



International Journal of Applied Dental Sciences

ISSN Print: 2394-7489
 ISSN Online: 2394-7497
 IJADS 2017; 3(4): 423-425
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 www.oraljournal.com
 Received: 25-08-2017
 Accepted: 26-09-2017

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Let's fill and not drill! A new innovation: A review

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Abstract

The foundation for all that exists in dentistry today was laid with the principal of G.V. Blacks "extension for prevention". Dental caries, one of the common chronic oral infections, is the second largest cause of tooth loss after periodontitis [1]. The chemo mechanical caries removal system proves to be an effective alternative to the traditional caries removal methods [2]. This method uses a chemical agent assisted by an atraumatic mechanical force to remove soft carious tooth structure.

Keywords: not drill, chronic oral infections

1. Introduction

Historical perspective

The history of chemo-mechanical caries began in 1975, when Habib *et al* began to test methods for the removal of carious dentin using sodium hypochloride [8]. It was too corrosive for use on healthy tissue and so they decided to incorporate it into Sorensen's buffer in an attempt to minimize this problem. In order to overcome the problems of chemical instability of and its adverse effects on the healthy tissue, a solution was formulated which was mixed with sodium chloride and N-chloroglycine [GK-101]. In subsequent studies they found that system was more effective if glycine was replaced by amino butyric acid, the product then being N-mono chloro aminobutyric acid also designed GK-101E [7-6]. The NMAB system was patented in the US in 1975 and a further patent was taken out by the National Patent Dental Corporation, New York in 1987. It received FDA approval for use in the USA in 1984 and was introduced in the market in 1980's as caridex [8-10].

Although the Caridex system initially proved to be quite popular large volumes of solution were needed and the procedure was slow. Only certain cavities were suitable for treatment by the technique and because of the time involved and limited use, popularity in the US. So the product has limitation in clinical practice as the large volume of the solution required, short expiry date, need of bulky equipment and preheating. In the early 1990's Caridex ceased to be marketed. The latest CMCR reagent known as Carisolv hit the headlines in January 1998. Although this is similar to the Caridex and NMAB systems it is in the form of a pink gel which can be applied to the carious lesion with specially designed hand instruments which have recently been modified. Because it is a gel, the volume required is now less than one milliliter and it requires neither heating nor a delivery system. The gel is applied to the carious lesion with one of the hand instruments and after 30 sec, carious dentin can be gently removed. The time required for the procedure is about 9-12 min and the volume of gel is only 0.2-1.0 ml. The solution does not need to be heated or applied through a pump mechanism and the increased viscosity of Carisolv enhances precision placement. The overall stability is increased which gives it an improved shelf life. In Brazil since 2003, a new formulation for chemo-mechanical caries removal was launched called papacarie [3].

Various methods of cavity preparation

| | |
|------------------------|--|
| Mechanical, rotary | Hand pieces with burs |
| Photo-ablation | Lasers |
| Chemo-mechanical | Caridex, Carisolv, Enzymes |
| Mechanical, non rotary | Hand excavators, Air abrasion, Air-polishing, Ultrasonics, Sono-abrasion |

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Caridex

The GK101 material is normally going to soften only the infected layer of carious dentine by selective attack on the degenerated collagen. It consists of solution of GK-101E, reservoir, heater, pump, hand piece and applicator tip attached to the hand piece. The tip is used for the delivery of solution heated at 37°C and as an exactor to remove the loosened carious dentin through gentle abrasion technique. The solution temperature was maintained at 35°C. Second, the air released from the air water syringe had mean temperature of 23.6°C. This source of thermal trauma may account for pain which was described as cool or cold. This condition was a cause of concern during operative procedure close to the pulp and also during drying of acid etched teeth prior to the placement of composite resin^[5].

Composition of carisolv

The residual dentin after carisolv application had an irregular surface, amorphous layer and small number of dentinal tubules^[12] Carisolv new gel is a viscous substance for chemo-mechanical caries removal^[13]. It consists of two basic components: one is a transparent liquid containing 0.5%. The other component is red gel containing 0.1M mixture of three amino-acids leucine, lysine and glutamic acid. Carboxymethyl cellulose enhances viscosity, erythrocin dye stains the carious dentin, provides a PH of 11. Sodium Chloride and purified water acts as the vehicle^[4].

Glutamic acid, leucine and lysine improved the clinical efficacy. Red dye (erythrosine) was added, which made it easily distinguishable from the tooth surface. The concentration of amino-acids was halved and the concentration of NaOCL was doubled in Carisolv new gel when compared to original carisolv^[13].

Delivery system is termed as the 'new carisolv twin multi-mix syringe dispenser'. It mixes two components in equal proportions, resulting in active jel which is then applied to the carious lesion. It consists of three parts: a] A syringe containing dual components, a] A static mixer that mixes the two components, c] A plunger to dispense the mixed jel^[4]. The previous research has shown that original carisolv caused no, or minor deviations to the pulp tissue compared to the control groups after direct or indirect contact^[13].

Mode of action

The active ingredient in Carisolv is Sodium hypochlorite which causes selective softening of the outer layer of the carious dentin. Due to the high PH of 11 only the organic phase of the dentin is affected^[4]. There is a risk of perforating the pulp chamber because carisolv hand instruments could cause iatrogenic damage and come in contact with the vital tissue^[13].

Papacarie

Dr. Sandra Bussadori, a professor at the university of Sao Paulo and Dr. Maria Mizziara, the home of formula pharmaceutical and action introduced Papacarie Papacarie is a papain based gel product for the selective removal of the carious dentin. Papain acts only on the infected dentin that lacks alpha -1 -antitrypsin, a substance that inhibits its proteolytic action on the healthy tissue^[7-7]. Papacarie thus softens the infected dentin allowing its easy removal. The time needed for the treatment using papacarie was 6 min. In accordance with the study conducted by Pandit et al, time needed for the caries removal was 4-5min with traditional methods and 8min using carisolv^[7]. The residual dentin after

application of papacarie had two patterns of dentinal substrates. The first pattern presented an amorphous layer similar to smear layer and exposed dentinal tubules^[12].

Composition of papacarie

Papain, Chloramine, Toluidine blue, Preservative, Thickeners and vehicles.

Papain is extracted from the latex of leaves and fruits of green papaya. The product is gel based on papain, a proteolytic cysteine enzyme that has antibacterial and anti inflammatory properties^[11, 4-5]. Papain acts as a debris removing agent, with no harmful effect on the sound tissue because of enzyme's specificity. It acts on the tooth necrotic tissues which lacks α 1-antitrypsin plasmatic antiprotease that inhibits proteolysis on healthy tissue^[11].

Chloramine Compound of chlorine and ammonia that has bactericidal and disinfectant properties. It is a chemical softener, so the secondary structure or quaternary collagen is affected, breaks down the bridges of hydrogen, facilitates the removal of decayed tissue.

Toluidine blue is a dye, Powerful antimicrobial agent and nontoxic photo sensitizer used because most of the oral bacteria do not absorb visible light. Carica papaya seed extract is currently being marketed as nutritional supplement with purported ability to rejuvenate the body condition and to increase the energy. The products claim to improve the immunity against common infection and body functioning^[6].

Conclusion

The chemo mechanical caries removal system proves to be an effective alternative to the traditional caries removal methods. But, these systems are time consuming as compared to the traditional caries removal methods.

The chemo mechanical caries removal system is a non fear provoking and non anxiety inducing system.

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