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ORIGINAL ARTICLE

Clinical evaluation of chemomechanical and mechanical caries removal: status of the restorations at 3, 6, 9 and 12 months

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Abstract In this study, the clinical efficacy of Carisolv™ system and the hand excavation method in the removal of occlusal dentine caries of primary molar teeth was evaluated. Both Carisolv system and hand excavation method were applied for the removal of caries on different teeth of the same children. After the removal of the caries, Dyract AP materials were used to restore the teeth. The clinical follow-up was made every 3 months within a year. The clinical evaluations of restorations were carried out in accordance with US Public Health Service (USPHS) criteria. To determine whether there was any statistical difference between the groups, chi-square analysis was used. During both excavation methods, pain occurrence and the need for anesthesia and the time spent were all recorded. The time spent for the removal of caries in Carisolv system and in hand excavation method was 9.03±4.14 min (mean±SD) and 7.34±3.41 min (mean±SD), respectively ($P>0.05$). At the end of 1 year, differences between Carisolv and hand excavation groups in terms of marginal adaptation and secondary caries were found to be statistically insignificant ($P>0.05$). During the removal of caries, certain children complained about pain both in Carisolv system and hand excavation method (7.1 and 35.7%, respectively). As a result, it can be argued that Carisolv system is effective in the removal of caries and causes minimum level pain occurrence. Compared to hand excavation, Carisolv system seems to be a promising restorative approach to remove occlusal caries in primary molar teeth. Studies of longer duration are needed to confirm these findings.

Keywords Caries removal techniques · Carisolv · Hand excavation · Primary teeth · Compomer

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Introduction

Rotary instruments have gradually improved in efficiency and accuracy for cutting enamel and for dentin excavation [33, 34]. However, their inherent fundamental drawbacks remain: unpleasant by many patients, require local anesthesia to control pain, and potential adverse effects on the pulp due to heat and pressure. Another important drawback is the removal of sound tooth structure that could be preserved during the preparation of teeth [28].

To avoid these drawbacks, alternative dentin caries removal techniques have been proposed, including hand excavation, air-abrasion, air-polishing, ultrasonication, sonoabrasion, lasers, and chemomechanical methods [4, 37].

Dentin caries can be divided into two distinct layers. The outer layer is contaminated by bacteria causing a non-remineralisable necrotic collagen matrix. In the inner layer, bacteria are much less frequently observed and the collagen has been reversibly denatured, but retains the crossbanded ultrastructure [31]. With conventional burs or sharp hand instruments, it is often difficult to distinguish exactly

between these two layers, and mechanical caries excavation may have the disadvantage of leaving residual caries or to overextend cavities [11]. Therefore, the necessity of using the mechanical non-rotary instruments has emerged to eliminate the negative effects of the conventional methods. One of these is the removal of caries by chemomechanical method. This method was first introduced in 1972 [35].

Chemomechanical caries removal involves the selective removal of soft carious dentin without the painful removal of sound dentin. Recently, Carisolv, a new chemomechanical system for caries removal, was proposed (Medi-Team Dental, Gothenburg, Sweden). The Carisolv system consists of a gel with amino acids and sodium hypochlorite, and special hand instruments. The resulting gel is reported to be efficient specifically on carious dentin, even in small amounts [10, 13].

One of the major advantages is the increased patient compliance to this technique of removing carious dentin compared to drills. In addition, unwanted removal of sound dentin is avoided [5, 20] and the need for local anesthesia is less [12, 14]. However, most of the studies reported that this method prolonged treatment time when compared with rotary instruments [12, 26].

Another caries removal method with mechanical non-rotary instruments is the hand excavation technique, known as atraumatic restorative technique (ART). This is defined as a procedure based on excavating carious cavities in teeth using hand instruments only and subsequent restoration with adhesive filling material. The ART technique for dental caries is an innovative, largely pain-free, minimal intervention approach of treating decayed teeth [17]. This method appears to be an ideal compromise, especially in developing countries where electricity supplies are limited and highly trained dentists are not readily available or affordable. The technique has been implemented in a school by an oral health programmer in Zimbabwe [18].

In our previous study, we compared the Carisolv system and hand excavation in terms of microleakage [19]. We removed the occlusal caries in the primary teeth by using conventional slowly rotating method, hand excavation and Carisolv system and placed ormocer material. There was no statistically significant difference between these methods.

The aim of this study was to evaluate the restorations at 3, 6, 9, and 12 months, and secondary objectives were caries removal, time, pain, and anesthesia.

