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**Dr. Sham S Bhat**  
Department of Paedodontics,  
Yenepoya University,  
Mangalore, Karnataka, India.

**Dr. Shaniya Sain**  
Department of Paedodontics,  
MES Dental College,  
Perinthalmanna, Kerala, India.

**Dr. Sundeep K Hegde**  
Department of Paedodontics,  
Yenepoya University,  
Mangalore, Karnataka, India.

**Dr. Vidya Bhat.S**  
Department of Prosthodontics,  
Yenepoya University,  
Mangalore, Karnataka, India.

## **Efficacy of chemomechanical caries removal**

**Sham S Bhat, Shaniya Sain, Sundeep K Hegde, Vidya Bhat.S**

### **Abstract**

Majority of the rural population does not have access to dental treatments. Poor oral health results in significant increase in dental caries. In this study chemo-mechanical agent was used for the removal of caries. Aim: To compare the efficacy of chemomechanical caries removal with that of conventional excavation technique using laser fluorescence. Methodology: Carious primary teeth each from a total of 30 children were chosen for this study. Molars with brown and softened dentine and having defects with broadly comparable depths from different quadrants were chosen for the study. Conventional caries removal was carried out with bur. Chemo-mechanical caries removal was done and compared with the control. DIAGNOdent values were recorded before and after the procedures. *Statistical methods:* The data was analyzed by paired T test. Results: Chemo-mechanical techniques are equally effective as conventional bur for caries removal

**Keywords:** chemo-mechanical agent, DIAGNOdent

### **1. Introduction**

Majority of the rural population does not have access to dental treatment in India. In addition, they lack literacy and are unaware of the consequences of poor oral hygiene. Poor oral hygiene drastically increases the probability of occurrence of dental carries. Basic interventions in the form of minimally invasive modalities like atraumatic restorative treatments, chemo-mechanical caries removal can be performed in rural areas with less instruments and in atraumatic manner. The chemo-mechanical removal of caries involves the chemical softening of the infected dentin, followed by the mechanical removal of the softened tissue using non-cutting manual instruments. In this study a newer chemo-mechanical agent was used for the removal of caries. It has the capability of dissolving carious tissue and is less expensive than other agents available in this strata. Reduction of risk to disease is only possible if services are oriented towards primary health care and prevention. If the result turns out to be positive it will be an effective method in providing primary health care. The findings of this study would highlight the need to establish distinct preventive and rehabilitative treatment strategies tailored to meet the specific needs of rural population.

An alternative method to conventional caries removal techniques is the use of chemo-mechanical techniques which will make the child co-operative to the dental treatment as this technique is free of sensitivity or pain<sup>[1, 2, 3]</sup>.

#### **1.1 Aim of the study**

To compare the efficacy of chemomechanical caries removal (caries- care) with that of conventional excavation (airotor) technique using two different parameters such as

1. Radiograph
2. Laser fluorescence

#### **1.2 Objective of the study**

1. To compare the efficacy of Carie- care with that of high speed bur
2. Evaluation of the use of Carie-care in interventional treatment modality

#### **1.3 Study Design:** In vivo study

#### **1.4 Inclusion Criteria**

Healthy children between 6 and 12 years of age with no defects in tooth formation or tooth development

#### **Correspondence**

**Dr. Sham S Bhat**  
Department of Paedodontics,  
Yenepoya University,  
Mangalore, Karnataka, India.

### 1.5 Exclusion Criteria

Defects in tooth formation or tooth development

### 2. Material and Method

Ethical clearance was obtained from Yenepoya university ethical committee before commencing the study and informed consents were obtained from parents of all children.

Two carious primary teeth each from a sample of 30 children was chosen for this study. Those children who were systemically healthy, showing normal development for age, and have no defects in tooth formation or tooth development was selected. The degrees of destruction of the molars were determined with a dental probe, radiographic methods and DIAGNOdent, using clinical criteria.

#### 2.1 Clinical criteria

Dental probe is used to access the depth and extent of carious lesions. Radiographs were pre-operatively used to confirm the extent of lesion and post-operatively to confirm the complete removal of the caries. DIAGNOdent was used as a guide to access the extent of lesion and to confirm its removal in a non-invasive manner.

Standard DIAGNOdent value

0-12----healthy tooth structure

13-24----decalcification

>25----dental caries

Molars with brown and softened dentine and having defects with broadly comparable depths (moderate caries or deep-seated caries) from different quadrants were chosen for the study.



Fig 1: DIAGNOdent

#### 2.2 Clinical procedures

Before caries removal, the selected teeth were radiographed and the DIAGNOdent values (fig-4) were taken. Caries removal was done by means of the respective methods. Conventional caries removal was carried out with a round bur on an airtor handpiece. After conventional caries removal with a spherical bur, dentine was considered caries-free, using established clinical criteria, with a dental probe. Carie-care (fig-1) was used for the chemomechanical caries removal. The gel was applied to the carious dentine (fig-2). After 60 seconds the softened dentine was removed with an excavator, without exerting force. It was repeated until the gel no longer turns cloudy with debris (fig-3). In those cases where there would be no sufficient access to the carious dentine, an access cavity was prepared with a high-speed drill. After the caries removal DIAGNOdent values were taken. Radiographic evaluation was done immediately after the restoration.



