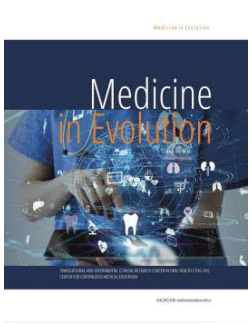
Chemomechanical caries removal – A systematic review



Brisc R.C.[1], Veltean-Corneschi R.L.[1], Vaida B.[2], Vasiliu R.D.[3], Matichescu A.[4], Jumanca D.[4], Craciunescu E.L.[5]

[1]Department of Pediatric Dentistry of Municipal Emergency Clinical Hospital, Timişoara
[2]Department of Dento-alveolar Surgery of Municipal Emergency Clinical Hospital, Timişoara
[3]Department of Prostheses Technology, Specialization Dental Tehnology, "Victor Babeş" University of Medicine and Pharmacy, Timişoara
[4]Department of Preventive, Community and Oral Health Dentistry, Faculty of Dentistry, "Victor Babeş" University of Medicine and Pharmacy, Timişoara; Translational and Experimental Clinical Research Center in Oral Health (TEXC-OH); 14A Tudor Vladimirescu Ave., 300173, Timisoara, Romania
[5]Department of Prostheses Technology and Dental Materials, Faculty of Dental Medicine, "Victor Babeș" University of Medicine and Pharmacy Timișoara, Research Center in Dental Medicine Using Conventional and Alternative Technologies

Correspondence to:
Name: Matichescu Anamaria
Address: Splaiul Tudor Vladimirescu, nr.14A
Phone: +40 788251979
E-mail address: matichescuanamaria@umft.ro

Abstract

Chemomechanical removal is an alternative method with important advantage. The method selectively removes the demineralized, carious dentin, leaving healthy dentin intact. Conventional treatments for caries removal are often associated with annoying sounds, vibration, heat and production of pain.

This systematic review aims to assess the efficacy of alternative methods for caries removal. The Medline, Pubmed, Web of Science, The Cochrane Library and Clinical Trials databases were searched.

Chemomechanical caries removal methods are beneficial both for pacients and dentist. Hence, it is recommended as an alternative method of caries removal.

Keywords: chemomechanical, dental caries, alternative methods, conservative treatment

INTRODUCTION

Dental caries is one of the most common chronic diseases, resulting in localized dissolution and destruction of tooth structure. The new method of caries removal was used to make the treatment more confortable and easier for both patient and doctor. Therefore, alternative methods of conventional caries therapy were introduced for the purpose of minimal invasion without causing pain. These methods are sono-abrasion, air abrasion, ultrasonic, chemo-mechanical systems and lasers. [6]

Also the concept of minimal intervention not only eliminates the pain associated with removal of caries but also can make a positive attitude in children towards dentistry. [1] Chemomechanical tehniques has gained acceptance, especially from children and patients with anxiety.

Chemomechanical system is the most effective alternative to the conventional dental removal method. [7-9]

Chemomechanical caries removal systems are solutions which act on the principle of carious tissue softening to facilitate their removal, applying enzyme-based agents or sodium hypoclorite (NaOCl). [2-4]. After use, the gel changes color or produces bubbles, making easier the identification of the occurring reaction, or absence, meaning no remaining decayed dentin. After that, the softented tissues are been removed by using non-cutting tip intruments. [2-4].

The enzyme-based agents have anti-inflamatory proprieties, wich can lead to less pain and better treatment experiences. Agents with hypoclorite are also associated with less necessary anesthesia, because sodium hypoclorite has its action within the already damaged collagen fibrils [3,4]. Examples of NaOCL-based agents are Carisolv, examples of enzyme-based agents are Papacarie, Brix 3000.

Aim and objectives

The purpose of this study was to carry out a systematic review of the literature to show how efficient are alternative methods for caries removal for both deciduous or permanent decayed teeth. (Table 1).

Table 1. Chemomechanical methods efficiency

Criteria	*Despription*
Intervention	Chemomechanical methods
Outcome	Efficacy for caries removal
Population	Deciduous and permanent decayed teeth

MATERIAL AND METHODS

The present systematic review was performed following the recommendation of Cochrane Handbook of Systematic Reviews of Intervention [5] version 6. Only Controlled trials were analysed with no restrictions on year of publication, status of publication or region.

The participants consisted of healthy adult patients or children with clinical diagnosis of primary dental caries. The inclusion and exclusion criteria is presented in Table 2.

Table 2. Inclusion and exclusion criteria

Inclusion criteria	**Exclusion criteria**
Controlled trials	Abstracts, preliminary reports, in vitro or animal studies
Primary dental caries in healty patients	Secondary caries lesion
Cavitated dentin lesions	More than one technique applied per tooth
One treatment per tooth	Patients with special care, with syndroms

There was two types of interventions:

1. Dental caries was removed with conventional mechanical methods, using both high-speed rotary instruments and excavators

2. Dental caries treatment using chemo-mechanical methods (Brix 3000, Carisolv, Papacarie or Carie-Care)

To identify the studies for this review, an electronic search was performed using the following database: Medline/PubMed (www.ncbi.nlm.nih.gov/pubmed), Cochrane Library (www.cochranelibrary.com), Embase (www.embase.com).

