

REVIEW ARTICLE

CARISOLV- "A CHEMOMECHANICAL CARIES REMOVAL AGENT"

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ABSTRACT

Dental caries is an epidemic that has swept the world and has been prevalent since times immemorial. Although there has been a substantial reduction in the incidence of caries in several countries, this disease continues to be widespread in the world. Once it has invaded the tooth, it is of fundamental importance to use conservative procedures that simultaneously prevent lesion progress and minimize healthy tooth structure wear. Minimal invasive chemico mechanical method for removal of dental caries like Carisolv ensures patient comfort especially for the school children and anxious uncooperative patients. It involves the selective caries removal of carious dentine. With advent of newer technology of caries removal by Carisolv, managing pediatric and geriatric patients has become easier. This review article gives a brief insight on this chemo-mechanical system of caries removal.

Keywords: Dental Caries, Conservative, Caridex, Carisolv, Pulp

INTRODUCTION

The idea of chemo-mechanical caries removal has been developed in 1970s by Goldman while using sodium hypochlorite (NaOCl) in removing organic materials in the root canals. This chemical got the ability to dissolve carious dentine and since that time, the idea of removing caries chemically was borne.¹

However, NaOCl itself was too corrosive to be used on healthy tissues because of its high reactivity and its ability to decompose nonnecrotic tissue, subsequently NaOCl was diluted and buffered with sodium hydroxide, sodium chloride and glycine producing a solution of 0.05% N-

monochloroglycine (NMG) having a pH of 11.4.² Commercially known as GK101, it normally softens only the infected layer of carious dentine by selective attack on the degenerated collagen fibres. The attack causes cleavage of the polypeptide chains and hydrolyses the cross-links of collagen fibrils.³ This chemical agent does not affect the sound collagen fibres in the inner affected and normal dentine, causing no or slight effect on the teeth pulps. GK101 system was found to be more effective if the glycine is replaced by aminobutyric acid 51, the product then being Nmonochloro- D-2 aminobutyrate (NMAB) and named as GK101E and marketed in the United States in 1984 as "Caridex".^{1,4}

DISCUSSION

CARIDEX

In 1976, Goldman and Kronman reported the effects of N-monochloro-DL-2 aminobutyrate (NMAB) solution used as a caries removal agent. The Caridex was marketed as a two-bottle system; the first contains sodium hypochlorite and the second contains glycine, aminobutyric acid, sodium chloride and sodium hydroxide. Both solutions are mixed immediately before use to give a reagent with a pH approximately equal to 11 that becomes stable for one hour.^{1,5}

The delivery system of Caridex consists of a reservoir for the solution, a heater and a pump which passed the liquid warmed to the body temperature through a tube to a hand piece and an applicator tip (20 gauge hypodermic needle, the tip of which had been modified into spoon shape).⁶ Caridex system was claimed to involve the chlorination and disruption of the partially degraded collagen fibres in carious dentine with NMAB. The carious dentine then becomes easier to remove by excavation using the modified needle tip. An additional attempt was carried out to improve NMAB reagent incorporating urea in its formula.

The action of this modification involved two amino groups of urea being chlorinated by sodium hypochlorite to form mono or dichloro derivatives. These intermediate compounds along with NMAB then attacked and broke down the partially degraded collagen in carious dentine.^{1-2, 7-8}

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CARISOLV

The Carisolv system has been developed by the Swedish Medi Team as an improvement over Caridex. Carisolv is a combination of a chemical gel for softening and partially removing decayed dentin (dentin caries). Dentin is a yellow material that makes up most of the tooth which is surrounded by enamel on the outside. The dentin is much more vulnerable to decay than enamel owing to its higher inorganic content in the form of a collagen matrix.¹ The product Carisolv™ is a gel composed by three amino acids (glutamine, leucine and lysine) and sodium hypochlorite. The Carisolv System is mixed into a gel, and then applied to the decayed tooth. This requires volumes of 0.2-1.0 ml and is accomplished by specially designed instruments. The gel softens the hard decayed material so that it can be partially removed with hand instruments. The decay that cannot be removed with hand instruments is then removed with a dental drill (bur). Carisolv partially removes some dental caries from a tooth and allows the dentist to slightly reduce the amount of time spent using the dental bur. According to the manufacturer, there are no known side effects of Carisolv.^{1, 9-10}