Fig 2: Carie-care

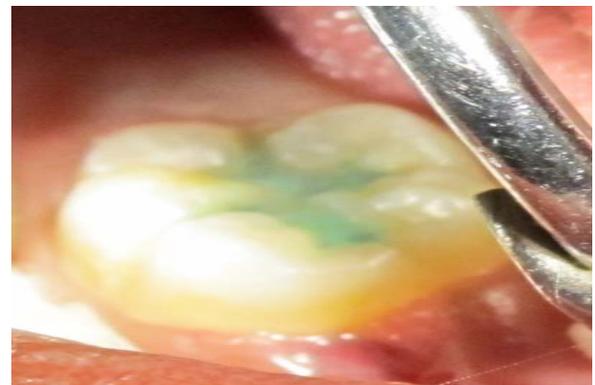


Fig 3: Carie-care application



Fig 4: after caries removal with Carie care

### 3. Results

DIAGNOdent values recorded from the 30 patients' pre and post for both groups was analyzed using paired t test. Statistical analysis of the results done by paired t test. The DIAGNOdent values pre and post had a significant difference.

**Table 1:** depicting the paired t test values

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	Bur1 - Carie-care1	1.867	11.125	2.031	-2.288	6.021	0.919	29	0.366
Pair 2	Bur2 - Carie - care2	-1.767	6.951	1.269	-4.362	0.829	-1.392	29	0.175

Both bur and carie-care were equally effective in caries removal. IOPA radiographs have also shown complete caries removal

#### 4. Discussion

Conventional drilling is the most common clinical procedure for caries removal, but it generates pain, fear, discomfort, and anxiety in children [4]. Chemomechanical caries removal eliminates the use of anesthesia, painful symptoms, and unnecessary removal of the sound tooth structure, as only the carious dentin is removed and the painful removal of sound dentin is avoided [5]. The dentinal carious lesion can be divided into two zones. An outer layer of infected dentin, in which the collagen fibers are partially degraded and cannot be demineralized, and an inner layer of affected dentin, which is partially demineralized with intact collagen fibers and can be remineralized. A chemomechanical caries removing system, acts by causing further degradation of the partially degraded collagen, in the infected dentin. The mechanism of action of the caries removing gel used in this study appears to be similar [6]. Conventional caries removal and cavity preparation entail the use of the burs. Disadvantages of this system include:

- (1) The perception by patients that drilling is unpleasant.
- (2) Local anesthesia is frequently required.
- (3) Drilling can cause deleterious thermal effect combined with the use of pressure for caries removal, causing pulpal effects.
- (4) The use of a hand piece may result in removal of affected dentine, resulting in an excessive loss of sound tooth tissue [7].

Chemomechanical caries removal has the following advantages over traditional drilling:

- (1) Less perception of pain and more comfortable for patient.
- (2) Less fear and anxiety lead to less discomfort to patients especially in children.
- (3) Removes only infected layer and leads to more tissue preservation.
- (4) No pulpal irritation.
- (5) Well suited to the treatment of deciduous teeth, dental phobic's and medically compromised patients.
- (6) Better removal of caries in uncooperative patients.
- (7) Useful in physically handicapped patients.
- (8) Useful in patients with T.B like infectious diseases (prevent droplet infection).<sup>7</sup>

DIAGNOdent values showed a significant reduction. Post values using bur was in the range of healthy tooth structure. Values using Cariecare was in range of decalcification. When comparing bur and carie-care, bur showed complete caries removal and was faster. While carie-care minimal tooth structure was removed. It was selectively removing only carious dentin. Patient co-operation was more with carie-care. There was no tooth sensitivity. Noise was not there as with airtor

#### 4.1 Composition (give the functions of individual ingredient)

**Table 2:** Ingredients and its functional role

INGREDIENTS	FUNCTION
Papaya extract-100mg	break peptide bond, anti-bacterial and anti-inflammatory properties
Clove oil-2mg	analgesic
Colored gel-10mg	
Sterile water-1ml	vehicle
Chloramine	dissolve carious dentin
Sodium chloride	for isotonicity
Sodium methyl paraben	preservative
Sodium propyl paraben	preservative

#### 4.2 Mechanism of action

According to the manufactures modus operandi Papain in Carie-care breaks peptide bonds and involves deprotonation. There is a nucleophilic attack on the carbonyl carbon and peptide there by it frees the amino terminal of the peptide and forms a covalent acyl intermediate. The enzyme is then deacylated by water molecule and release the carboxy terminal portion of the peptide. Papain also exhibits anti-bacterial and anti-inflammatory properties. Papain in papaya extract acts as a debris removing agent, with no harmful effects of sound tissues because of the enzyme specificity. It acts only on affected tissues. It lacks the all anti trypsin plasmatic anti-protease proteolysis in healthy tissues. In addition to Papain, the chloramines present in the product have the potential of dissolving carious dentin by means of chlorination of the partially degraded collagen. Thus chloramines help to soften the carious dentin, thus facilitating its removal. Clove oil is a natural analgesic.

**Table 3:** Comparison of dental drill over carie-care

Dental drill	Carie-care
Invasive	Selective
Low precision	Precise
Pain	painless
Sensitivity	No sensitivity
Noise	No noise
Patient un-co-operative	Co-operative

There were no side effects in soft and hard tissues of mouth. Within the philosophy of health promotion; the Carie-care may represent a new option for caries removal. Carie-care is more economical when compared to other chemo-mechanical agents. The product is readily available in Indian market. The chemo-mechanical caries using carie care seems to be more practical clinically than other minimally invasive techniques like

- atraumatic resin restoration where the caries cannot be completely removed by manual instrumentation alone
- air abrasion-due to specialised instruments and the need of power supply
- lasers-because of the large unit with a very sensitive delivery system and is not cost effective

Further clinical studies with large samples, long term follow-up and comparison with other agents are required.

## 5. Conclusion

Chemo mechanical agent might be an alternative method for caries removal because of utmost patient co-operation. It will remove the fear of the dental drill and make the child co-operative to the dental treatment.

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