Materials and methods

This was a prospective, open, randomized, and controlled study. Child patients who came to Pedodontics Department, School of Dentistry at Atatürk University in Erzurum, Turkey for a regular dental examination and presented at least two active primary coronal carious lesions in a vital tooth were asked to enter the study. The child and the escorting parent were informed of the purpose of our investigation, the experimental procedures to be performed, and the possible benefits and potential risks involved. The study had been approved by the Dental Institute Ethics Committee and written parent consent was obtained before treatment.

The steps of the study were as follows: a pre-treatment examination, informed consent, randomization, caries removal, cavity inspection, restoration, and a patient interview. All treatments were performed by the main investigator (T.G.). The cavity inspection for the successful removal of caries was performed by an independent examiner (Y.Y.).

The pretreatment examination involved a medical history, a clinical examination with a dental mirror, and explorer and radiographs. Special attention was paid to possible pulp or soft tissue abnormalities or other pathological processes.

Patients that were included in the study presented with contralateral primary molars with approximately equal-sized open access (diameter ≥1.5 mm, requiring no access drilling) occlusal primary decay, requiring occlusal restorations. The teeth also had to display a positive response to sensitive testing using cold, heat, mechanical stimulation, or a pulp tester. Patients who were expected to lose the treated tooth within 3, 6, 9, and 12 months due to extreme caries activity were excluded. All teeth and surrounding tissues were clinically free of any pathologic condition other than dental caries.

In patients with at least two lesions, a within-subject comparison was used, i.e., one of the lesions was treated with the Carisolv system and one with the hand excavation method, one immediately after the other. The location of either of the treatments was randomized by a series of consecutively numbered randomization envelopes. In patients with more than two carious lesions, the other lesions were treated with either of the two methods, but they were not included in the study.

The process of caries removal both by the Carisolv system (Group 1) and hand excavation method (Group 2) in the different teeth of all the children admitted to the study was realized as follows:

Group 1 (Chemomechanical method) Carisolv gel multimix (MediTeam Dental AB, Gothenburg, Sweden) was used for the process of caries removal. Before the treatment, no rubber dam was used. Isolation was done with cotton rolls in the children. Then, the dentin caries was first covered with the pink Carisolv gel. After 30 s, the carious dentin was gently scraped with hand instruments to remove softened carious tissue. A special hand instrument (MediTeam Dental AB, Gothenburg, Sweden) fit for the

dimension and availability of the cavity was chosen and the softened carious dentin on the surface was scraped. When the gel becomes heavily contaminated with debris, it was removed with cotton pellets and more fresh gel was applied. The procedure was repeated until the gel no longer became cloudy and all surfaces of the cavity were hard on probing, indicating that no soft dentin caries was left. After complete caries removal, the remaining gel was removed with wet and dry cotton pellets.

After making sure that the caries was cleaned, we moved to the restoration phase. Non-rinse conditioner (Dentsply/De Trey, Germany) that does not require washing was applied for 20 s to the prepared cavity. Without any further process, then Prime and Bond NT (Dentsply/De Trey, Germany) bonding agent was applied according to manufacturers' instructions and polymerized utilizing a visible light for 10 s after a 20-s wait. A 2-mm thickness of Dyract AP (Dentsply/De Trey, Konstanz, Germany) material was placed on the cavity by using the layer method and exposed it to light for 40 s. Using the Sof-Lex (3M Dental Products, St. Paul, MN 55144-1000, USA) polish discs. The process was finished. The color of the restorative material used for each patient was recorded in the forms.

Group 2 (Mechanical method) The carious dentin was gently removed using new, sharp conventional spoon excavators (Ash G5, Claudius Ash, Potters Bar, Herts, UK). When the cavity became full of debris, it was cleaned with cotton pellets. The procedure was repeated until all surfaces of the cavity were hard on probing. After complete caries removal, the cavity was covered with the pink Carisolv gel. The gel was removed with wet and dry cotton pellets. The aim was to prevent the blinded evaluator from inadvertently identifying traces of pink color in one cavity only. The restorative processes were carried out as described in group 1.

Patient evaluation of the procedures was carried out immediately after the procedure using an interview based on a questionnaire. It included patient's initials, age, sex, tooth number, and a question rating the pain during the procedure.

The completeness of caries removal was judged by the clinical criteria that a sharp explorer should not stick in the dentin, and not give a "tug-back" sensation. The efficacy of caries removal was graded as complete and incomplete. The efficiency of the removal of caries was evaluated by the independent examiner (Y.Y.), using the same criteria as above. If the case was regarded as a failure, i.e., caries excavation was not complete as judged by the examiner, the removal of the remaining carious dentin was completed by carbon-steel bur.

A chronometer was used by a supervisor to measure the time taken to remove the caries tissue from the cavity (min) with hand instruments. The time it took to remove the caries tissue with the chemomechanical method included all gel applications. Duration of the treatment with the chemomechanical system or hand excavation technique was separately recorded in the questionnaire. To compare the two techniques, the time needed for the removal of caries remains with the carbon-steel bur was not counted.