MODE OF APPLICATION⁸

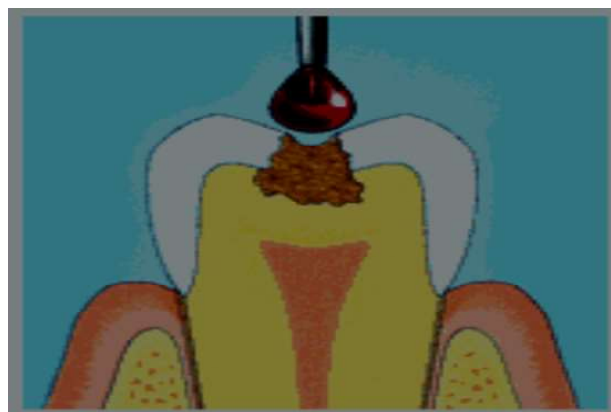
1. Carisolv gel is applied to the carious tooth surface and left for 30 seconds.
2. The Carisolv gel and the caries are then 'scooped out' using hand instruments.
3. This procedure is then repeated until all the carious tooth substance has been removed.

The tooth is then restored using a suitable restorative material

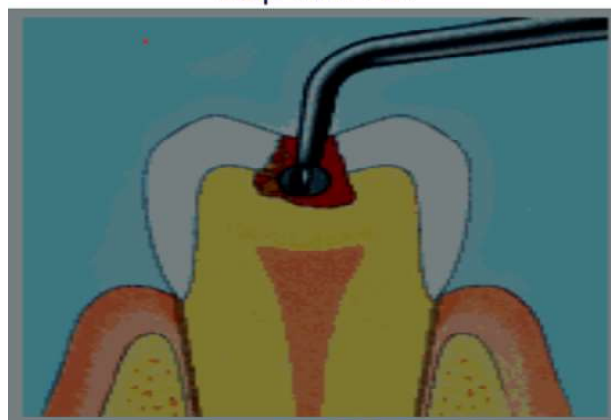
EFFICACY OF CARISOLV

A study was conducted and it was concluded that root caries can be effectively removed using the Carisolv method. The longer treatment time was compensated by less need for anesthesia. The chemo-mechanical caries removal technique using Carisolv proved to be an effective atraumatic treatment modality with potential interest for use in clinical pediatric dentistry.^{1,11} In a study, in 78.3% of the cases, carious dentin was totally removed with Carisolv, and in 21.7%, the dentin treatment was completed by drilling. In cases performed with Carisolv alone, the time required to remove carious dentin was 11.1+/-9.51 min. Treatment time was equivalent for all sites and increased significantly with each successive stage of lesion progression. In 82.5% of cases, the clinicians were satisfied with Carisolv, and in 99.2%, so were the patients.¹² Advantages of Carisolv

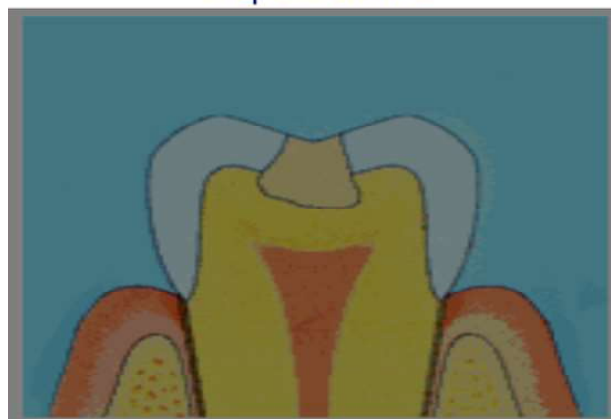
Treatment with Carisolv is painless. The need for drilling and local anesthesia is often unnecessary, and the use of the drill is restricted mainly to complement Carisolv in cavities where access is difficult. However, its use can usually be limited to the outer, less sensitive parts of the tooth. With Carisolv, sound and carious dentine are clinically clearly separated, so that only the carious tissue is removed. No sound tooth substance is sacrificed or damaged unnecessarily.¹ The restoration will be smaller so the remaining tooth substance will not be weakened by loss of sound tooth structure. The longevity of the tooth will not be compromised. The



Step 1. APPLY



Step 2. SCRAPE



Step 3. RESTORE

cavity will not be deeper than necessary, which means that there is less risk of pulpal exposure.^{1, 13}

It is particularly useful for children and patients who suffer from dental fear. The basis for all patient treatment in children's dentistry is a correct psychological approach. Painless treatment is of central importance in children's dentistry. Carisolv can eliminate the need for drilling and local anesthetic making an appointment more pleasant for the child. Many adults suffer from dental fear and therefore avoid going to the dentist. Around eight out of nine patients, who are regular dental attendants, also find drilling and anesthesia uncomfortable and become anxious before their dental appointments.

