RESEARCH ARTICLE

Chemo mechanical caries removal CMCR: Efficacy of Carisolv gel in primary molar teeth

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Abstract

Objective: To evaluate the efficacy of CariSolv gel with respect to chemo-mechanical caries removal in primary molar teeth.

Method: The cross-sectional study was conducted at the Department of Paediatric Dentistry, Bakhtawar Amin Dental College and Hospital, Multan, Pakistan, from July to December 2022, and comprised patients of either gender aged 6-12 years having vital, primary molar teeth with clinical and radiographic evidence of carious lesion. Freshly prepared CariSolv gel 0.2 ml to 1.0ml was applied to carious dentine for a minimum of 30 seconds, using chemo-mechanical caries removal hand instruments. The cavity preparation was rinsed and dried. Image caries detector dye was applied by micro brush for 10 seconds. After the cavity preparation was washed and dried, any red-stained dentine indicated residual infected dentine. A maximum of 3 chemo-mechanical caries removal cycles were allowed. Data was analysed using SPSS 26.0.

Results: Of the 134 patients, 74(55.2%) were boys and 60(44.8%) were girls. The overall mean age was 8.55±1.58 years. The procedure was successful in 115(85.8%) cases. Age and gender were not significantly associated with the outcome ($p>0.05$).

Conclusions: Chemo-mechanical caries removal method using CariSolv gel was found to be a viable alternative to traditional drilling techniques for caries removal in primary molar teeth.

Keywords: Caries, CariSolv, Paediatric dentistry, Primary molar teeth, Restorative dentistry. (JPMA 74: 1630; 2024)

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Introduction

The field of restorative dentistry is constantly evolving and one technique that has gained popularity recently is minimum intervention dentistry (MID) which combines the concept of caries prevention, dentine re-mineralisation and conservation of sound dental tissues.[1] The conventional approach of utilising high-speed rotary drills for caries removal can be emotionally distressing for both children and their mothers, as it often leads to anxiety and fear.[2] The invasive management of caries should be kept to a minimum and hard dentin should be preserved whenever possible.[3] The chemo-mechanical caries removal (CMCR) method is a minimal invasive technique that removes the carious dentin by a chemical dissolution.[4] A CariSolv gel is a CMCR system that is available in the form of 2 syringes; Syringe I contains 0.5% sodium hypochlorite (NaOCl), and Syringe II contains amino acids, lysine, leucine and glutamic acid, carboxymethyl cellulose, erythrocin and sodium hydroxide (NaOH). The two syringes are mixed in equal parts to form the activated gel.[5] A modified CariSolv system was introduced in 2013, which had conservative polymer burs and a caries detector dye.[6] The dye is used to selectively stain and identify the carious dentine layer, which is then removed using a blunt instrument, leaving the affected dentine intact.[7] The CariSolv gel has been around for many years, but it has not been widely used because it is quicker and easier to use the drill that removes the carious dentine, which may cause the removal of the sound tooth structure, and cause an iatrogenic damage to pulp.[8] Recently, alternative methods for caries removal have been introduced, including CMCR agents, air abrasion, sono-abrasion, atraumatic restorative technique, and hard tissue lasers.[9]

The preventive guidelines during the coronavirus disease-2019 (COVID-19) pandemic reintroduced MID techniques, such as CMCR, as an alternative to aerosol-generating procedures as the splatter and aerosols that result from cavity preparation posed a serious threat to the dental staff.[10] CMCR reduces aerosols by using hand excavators for caries removal, avoiding mist, moisture, splatter and coughing or gag reflex.

The CMCR method is also comfortable for patients, reducing pain, anxiety and does away with the requirement of local anaesthsia.[11] CariSolv has been known to be effective in root caries removal even with a longer duration of treatment.[12] Restoration of cavities requires materials, such as bulk-fill flowable composite restorations, glass ionomer cements, or resin-modified glass ionomers (RMGIs). Ccarious dentin was completely removed with CariSolv in 78.3% cases in a study, and the cavity

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preparation was completed by drilling in the remaining 21.7% cases.[13]

Indications for CariSolv include primary carious teeth in paediatric patients, patients with less compliance, those with high anxiety regarding cavity drilling, soft carious lesions in dentine, cervical lesions like root surfaces, deep carious lesions close to pulp, cleaning cavities, and with smear layer removal/open tubules.

The current study was planned to evaluate the efficacy of CariSolv gel for the complete caries removal in primary molar teeth, and to see if the CMCR was successful as an alternative to the traditional method of drilling.

Methodology

The cross-sectional study was conducted at the Department of Paediatric Dentistry, Bakhtawar Amin Dental College and Hospital, Multan, Pakistan, from July to December 2022. After approval from the institutional ethics review committee, the sample size was calculated using the World Health Organisation (WHO) calculator with the formula for hypothesis testing between two population proportions, with p=78.314, q=1-p, and margin of error (d) = 7%.

Those included were patients of either gender aged 6-12 years having vital, primary molar teeth with clinical and radiographic evidence of carious lesion.

Those with clinical signs and symptoms of pulpitis, radiographic evidence of pulp involvement by carious lesion, tooth mobility or tooth tenderness were excluded.

After taking informed consent from the subjects and their parents, data was collected.