Pain was recorded during the procedure and immediately after the removal of caries. Judgments were asked during and after treatment of each tooth. The options were: absent pain, a little pain, or much pain (present pain). It was also recorded whether the patient requested local anesthesia during caries removal.

In addition, status of the restorations at 3, 6, 9, and 12 months were independently examined by two calibrated authors (Z.K. and Y.Y.) using the United States Public Health Service (USPHS) Ryge criteria (Table 1) [32]. When a disagreement occurred, the decision was made by consensus.

Statistical analysis

Mostly descriptive statistics were used. The comparison of the caries removal status scores, the time taken for caries removal and the condition of the restorations in the follow-up examination between the methods were assessed by the chi-square analysis.

The pain during treatment and requested anesthesia were compared using Fisher's exact test for the two treatment groups.

Statistical analysis was performed with Statistical Package for the Social Sciences for Windows (SPSS version 12.0, Chicago, IL, USA).

Results

Twenty-eight patients with 56 lesions were included in the study. Twenty-eight of the lesions were randomized for treatment with Carisolv and 28 for hand excavation method. The random population of patients affected with occlusal dentin caries and their ages ranged from 4 to 6 years, 14 boys (mean age=5.2 years) and 14 girls (mean age=5 years).

The clinical cases were selected randomly within different sexes, ages, groups of teeth, and upper or lower arch. A distribution of the caries removal methods according to the teeth and jaws is given in Table 2.

Efficacy-complete caries removal

The caries-free state of cavities were judged by the independent examiner (Y.Y). The examiner found that there

Table 1 US public health service criteria rating system (Ryge 1980)

Category and rating	Criteria
Color match	
Alpha	Restoration matches adjacent tooth structure in color, shade, or, translucency
Bravo	There is a mismatch in color, shade, or translucency but within the normal range of adjacent tooth structure
Charlie	There is a mismatch in color, shade, or translucency outside of the normal range of adjacent tooth structure
Cavosurface marginal discoloration	
Alpha	There is no discoloration anywhere on the margin between the restoration and the tooth structure
Bravo	Discoloration is present but has not penetrated along the margin in a pulpal direction
Charlie	Discoloration has penetrated along the margin in a pulpal direction
Anatomic form	
Alpha	The restoration is continuous with existing anatomic form
Bravo	The restoration is discontinuous with existing anatomic form, but missing materials are not sufficient to expose dentin or base
Charlie	Sufficient restorative material is missing to expose the dentin or base
Marginal adaptation	
Alpha	There is no visible evidence of a crevice along the margin into which the explorer will penetrate
Bravo	There is visible evidence of a crevice along the margin into which the explorer will penetrate or catch
Charlie	The explorer penetrates the crevice, and dentin or base is exposed
Delta	The restoration is mobile, fractured, or missing, either in part or total
Secondary caries	
Alpha	No caries is present at the margin of the restoration, as evidenced by softness, opacity, or etching at the margin
Bravo	There is evidence of caries at the margin of the restoration

were three remaining caries in the hand excavation group and only one in Carisolv group. In both groups, remaining caries were removed by bur and these teeth were excluded from further analyses. No case of pulp exposure occurred.

Efficiency-caries removal time

The distribution of the time spent for the caries removal process by both Carisolv system and hand excavation method is given in Fig. 1. As can be seen in Fig. 1, with the Carisolv system the average time spent to remove caries was 9.03±4.14 min, while it was 7.34±3.41 with the hand excavation method. This small difference was not statistically significant.

Pain and anesthesia

In the Carisolv group only two of 28 patients experienced pain, but in the hand excavation group 10 of 28 patients did ($P<0.05$, Fisher's exact test, Table 3).

In the hand excavation group, six patients needed local anesthesia due to pain they felt during the excavation, whereas in the Carisolv group, none of the patients complained about pain and needed anesthesia. Significantly better results for treatment experience were found with the Carisolv group compared to the hand excavation group ($P<0.05$, Fisher's exact test).

