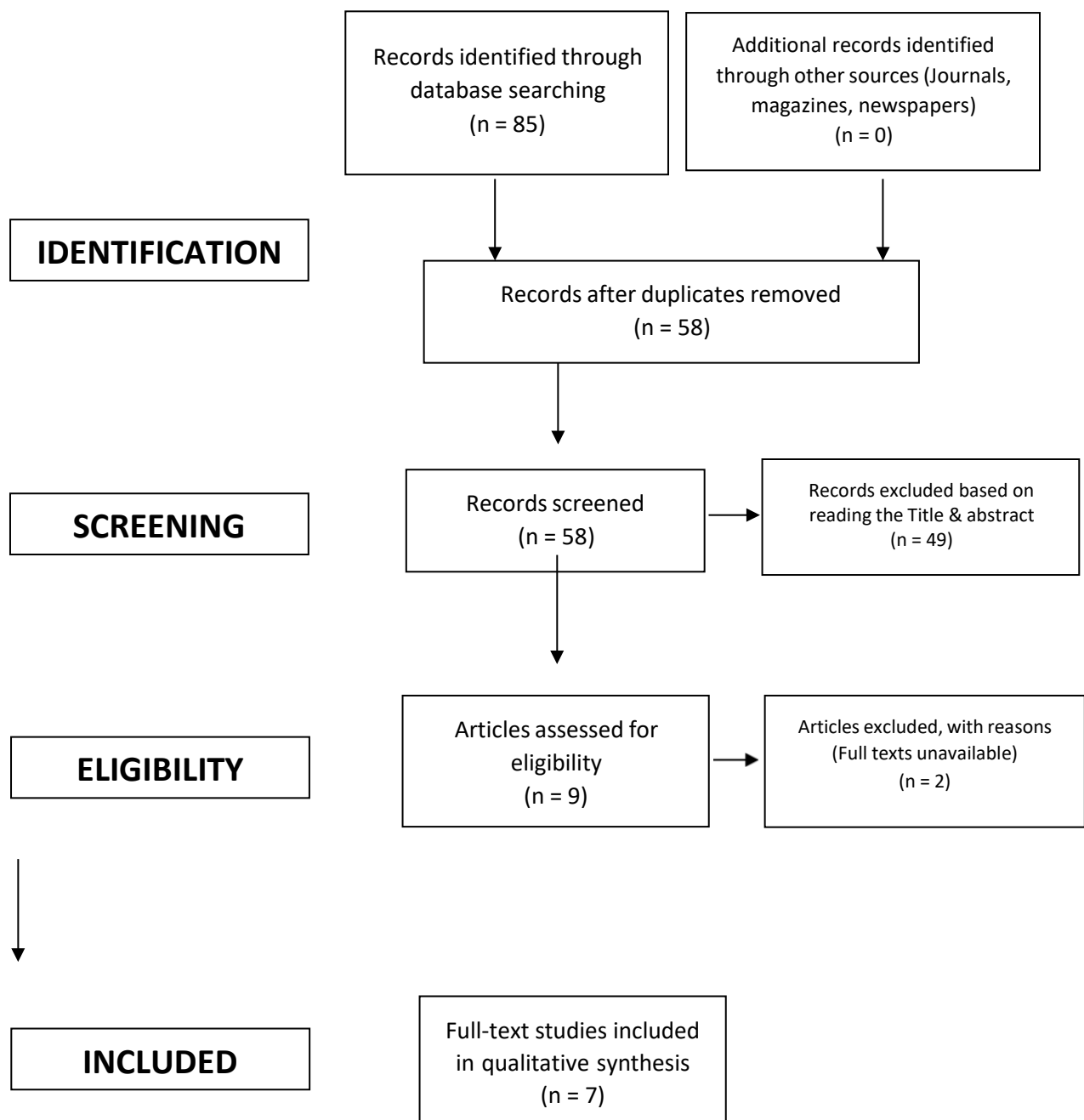
EXCLUSION CRITERIA:
The articles were excluded in this review based on the following criteria:

- Articles published in other languages
- Articles where only abstracts were available
- Unrelated articles
- Review articles
- Case reports
- Editorials

SEARCH STRATEGY:

A systematic computerised search was performed on electronic databases such as PubMed, Cochrane, Google Scholar, Wiley online library, Ovid Medline and LILACS. A total of 85 articles were collected, and these articles were scrutinised based on the inclusion, exclusion criteria, out of which seven relevant articles were chosen for this comprehensive analysis. Table/Fig 2 contains the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart indicating the number of articles obtained and scrutinised.

