Chemo-mechanical Caries removal technology – Dentistry at ease

Dr.Rachna Thakur, Dr.Sandya S Patil, Dr. Anil Kush

Abstract
In the present day of Dental Care, Caries mount a great challenge both in terms of its frequency and technologies available for their safe removal. The conventional way of using bur/ drill creates another barrier between the Patient and Doctor often resulting in avoidance of visit to a dental doctor. The transformation from the traditional concept of “extension for prevention” to “minimal invasive dentistry” has given various rationales to manage the dental caries. Providing emphasis on preserving the tooth structure along with a suitable patient-dentist team-care approach to maintaining oral health, the chemomechanical caries removal (CMCR) technology stands out among the other available options. CMCR is a minimally-invasive, gentle dentine caries removal based on biological principles. With the range of products available under CMCR, the latest added to this group is Carie Care, a natural endoprotein based formulation containing papaya extract. This paper presents the literature review, limitations of other CMCR agents with the case report on clinical application of the same.

Introduction
Dental caries is the most common chronic disease, being at least five times more common than asthma. It affects at least 90% of the world’s population at some time in their lives. It is the primary cause of tooth loss in children, while between a third and two thirds of people over 50 years’ experience caries too.

Due to lack of awareness of oral health among the Indian population, majority of the population report the dentist with the complaint of sensitivity and pain due to dental caries which require restorative procedures. Also, people don’t go to the dentist regularly is fear. There are several clinical technologies available for cutting teeth and removing caries. The conventional method using the turbine handpiece is synonymous with anxiety for many patients whereas other treatment options are not self-selective for caries-infected dentine and involve active discriminatory action from the operator when considering minimal invasive operative caries management strategy. If the patients’ can be offered with a treatment option that is completely non-invasive, that doesn’t involve a mechanical drill, then the dental surgeons’ can change that perceived link between dental treatment and pain.

Recently developed techniques such as laser, chemomechanical excavation and air abrasion have been shown to be more or less successful in overcoming these problems; Chemomechanical caries removal system (CMCR) stands out among other alternative methods. Hence the recently developed CMCR system, Carie CareTM has such much amplified effect on anxious and fearful patients who are much more sensi-

Key words: Chemomechanical caries removal, dentinal caries, conventional drilling.
CMCR consists of the dissolution of carious tissue by the application of a natural or synthetic agent, followed by atraumatic mechanical removal. CMCR was first described by Habib and co-workers in 1975, using 5% sodium hypochlorite. Subsequent studies have introduced formulas with the same purpose, such as Caridex™, Carisolv™, Papacarie™ and Carie Care™.

Carie Care™ is a natural product developed by extensive research at Vittal Mallya Scientific Research Foundation, a Ministry of Science and Technology, Govt of India approved Research Centre. The research involving biotechnology, natural products chemistry and cell biology was followed by lots of scientific and clinical validation for its efficacy and safety by various in-house and external accredited agencies including multiple dental colleges. Eco works India Pvt Ltd, Bangalore has launched the product with an aim to make it available to the large population at a reasonable price using efficient supply chain (Figure -2). This product is a gel based on the papaya extract, an endo-protein in combination with essential therapeutic oils. This active ingredient has proteolytic action that would soften the pre degraded collagen of the lesion without pain or undesirable effects to adjacent healthy tissues with the antiseptic and anti-inflammatory properties of the essential therapeutic oils.

Mechanism of action of CMCR agents and Carie care on the affected tissue: When the organic matrix of the enamel and dentine has been demineralised, the collagen and other matrix components are then susceptible to enzymatic degradation, mainly by bacterial proteases and other hydrolases. With respect to collagen degradation, two histopathological zones can usually be distinguished within a dental lesion. There is an inner layer (deeper caries-affected zone), which is partially demineralised and can be remineralised and in which the collagen fibrils are still intact, and there is an outer layer (peripheral caries-infected zone (close to the enamel-dentine junction [EDJ]) where the collagen fibrils are partially degraded and cannot be remineralised.

A CMCR reagent must be able to cause further degradation of this partially degraded collagen, by cleavage of the polypeptide chains in the triple helix and/or hydrolysing the cross linkages. The polypeptide hydrolysis is brought about by endopeptidases extracted and purified to homogeneity from papaya extract (Figure -3).