For each database used there was a specific research strategy applied: caries, decay, alternative, removal, brix 3000, carie-care, papacarie, carisolv, enzyme, caridex.

There was no restriction on language or date of publication and the last literature search was performed on 24 February 2021.

We have selected the studies with more than one comparison:

1. Chemomechanical vs Control: 10, 12- 21, 23-25, 27-31
2. Carisolv vs Papacarie vs Control: 11, 22, 30
3. Sodium hypoclorite gel vs Brix 3000 vs Control: 26

Twenty-tree studies 10- 25, 27-31 reporting chemomechanical caries removal systems were included. Two studies 23, 26 involved the used of Brix 3000, and three 18, 19, 27 the use of Carie-Carie, eight 11, 12, 14, 22, 25, 28, 29, 30 the used of Carisolv and twelve 10, 11, 13, 15, 16, 17, 20, 21, 22, 24, 30, 31 the used of Papacarie.

All studies were considered to have an uncertain risk related to other biases. The criteria previously stated were considered to interfere with the outcomes assessed. The generally synthetized reports of the methodology in the included studies led to uncertainty towards the interference of additional biases.

RESULTS

These are the results for the first comparison: Chemomechanical vs Control

All alternative treatment approaches demonstrated longer treatment time. Specifically, this aspect was reported in one study using Brix 3000 [23], in two studies that involved Carie-care [18,27], in three using Carisolv [12,25,28] and in two studies evaluating Papacarie [12,45].Six studies reported caries removal related outcomes.

The final cavity of the conventionally treated tooth was wider. Carisolv produced significantly smaller free caries lesions in one [12] out of three studies and Papacarie [10] in one out of one study.

Regarding efficacy in caries removal and considering the several and different criteria described in the included studies, there was no statistical difference between effectiveness of caries removal with rotary instruments and Carie-care in one [18] out one study and Carisolv in two [25, 29] out two studies. However, in one study [25], Carisolv was statistically more effcient than the excavator.

The patient's pain perception or behavior during the intervention showed significantly better treatment experiences and fewer signs of discomfort or pain. However in the five studies starting treatment without anesthesia, patients receiving conventional treatments requested anesthesia more often than treatment with Carisolv [12,28] and with Papacarie [17, 20,21].

Five studies reported CFU dentin count after treatment. These studies showed significantly reduced total bacterial count. Two studies [13,14] reported similar reductions after conventional treatments and treatment with Carisolv and Papacarie, three studies reported higher reductions when using alternative approaches, such as Brix 3000 [23] and Papacarie [10, 21].

These are the results for the second comparison: Carisolv vs Papacarie vs Control

Carisolv and Papacarie showed longer treatment times. Papacarie was faster than Carisolv in one study [22] and significantly quicker than Carisolv in another study [30].

In one [22] of the included studies, Papacarie was significantly more effcient than Carisolv within the criteria used. In another study [30], there were less remaining caries in the Papacarie group selected than the Carisolv treated patients. None of the included studies reported the anesthesia requested by the patients during treatment. None of the included studies assessed the restoration´s performance. In two of the included studies [22,30], Papacarie induced significantly less pain and offered a more comfortable treatment approach, being the most accepted.

These are the results for the third comparison: Sodium hypoclorite gel vs Brix 3000 vs Control

Only one study [26] was included regarding this intervention. The study has an overall unclear risk of bias. Treatment with the sodium hypochlorite gel and Brix 3000 was significantly longer than that of conventional methods. There was no outcomes related to caries removal. The included study did not report the anesthesia requested by the patients during treatment. Treatment with Brix 3000 was significantly less painful than the conventional methods, followed by treatment with the sodium hypochlorite gel.

DISCUSSIONS

Alternative methods are preferable, because these methods allow more conservative treatments, being more selective in removing decayed tissue and preserving more healthy tissue. The chemomechanical agents are the most conservative treatment approach because of their specific action towards decayed dentin.

In the chemomechanical treatments, despite every method inducing less pain in patients compared to mechanical treatment, it is important to acknowledge the tendency for statistically significantly less pain reported when using the enzyme-based agents, as Carie-Care [18,27], Papacarie [10,13,17,22,24,30] and Brix 3000 [23,26].

The restorations performed by each method did not have significantly difference from each other in terms of longevity and survival. Further discussion in this matter is not possible because of the differences between the clinical restoration protocols in the isolation of the operative field.

CONCLUSIONS

Alternative methods for caries removal tend to prolong treatment time. These methods cause fewer requests for anesthesia during treatment.

Both conventional and alternative approaches are effcient in reducing cariogenic flora from the cavities. The marginal integrity of restorations did not prove to differ significantly between methods for caries removal.

Patients reported more pleasant treatment experiences with alternative treatment approaches than conventional. There was also registered a higher percentages for acceptance and preference in future treatments for alternative methods.

Chemomechanical solutions are the best option for minimally invasive treatments, with good control of their action and application.

Papacarie was the most studied solution in this treatment methods and presented effciency for caries removal and high patients' acceptance.

More studies are needed, comparing more than one alternative treatment simultaneously.

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