Table/Fig 2: PRISMA Flow chart



Table/Fig 3: Data collection and Analysis:

S.NO	AUTHORS NAME JOURNAL NAME YEAR, VOLUME (ISSUE); PAGE NO.	STUDY DESIGN	SAMPLE SIZE & MATERIALS USED	RESULTS	OUTCOME OF STUDY
1	Kumar J et al Indian Journal of Dental Research 2012, 23(5);697	In Vivo study	40 patients Age: 20 to 40 years GV Black class I cavity on permanent molars Maximum entrance size of dental caries $\geq 3\text{mm}$ Group I (n=20): Carisolv Group II (n=20): Papacarie	Time taken (in minutes) Carisolv = 11.67 ± 3.25 Papacarie = 10.48 ± 2.96 p value > 0.05 Volume of dental caries removed (in mm³) Carisolv = 126.33 ± 53.56 Papacarie = 135.99 ± 66.43 p value > 0.05	Carisolv and Papacarie were both clinically efficient in dental caries removal. Papacarie was marginally better in tested clinical parameters i.e. time taken and volume of dental caries excavated.
2	Tri MR et al The Journal of Contemporar y Dental Practice 2012,	In vivo study	120 teeth from pediatric patients Age: 5 to 9 years Group A (n=30): Conventional Airtor method Group B (n=30): Carisolv	Pre & Post-operative DIAGNOdent value Carisolv: Pre-op = 73.2 ± 22.8 Post-op = 7.0 ± 4.5 Percentage change = 87.7 ± 6.4 p-value = 0.001 Papacarie: Pre-op = 77.7 ± 17.3 Post-op = 8.5 ± 4.2 Percentage change = 88.9 ± 6.0 p-value = 0.001	Papacarie and Carisolv showed almost comparable results in terms of efficacy, efficiency and Pain & discomfort. Their comparison did not show

	13(1);40-47			Intergroup comparison of DIAGNOdent value between carisolv & papacarie = p value = 0.576	
			Group C (n=30): Papacarie	Time taken (in secs) Carisolv = 474 ± 43.0 Papacarie = 471.3 ± 68.2 p value = 0.994	any statistically significant changes.
			Group D (n=30): Photoablation using Er:YAG Laser method	FLACC Score Carisolv = 1.13 ± 1.25 Papacarie = 1.37 ± 1.79 p value = 0.942	
3	Viral PM et al Journal of Clinical Pediatric Dentistry 2013, 37(3);269-274	in vitro study	60 primary molars Group I (n=30): Carisolv Experimental group I A (n=15): Carisolv treated teeth undergoing marginal leakage test Experimental group I B (n=15): Carisolv treated teeth undergoing Shear bond strength test Group II (n=30): Papacarie Experimental group II A (n=15): Papacarie treated teeth undergoing marginal leakage test	Time taken (in seconds) Carisolv = 461.33 ± 27.76 Papacarie = 337.67 ± 18.13 p value < 0.001 Marginal leakage Carisolv = 33.33% Papacarie = 80% p value= 0.032 Shear bond strength Carisolv = 9.67 ± 3.80 MPa Papacarie = 8.36 ± 4.51 MPa p value = 0.396	Papacarie was more clinically efficient than Carisolv with respect to amount of time required for complete dental caries removal Papacarie showed more marginal leakage than Carisolv . The shear bond strength comparison was not statistically significant between Carisolv and Papacarie .

			Experimental group II B (n=15): Papacarie treated teeth undergoing Shear bond strength test		
4	Kochhar GK et al Journal of Clinical Pediatric Dentistry 2011, 36(1);5-10	In Vivo study	80 patients – 120 carious primary teeth Age: 5 to 9 years Group I (n=30):	Remaining dental caries following removal Carisolv = 0.90 ± 0.845 Papacarie = 0.47 ± 0.571 Time taken (in seconds) Carisolv = 723.73 ± 179.476 Papacarie = 590.80 ± 187.004	Papacarie was clinically more efficient in dental caries removal compared to Carisolv. Papacarie took lesser