With Carisolv, it is possible to successfully treat patients with grave dental fear.² Disadvantages of Carisolv Studies show that the majority of children reported disliking the taste of Carisolv and estimated Carisolv to have taken longer time. It was suggested that conventional rotary instrument (bur) is more effective than Carisolv in removal of carious tissue and also takes shorter time.^{12, 15-17, 19}

EFFECT OF CARISOLV ON THE DENTAL TISSUES

i. Effect on dentine

It is found that caries removal with Carisolv leaves up to a mean of 50 micron more carious dentine than round burs. Carisolv treatment resulted in higher mean depths of caries-active dentine (71-78 micron) than conventional caries removal using the round bur (19-51 microns).¹¹ Carisolv gel does not affect sound fractured dentin, does not dissolve demineralized dentin, and has a limited potential to chemically dissolve denatured dentin.

Cariou dentine treated with Carisolv does not affect the adhesion of the adhesive restorative materials.

ii. Effect on the pulp Kidd (2000) in study on histological examinations found that the Caridex system was biocompatible for the human dental pulp.¹⁷ Bulut et al, in a histological evaluation of the pulp revealed similar pulpal response which consisted of a slight inflammation after 1 week. No hemorrhage was observed in the test group which may show the hemostatic effect of Carisolv. After 1 month the test teeth displayed a very mild inflammation adjacent to the perforation area.⁷

iii. Bonding to dentine after Chemo mechanical caries removal systems Enhancing the dentine-adhesive bond seems desirable to achieve longevity of restorations and to minimize the postoperative

complications.²⁰ However, the quality of bonding to dentine could be affected to a great extent by the mode of caries removal.

Enhancing the dentine-adhesive bond seems desirable to achieve longevity of restorations and to minimize the postoperative complications.^{21, 22} However, the quality of bonding to dentine could be affected to a great extent by the mode of caries removal. The chemo-mechanical caries removal show more irregular and rougher surfaces with modified smear layer when compared with the conventional rotary preparation.

Moreover, acid etching of the chemomechanically treated dentine exposed a clear peritubular and intertubular collagen network.²³ This finding for sure could affect the quality of the formed hybrid layer and therefore the longevity of the adhesive restorations. Reports suggest bonding quality of modern adhesive systems to dentine seems not to be affected in presence of chemo-mechanical caries removing agents. However, reports too indicate higher bond strength values with the chemomechanically prepared dentine than those exhibited with conventionally prepared dentine.^{1, 24}

CONCLUSION

The golden rule in conservative therapy is that all the healthy structures should be preserved. This can only be ensured when invasive treatment is kept to a minimum. The best method to ensure maximum life for a tooth is to salvage the sound and healthy tissue and protect it from damage by using minimally invasive techniques. Carisolv, a chemo-mechanical caries removal agent has been proved to be an efficient method of caries removal. Though it takes more time for caries removal using it but it reduces anxiety, need of anesthesia, pain and removes only infected dentin thereby, preserving tooth, combined with a patient friendly approach ensuring promising results and favorable treatment outcome.

REFERENCES

1. **Ericson D.** The Efficacy of a New Gel For Chemo-Mechanical Caries Removal. *J Dent Res* 1998; 77(5):1252-1253.
2. **Kakaboura A, Masouras C.** A Comparative Clinical Study On The Carisolv Caries Removal Method. *Quint Int* 2003; 34: 269-71.
3. **Beeley A, Yip HK, Stevenson AG.** Chemo-Mechanical Caries Removal: A Review Of The Techniques And Latest Developments. *Brit Dent J* 2000;188(8): 427-30.
4. **Dammaschke T, Stratmann U, Mokrys K, Kaup M, Ott KHR.** Histocytological Evaluation Of The Reaction Of Rat Pulp Tissue To Carisolv. *J Dent* 2001;29:283-290.

