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CARISOLV: AN AID FOR NON INVASIVE DENTAL CARIES EXCAVATION

Public Health

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ABSTRACT

A new technique of caries removal has been introduced in dentistry recently due to the advances and development of more preservative method of caries removal. Instead of using old methods of drilling and cutting, this new technique involves chemico-mechanical removal of infected tooth structure using material like Carisolv. Application of carisolv will make the patient more comfortable while caries removal as less pain occurs while excavating the caries using carisolv. Further, Carisolv allows removal of only infected dentin and preservation of affected dentin which can be remineralized in the future. Thus, Carisolv is considered as a minimal invasive approach of treating the dental caries. This review includes the study conducted in the recent years comparing the conventional or mechanical method versus chemico-mechanical method using Carisolv.

KEYWORDS

Carisolv, Minimal invasion, Dental caries

INTRODUCTION:

Dental caries is the most prevalent oral disease and it is a matter of concern worldwide [1]. Dental caries has inner and outer layers. The outer layer of dentin comprised of infected dentin and demineralized dentin. Whereas, the inner layer consists of demineralized layer of dentin which is less decalcified and has no bacterial invasion [2]. The conventional technique removes the infected or the outer layer as well as the affected or inner layer. So, a new method of caries excavation was introduced in dentistry, which is called as chemicomechanical method of caries removal. This method includes application of Cariosolv gel, which removes the outer layer and preserves the inner layer for future remineralization process[3].

The first chemicomechanical agent which came into the market was G K 101 in 1972[4]. Later on, came the product Caridex, which was costly, required special equipments and had short life span [3]. So, in 1998 Carisolv (MediTeam Dentalutveckling AB, Savedelen Sweden) was introduced which consisted of one part of sodium hypochlorite and second part consists of three amino acids- lysine, glutamic acid and leucine. When the two parts are mixed prior to the procedure, these acids gets chlorinated and improved the effect of sodium hypochlorite on denatured collagen, and decreases the involvement of healthy hard dental tissue [5]. This sodium hypochlorite is also responsible for the antimicrobial effect of Carisolv. This review discusses this new minimal invasive agent of caries removal i.e. Carisolv. It may be a method of choice in pediatric dentistry as it makes the child more comfortable, no vibrations and pain can be felt by the child during the treatment[6].

MECHANICAL VERSUS CHEMICOMECHANICAL METHOD (CARISOLV):-

Since ancient times various mechanical approaches were used for excavating these dental caries from tooth structure. These techniques used to be painful, ineffective, removed healthy dentin and were uncomfortable for the patients as well. The conventional mechanical method of caries removal involves use of carbide burs and rotary instruments[7]. The sounds of these rotary instruments are very uncomfortable for the already anxious patients. Further, the speed of these rotary instruments poses a risk for pulp exposure.

The traditional method require excessive tooth cutting for proper retention and resistance of restoration which makes the tooth brittle and weak. Further, this method is traumatic for the already feared and anxious children as it causes vibration, noisy sound as well as pain. Now days, the ideal restorative dentistry rely on the principle of maximum preservation of tooth structure using minimal invasive techniques [8,9,10].

The newer minimal invasive techniques involve use of air abrasion, lasers, chemico-mechanical methods of caries removal, sonic oscillations and other atraumatic restorative techniques. Among these, the most acceptable and comfortable minimal invasive technique is chemico-mechanical removal of dental caries using Carisolv[11]. The main objective of using Carisolv is excavation of only soft and infected tooth structure and preservation of sound tissue.

MECHANISM OF ACTION OF CARISOLV

In dental caries process, dentinal tubules provide entrance to the acids and bacteria. This acid causes a decrease in pH which further result in, demineralization of inoranic and dissolution of organic matter. Carisolv causes breakage of polypeptide chains and hydrolyze the cross linkages. This disruption results in friable collagen fibrils which can then be removed easily[12].

I *Antimicrobial action* –

It has been already proved that bacteria are the main causative factor in the initiation and succession of dental caries[13]. Two bacterial species responsible for dental caries are mutans streptococci and lactobacilli [14]. Mutans Streptococci is the main micoorganism responsible for initiation of any dental caries. Gisele Quariguasi Tobias et al. evaluated the influence of Chemo-mechanical (Carisolv) and mechanical (rotatory) methods on the reduction of the number of S. mutans and Lactobacillus[15]. It was observed that carisolv reduces the number of these bacteria though this reduction was less as compared to mechanical method.

Reddy M V C et al did a study to to evaluate the antimicrobial efficacy of Chemicomechanical caries removal agents (CMCR agents) Carisolv and Papacarie. Difference in the bacterial count before and after application of CMCR agent was considered as the measure for its antibacterial efficacy [16]. Before using the CMCR agent, a dentin sample showed increased number of microorganisms and degraded collagen (infected dentin). It was found in the next dentin sample that the bacterial count reduced in affected dentin after the application of CMCR agent. Further it was concluded in the study that Carisolv excavation resulted in a significant reduction of all tested viable bacteria.

Similar results have been reported in the study done by Lager et al. They did a study to measure the amount of vital bacteria after excavation using conventional mechanical bur or the chemo-mechanical Carisolv method. The Carisolv-treated dentin showed increased reduction in Colony Forming Units after excavation compared to the drill treated cavities [17]. The reason for this antimicrobial activity of carisolv can be chloramines or sodium hypochlorite.