			Hand instruments Group II (n=30): Airotor Group III (n=30):	Pain score using Visual Analog scale Carisolv = 19.33 ± 11.725 Papacarie = 7.33 ± 5.833	time for dental caries removal compared to Carisolv Papacarie
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			Carisolv Group IV (n=30): Papacarie	Pain score using Verbal scale Carisolv = 1.93 ± 0.868 Papacarie = 0.73 ± 0.583	was lesser painful than Carisolv.
5	Boob AR et al International Journal of Clinical Pediatric Dentistry 2014, 7(1);11-18	in vitro study	30 extracted human permanent teeth Split tooth design, therefore final sample size = 60 Halves Group 1 (n=20): Conventional (hand method) Subgroup A vs Carisolv Subgroup B Group 2 (n=20): Conventional (hand method) Subgroup c vs Papacarie Subgroup D Group 3 (n=20): Papacarie Subgroup E vs Carisolv Subgroup F	Time taken (in seconds) Carisolv = 657.00 ± 135.84 Papacarie = 601.50 ± 101.79 Knoop hardness mean value after excavation Carisolv = 57.39 ± 3.37 Papacarie = 54.24 ± 3.61	Papacarie showed better efficacy and effectiveness than Carisolv.
6	Chowdhry S et al International Journal of Clinical Pediatric Dentistry 2015, 8(1);6-11	in vivo study	90 primary molars from 30 children (10 males & 20 females) Age: 6 to 9 years	Clinical efficacy Carisolv = Papacarie Time taken (in seconds) Carisolv = 375.33 ± 41.00 Papacarie = 387.83 ± 38.53 p value = No statistical significance	Clinical effectiveness was almost comparable in Carisolv and Papacarie. Microbiologic al efficacy was almost comparable

				Microbial load after treatment p value = 0.079
				Patient acceptability Papacarie > Carisolv
				Time taken (in seconds) Carisolv = 461.60 ± 25.65 Papacarie = 359.60 ± 28.39 p = 0.001
				Bacterial deposits p = 0.350
				Dentinal tubule destruction p = 1.00

RESULTS:

The search yielded 85 articles, out of which 58 were screened and assessed independently. Among these articles, seven were included and studied (Table/Fig 3).

DISCUSSION:

The chemomechanical dental caries removal technique has gained importance due to its property of selective removal of carious lesions with avoidance of pain^[13].

Carisolv is available either as a single mix or multi mix forms^[13]. It contains sodium hypochlorite, along with three amino acids along with carboxymethyl cellulose that provides viscosity, leading to the removal of infected dentin and preservation of affected dentin^[7,8,13].

Papacarie contains a proteolytic enzyme Papain acting as a selective debriding agent with bactericidal, anti-inflammatory properties^[10, 14]. The gel also contains Chloramine, which enhances the removal of the denatured tissue^[11]. Specific hand instruments are recommended by manufacturers for each of the above agents.

As Carisolv and Papacarie are of different formulations with varied pros and cons, a systematic review was conducted to identify the most potent chemomechanical caries removing agent. This resulted in the collection and analysis of 7 original comparative articles enabling comparison in their efficiency and effectiveness, out of which five were in vivo studies, and two were in vitro trials.

In a study performed by Bohari MR et al^[2] comparing the caries removing property of Carisolv, Papacarie, Er: YAG laser and Airtor, it is revealed that laser irradiation and rotary

instrument were more efficient in caries excavation with less time consumption, but was found to be inferior than the chemomechanical caries removal agents as it caused pain and discomfort to the patients during the procedure. However, the results shown by carisolv and papacarie was not found to be statistically significant. In another similar study by Kochhar GK et al ^[3], in which hand instruments were compared instead of laser irradiation, Papacarie was found to be superior to Carisolv, and rotary excavation was the most painful of all.

The results are on par with an original study by Chowdhry s et al ^[15], which also found out that Papacarie had better patient acceptability than Carisolv.

In a study conducted by Kumar J et al ^[4] in the above design, it was found that despite the fact that both Carisolv and Papacarie were efficient, the latter was concluded to have a marginally better clinical parameter, especially in terms of the time consumed for procedure and volume of dental caries excavated.

The above finding is in agreement with another similar study done by Viral PM et al ^[16]. This study also led to the conclusion that Papacarie demonstrated more marginal leakage after the restoration when compared to Carisolv, and there were no statistically significant results observed on comparing the shear bond strength.

In vitro trials with a similar aim by Boob AR et al ^[6] revealed that the hand instrumentation method was the most superior method of caries excavation followed by Papacarie than carisolv. Another trial by Divya G et al ^[17] proved that there was no statistical difference between Papacarie and Carisolv in terms of bacterial remnants and dentinal tubule destruction post-excitation. However, the former was less time consuming than the latter.

CONCLUSION:

Out of the seven reviewed studies, it is evident that Papacarie is superior to carisolv in terms of chemomechanical caries removal potency with five supportive studies, less pain and discomfort with two evidence-based in vivo trials.

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