In addition to the papaya extract, therapeutic oils present in the formulation exhibit natural analgesic and antiseptic action. It minimises any sensitivity and pain sensation while application thus ensuring a soothing effect and has a pleasant taste acceptable by the patient (Figure -4).
Indications / Case selection: Caries-infected dentine is necrotic, wet, sticky and soft to a sharp dental explorer whereas caries-affected dentine is a little more tacky (‘scratchy and sticky’) in nature and blends to the hard, scratchy consistency of deeper sound dentine. The success of the procedure depends on the question “How much dentine caries should be excavated?” the answer to this question depends on the following criteria:

a) Pulp status: The vitality (sensibility) of the pulp must be assessed from the clinical signs and symptoms and suitable investigations like sensitivity tests.

b) Lesion depth: Lesion-pulp proximity affects the level of protection afforded to the vital pulp. Indirect pulp protection (capping) conserves caries-affected dentine close to the pulp, minimising the risk of unnecessary pulp exposure.

c) Extent of viable tooth structure: The functional and aesthetic restorability of the tooth must be assessed. A minimal invasive technique conserves more tooth structure that can help retain and support the definitive sealed restoration.

Thus considering all the key points, the ideal indication for the usage of Carie care is any carious lesion extending into the dentine. The cases may vary from the pin point or bottle neck caries into the dentine to the grossly carious lesion in the dentine. It is an established approach for the anxious patients and young pediatric patients.

**Limitations of other CMCR agents:** The challenges the Indian dental doctors faced with respect to imported CMCR products like Carisolv and Papacarie are their astronomical cost, non availability at ease, short shelf life, difficulty in using, special instruments/gadgets and skill set required compounded by often the unpleasant smell of the product. These challenges seem to be addressed by innovative Carie Care whose availability in all the pockets of India still waited. The initial feedback both from doctors and patients have shown over 90% as satisfying experience both for the product efficacy and patient-doctor acceptability (Table – 1)

Table – 1: Comparison of the three leading products in terms of pain perception, requirement of local anaesthesia as efficiency of removal of caries from.

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<th>Carisolv</th>
<th>Papacarie</th>
<th>Carie-care</th>
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<tbody>
<tr>
<td>Pain perception</td>
<td>++</td>
<td>+</td>
<td>--</td>
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<tr>
<td>Requirement of LA</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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<td>Efficiency of caries removal</td>
<td>Good</td>
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Case Report with the management: A 14 years old male patient with the deep dentinal caries in relation to 36 without any clinical symptom of pain and sensitivity was selected (Figure - 5A).

The radiographic evaluation was done to confirm the extent of caries into the dentine with no pulpal involvement. The tooth was isolated using the proper isolation method (Figure - 5B).

The caries excavation was done according to manufacturer’s instructions. The carious lesion was covered with the gel and left undisturbed for 30-60 seconds (Figure - 5C). The gel was removed by gently scrapping with the spoon excavator without applying pressure. Removal of the caries was continued until the hard and affected dentine appeared on the tooth. Then gel was removed and the cavity was wiped with the moistened cotton pellet and rinsed (Figure - 5D).

Dental caries in children continues to affect a significant portion of the world population, especially in developing countries. There are many techniques used for dental caries treatment. The conventional method is to remove caries and prepare the cavity using dental burs. Disadvantages of this method; however, include the patients’ repulsion of drilling, and possible thermal changes on tooth surface that may have an effect on the dental pulp tissues. In addition, the drilling technique frequently requires local anaesthesia injections and sometimes results in the removal of sound tooth tissues. To overcome these problems and preserve the healthy dental tissues, the chemo-mechanical caries removal method was developed. The advantage by chemomechanical caries removal include less traumatic, less need local anaesthesia, reduced chance of dental pulp exposure. And also it could be benefit to medical compromised patients. Rotary instruments may still be required however for some cavities but preliminary reports indicate that patient acceptance is very good 15, 16.

In a recent clinical trial in India, a total of 64 teeth of 32 children with class 1 open carious lesion...
were selected for the study. They were divided into two equal groups according to method of caries removal (32 chemo-mechanical using CarieCare and 32 conventional drilling from both primary and permanent teeth respectively. After the cavity preparation by either of the two methods, the teeth were restored and were later followed up after 1 week, 1 month, 6 months and 1 year respectively for its clinical success.17.

The results showed that the two techniques were comparable in caries removal efficiency and removal of caries by Carie care was pain less, non-invasive, safe and more patient friendly.

The above study does underlines and supports the previous extensive studies which also showed better efficiency of a new product Carie Care in various patients tested17, 18, 19, 20.

Conclusion: Development of a clinically effective CMCR, which is harmless to healthy tissue and bio-compatible has given a conservative clinical approach to the management of the extensive caries. The new system offers considerable attractions for the clinician to opt it as a routine practice for the painless and non-invasive approach thus ensuring a positive patient dentist relationship. Carie Care provides a unique opportunity of pain-less bondage between the patients and dental doctors as such- which could serve as a unique step in dental health in country like India.

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