5. **Young C, Bongenhielm U.** A Randomised, Controlled And Blinded Histological And Immunohistochemical Investigation Of Carisolv On Pulp Tissue. *J Dent* 2001;29:275-281.
6. **Ericson D, Zimmermen M, Raber H.** Clinical Evaluation of Efficacy And Safety Of A New Method For Chemo-Mechanical Removal Of Caries. *Caries Res* 1999;33:171-77.
7. **Bulut G, Zekioglu O, Eronat C, Bulut H.** Effect Of Carisolv On The Human Dental Pulp: A Histological Study. *J Dent* 2004;32:309- 314.
8. **Raju HG.** New Trends In Treatment Of Dental Caries In Outreach Programme– Carisolv. *Annals Ess Dent* 2011;3:1.4-6
9. **Dammaschke T, Stratmann U, Mokrys K, Kaup M, Ott KHR.** Reaction Of Sound And Demineralised Dentine To Carisolv In Vivo And In Vitro. *J Dent* 2002;30:59-65.
10. **Yip HK, Stevenson AG, Beeley JA.** An Improved Reagent for ChemoMechanical Caries Removal In Permanent And Deciduous Teeth. An In Vitro Study. *J Dent* 1995; 23(4):197-204.
11. **Yip HK, Stevenson AG, Beeley JA.** Chemo-Mechanical Removal of Dental Caries In Deciduous Teeth: Further Studies In Vitro. *Bri Dent J* 1999; 18(6):179- 82.
12. **Kavvadia K, Karagianni V.** Primary Teeth Caries Removal Using The Carisolv Chemo-Mechanical Method: A Clinical Trial. *Paedia Dent* 2004; 26(1); 23-28.
13. **Lager A, Thornqvist E, Ericson D.** Cultivable Bacteria In Dentine After Caries Excavation Using RoseBur Or Carisolv. *Caries Res* 2003;37:206-211.
14. **Nadanovsky P, et al.** Removal Of Caries Using Only Hand Instruments: A Comparison Of Mechanical And Chemo-Mechanical Methods. *Caries Res* 2001;35:384-89.
15. **Pandit IK, Srivastava N, Gugani N, Gupta M, Verma L.** Various Methods Of Caries Removal In Children. A Comparative Clinical Study. *J Indian Soc Pedo Prev Dent* 2007; 2:93-97.
16. **Hirota K.** A Study On Partial Pulp Removal (Pulpotomy) Using Four Different Tissue Solvents. *J Jap Stomatol Soc* 1959;26:1588- 1603.
17. **Banerjee A, Kidd EAM, Watson TF.** In Vitro Evaluation Of Five Alternative Methods Of Carious Dentine Excavation. *Caries Res* 2000; 34: 144-150.
18. **Hahn SK, Kim JW, Lee SH.** Microcomputed Tomographic Assessment of Chemo-Mechanical Caries Removal. *Caries Res* 2004; 38:75-78.
19. **Fure S, Ling storm P, Birkhed D.** Evaluation of Carisolv For The Chemo Mechanical Removal Of Primary Root Caries In Vivo. *Caries Res* 2000; 34:275-280.
20. **Kilani MG, Whitworth JM, Dummer PMH.** Preliminary In Vitro Evaluation Of Carisolv As A Root Canal Irrigant. *Int Endod J* 2003;36:433- 440.
21. **Kumar J, Nayak M, Prasad KL, Gupta N.** A Comparative Study of The Clinical Efficiency Of ChemoMechanical Caries Removal Using Carisolv And Papacarie – Papain Gel. *Ind J Dent Res.* 2012;23:697
22. **Erhardt et al.** In Vitro Influence Of Carisolv On Shear Bond Strength Of Dentin Bonding Agents. *Quint Int* 2004;35(10); 801-07.
23. **Dammaschke T, Stratmann U, Danesh G, Schäfer E, Ott K. H. R.** Reaction Of Rat Pulp Tissue To Carisolv ‘New Gel’—A Histocytological Evaluation. *Aust Dent J* 2006; 51 (1): 57–63.
24. **Tobias GQ.** Comparision Of ChemoMechanical And mechanical method of caries removal in the reduction of streptococcus mutans and lactobacillus spp in carious denine of primary teeth. *J Appl Oral Sci* 2005;13 (4):399-405