II *Efficient dental caries removal*

Absolute removal of caries is necessary for treatment of dental caries. So, the main purpose of using carisolv is efficient caries removal. Kumar KVKS et al did a study to compare the effectiveness of various caries removal techniques in mandibular primary molars using smart burs, atraumatic restorative technique (mechanical caries removal) and carisolv (chemomicomechanical caries removal) among primary school children in clinical and community based settings. Carisolv was found to be superior to the mechanical caries removal in terms of time, efficacy, and acceptance in both clinical and community based settings[18].

Banerjee A, Kidd EA and Watson TF, also evaluated the efficiency and effectiveness of various caries excavation methods and observed that the Carisolv gel, air-abrasion and hand excavation methods were found to prepare the cavities of a similar extent when related to the Autoflourescence signature of the lesion, whereas the bur technique tended to over prepare cavities and the Sono-abrasion tended to under prepare its cavities [19].

Fure S, Lingstrom P, Birked D did a study to evaluate a new chemo–mechanical method (Carisolv™) for the removal of primary root caries in vivo in terms of efficiency, treatment time and patient perception. It was seen in the study that root caries can be effectively removed using the Carisolv method [20].

S No	Author	Year	No of teeth with caries	No of Patients	Measures	Technique	Mechanical method	Carisolv
1	Hosein [21]	2008	60	30	Incomplete removal	Clinical assessment	0/30 (0%)	3/30(10%)
2	Peric [22]	2009	120	120	Pain perception	Patient survey	10/24 (41.6%)'No pain'	46/53 (86.7%) 'No Pain'
					Anaesthesia needed		36/60 (60%)	7/60(11.6%)
					Patient satisfaction	Patient survey	47%	85%
3	Avinash A [23]	2012	30		Antibacterial property	Bacterial colony count remained after excavation	Deciduous teeth – 13.33% Permanent dentition – 13.33%	Deciduous teeth – 33.33% Permanent dentition – 40%
4	Pai V S5	2009	20		Penetration of dentin bonding resins	SEM Observation	10um	15 um
5	Goomer P[24]	2013	150	80	Pain Score	Visual Analogue scale	Air rotar - 77.2 ± 19.7 Hand instrument- 60.40+/-13.0	20.40+/_12.28
						Verbal pain scale	Air rotar -2.72+/-0.607 hand instrument 1.84+/-0.548	0.82+/- 0.2
					Time taken	Time scale	Air rotor 202.30+/_66.60 hand instrument 414.66+/_103.51	580.26 s +/_121.702
					Efficacy	Ericson D et al scale	Air rotor - 0.480.303 Hand instrument technique-2.62 0.490.	Carisolv - 1.20 0.833
6	Divya G [25]	2015	60		Bacterial remnants	Conventional light microscope.	Absent – 9/10 Present 1/10	Absent – 6 Present - 4
					Dentinal tubule destruction	Conventional light microscope.	Yes – 8/10 No – 2/10	Yes – 0/10 No – 10/10
					Time taken for caries removal	Stop watch	155.40	451.40
7	Bohari M R [26]	2012	120		Efficacy	Diagnodent pen values	Preoperative – 67.8 (24.1) Postoperative – 4.4 (4.3)	Preoperative – 73.2 (22.8)Postoperative – 7.0(4.5)
					Efficiency	Time taken	206.7+_ 22.1	474.7+_43.0
					Pain	FLACC Score	2.93+_1.74	1.13+_ 1.25

PROCEDURE OF USING CARISOLV

Carisolv "new gel" which is marketed by Mediteam Dental AB (Goteborg, Sweden) is a gelatinous substance for chemomechanical caries removal. The delivery system is termed as the “new carisolv twin Multimix Syringe Dispenser”. It mixes the two components in equal proportions which results in the formation of an active gel. This gel is then applied onto the carious part of the tooth. It consists of 3 parts (Figure 3): (1) a syringe containing the dual components of carisolv, (2) static mixer that mixes the two components and (3) a plunger to dispense the mixed gel. The carisolv gel was mixed using the Multimix Syringe Dispenser. The required amount of active gel (few drops) is dispensed into a suitable container; drops of the gel were removed from the container with a carisolv instrument. It is then applied to the carious dentine. The carious lesion was completely soaked by the gel for at least 30 seconds but not more than 60 seconds[27].

Following this, carisolv instruments were selected to match the size, position and accessibility of the cavity. The superficial softened carious dentine was gently excavated and scraped using a spoon excavator, flushing or drying the cavity was avoided. On application, the gel was clear, but became opaque or cloudy when it was contaminated with the debris during removal. Then gradually new gel was added and continued excavated and scraped. The procedure was repeated until the gel was no longer cloudy and the cavity surface was felt hard with the excavator. The cavity was checked for remaining caries using an explorer, when the cavity was felt free from caries it was wiped with a moistened cotton pellet or rinsed with water[27].

ADVANTAGES AND DISADVANTAGES

The advantage of chemomechanical agents are [12,28]:-

1. It removes only infected dentin
2. Conserves the tooth structure
3. Reduced risk of pulp exposure
4. Pain free procedure
5. Bio compatible, with no pulp reaction.
6. Helps in bonding of adhesive fillings.

The limitations or disadvantages of carisolv are [29]:-

1. Time-consuming
2. Unpleasant smell
3. Unpleasant taste
4. Costly

5. Due to prolonged time the patient may become uncooperative
6. Limited shelf life
7. Wastage of material while re-application

CONCLUSION

It is now believed that preservation of the tooth structure is the best way to treat the dental caries. So, the treatment procedure should be kept as less invasive as possible to provide maximum life to the tooth structure. Carisolv has proved to be an efficient method of caries removal. Though, it is a time consuming but it is the method of choice for caries removal in case of anxious patient, pediatric patient as well as special and old age patient.

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