Non-probability Consective sampling technique was used Isolation of tooth was done by cotton rolls or rubber dam. If direct access to carious dentine was not possible, high-speed rotary instruments with round burrs were used to remove minimal enamel or old restoration without removing the underlying dentine. Freshly-prepared CariSolv gel 0.2ml to 1.0ml was applied to carious dentine for minimum 30 seconds, using CMCR hand instruments to remove superficial, softened dentine. The cavity preparation was rinsed and dried. Image caries detector dye was applied to dentine by micro-brush for 10 seconds. After the cavity preparation was washed and dried, any red-stained dentine indicated residual infected dentine. This step was considered as a single CMCR cycle. If carious dentine was detected by tactile sensations with dental explorer, the operator reapplied the gel, and entire cycle was repeated. Maximum 3 cycles were allowed. Removal of caries was assessed immediately after the application of CariSolv gel by the operator. If any residual caries remained, slow-speed hand-piece and round burs were used to remove carious dentine. The restoration of cavity was done using RMGI or bulk-fill flowable composite.

Data was analysed using SPSS 26.0 Data was expressed as frequencies and percentages, or mean±standard deviation, as appropriate. Data stratification was done with age and gender using chi-square test. P<0.05 was considered significant.

Results

Of the 134 patients, 74(55.2%) were boys and 60(44.8%) were girls. The overall mean age was 8.55±1.58 years. Carious tooth No 84 was present in 23(17%) patients, followed by No 74 in 21(15.7%) (Table 1). The procedure was successful in 115(85.8%) cases (Table 2). Age and gender were not significantly associated with the outcome (p>0.05) (Table 3).

Table-1: Carious tooth distribution.

Carious tooth No.	n (%)
54	10 (7.5)
55	12 (9.0)
64	13 (9.7)
65	17 (12.7)
74	21 (15.7)
75	19 (14.2)
84	23 (17.0)
85	19 (14.2)
Total	134 (100)

Table-2: Efficacy of CariSolv gel in patients who presented with caries.

Efficacy	n (%)
Yes	115 (85.8)
No	19 14.2)
Total	134 (100)

Table-3: Association of age and gender with outcome.

Characteristics		Efficacy		*p*-value
		Yes	No	
Age (years) **Groups**	6-9	79	12	0.631
	10-12	36	7	
Gender	Male	67	7	0.081
	Female	48	12	

Discussion

The current study found that the CMCR method with CariSolv gel was an alternative to conventional mechanical caries removal in primary teeth, with the potential for pain-free treatment and the preservation of healthy dentine. A meta-analysis evaluated the efficacy of CariSolv in caries removal, and indicated that the clinical efficacy of CariSolv seemed to be as reliable as the rotary drill technique.[15]

Caries removal with CariSolv could be considered as an alternative method to painful rotary drilling method for the management of caries in children.[16] A randomised clinical trial (RCT) also showed that significantly fewer patients required local anaesthesia during CariSolv treatment compared to the traditional drilling techniques.[17] CariSolv has the capability of smear layer removal and carious dentinal tubule exposure, facilitating the infiltration of adhesive layer of the composite.[18] A study found out that chemo-mechanical treatment of dentin in primary teeth did not have any adverse effect on the boding of resin composite.[19]

The current study showed an efficacy rate of 85.2%, indicating that CariSolv gel was effective in the removal of caries from primary molar teeth. These findings are consistent with literature.[20,21] One study[20] evaluated the efficacy of CariSolv in soft carious lesions, and reported that 83.3% cases showed complete removal of soft carious dentine, while among the hard carious lesions, 68.75% showed partial removal of carious dentine in primary teeth. Another study[21] compared CariSolv with conventional methods, and found that complete removal of carious dentine was achieved in 88% teeth with the CMCR approach. On the contrary, a study[14] evaluated CMCR method in primary molar teeth, and concluded that the efficacy of CMCR method was not achieved in over one-third of the sample. Also, the procedure was more time-taking, and the patients did not like the taste and smell of it. The disadvantages of CariSolv included longer duration, requirement of access to carious dentine by removing enamel with traditional drilling technique, and the CMCR method is less effective in hard arrested carious lesions. Also, the CariSolv gel system is expensive, and has a shorter shelf-life.

The current study has limitations, such as the lack of a control group and long-term follow-up to evaluate the success of restorations. Furthermore, the study was conducted at a single centre, limiting the generalisability of the findings.

The use of CariSolv on root surfaces may not be appropriate in all cases, and clinical judgment should be used to determine the best approach for each individual patient. Further studies, especially RCTs. are required with larger sample size and longer follow-up to confirm the current findings, and to evaluate long-term outcomes.

Conclusion

Carisolv gel had a high efficacy rate of 85.8% in complete caries removal in primary molar teeth of paediatric patients, and it could be considered an alternative to traditional drilling methods. Despite the time required to remove caries, and the significantly high cost, CariSolv gel could be a valuable tool in the armamentarium of paediatric dentists. The combination of traditional method with CMCR can provide better results.

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Author Contribution:

JP: Concept, literature search, writing, editing and statistical analysis.
HMA: Data collection, methodology, investigation and statistical analysis.
MR: Data collection, methodology, investigation.