One-year follow-up

No complications or adverse effects were reported during the follow-up year. Fifty-five of the 56 fillings were examined after 1 year, 28 in the Carisolv group and 27 in

Table 2 The distribution of the caries removal methods according to the teeth and jaws

Methods	Jaws and teeth			
	Maxilla		Mandible	
	Primary first molar	Primary second molar	Primary first molar	Primary second molar
Carisolv system	2	10	4	12
Hand excavation	5	9	2	12
Total	7	19	6	24

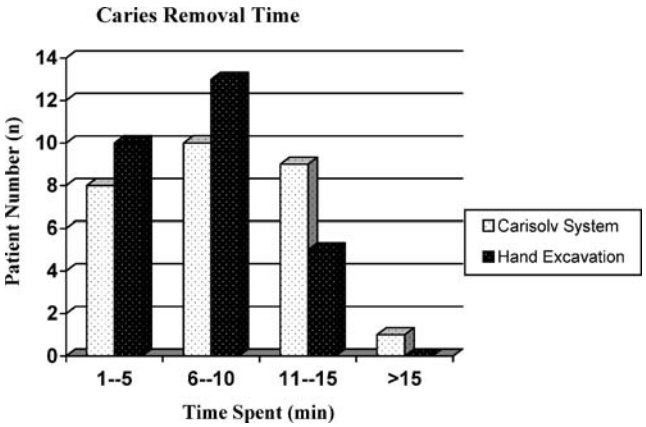

Fig. 1 The distribution of the time it took to remove the carious dentin completely

the hand excavation group. The clinical follow-up of the children, whose restorations were finished, were carried out every 3 months for 12 months. Three-month periodical clinical control results of the restored teeth are given in Table 4.

In the clinical evaluation of the cavosurface marginal discoloration in the Carisolv group, a Bravo value in one tooth in the 12th month was detected. In the hand excavation group, a Bravo value in one tooth in the 3rd month, a Charlie value in the 6th and 9th months, a Bravo value and a Charlie value during the 12th-month evaluation was observed. Although the cavosurface marginal discoloration in the restorations applied after the caries removal process by both methods is more often seen in the hand excavation method, there was found no difference of statistical significance ($P>0.05$).

In the clinical evaluation of the anatomic form, in both groups during the 3rd and 6th month evaluations, one Bravo value was detected. In the Carisolv group, observed were three Bravo values in the 9th month and four Bravo values in the 12th month, and in the hand excavation group, two Bravo values in 9th month and five Bravo values in the 12th month. There was no statistically significant difference between the two groups after 12 months in the anatomic form evaluation of the restorations ($P>0.05$).

At the end of 1-year follow-up period, there was no statistically significant difference ($P>0.05$) in the clinical evaluation of the marginal adaptation restored with Dyract AP after the removal of the caries by Carisolv system. We determined a Bravo value in one tooth in the 9th month evaluation and two Bravo values and one Charlie value in the 12th month.

Throughout the observation period, a statistically significant difference was observed ($P<0.05$), contrary to the Carisolv group, in the evaluation of the marginal adaptation in the teeth restored after the removal of the caries by hand excavation method. In this group, one tooth presented Charlie value in the 3rd month and this tooth was extracted in the 6th month on account of the infection developed later. There appeared two Bravo values in the 6th, 9th, and 12th months. Both of the Bravo values in the 9th month turned into Charlie value in the 12th month. Yet no infections developed. Of the restorations evaluated for 12 months, there was no difference in statistical significance between the Carisolv and the hand excavation groups in the 3 months' follow-up periods ($P>0.05$).

In the evaluation of the secondary caries, we determined a Bravo value in the Carisolv group in the 12th month. This restoration was the one displaying the Charlie value in the marginal adaptation. In the secondary caries evaluation of the hand excavation group, four teeth displayed Bravo. The Bravo value observed in the 3rd month resulted in extraction due to the common periapical pathology. There was no periapical pathology in the teeth with the Bravo value observed in terms of secondary caries in the 9th and 12th months. There was no statistically significant difference either among the 3 months' follow-up periods or at the end of a year's evaluation ($P>0.05$).

Table 3 Experience of pain and the need for local anesthesia (n, %)

Methods	Pain		Necessity of local anesthesia for the pain
	Present	Absent	Present
Carisolv system	2 (2.1)	26 (92.9)	0
Hand excavation	10 (35.7)	18 (64.3)	6 (60)

Discussion

Advancements in the adhesive restorative materials have played an important role in the development of the caries removal techniques that feature the protection of healthy tooth tissue. The present study is the first one which reports, in children between 4 and 6 years of age, on the differences between the conventional spoon hand excavators and a chemomechanical system, in terms of completeness of caries removal, time taken to remove caries, pain and anesthesia, and the status of restorations at 3, 6, 9, and 12 months as standard routine.

In this study, 27 of the lesions treated with Carisolv and 25 of the lesions treated with hand excavation method were found to be caries-free as judged by the independent examiner. The conventional visual and tactile criteria using a probe were used for this assessment. It can be argued that these criteria are not completely reliable when it comes to assessing the carious status of the dentine, and that additional criteria such as caries detector dye might have been useful [16]. However, studies have shown that the tactile and visual criteria are satisfactory for assessing

Table 4 Status of the restorations at 3, 6, 9, and 12 months of the caries-removed teeth by two manual techniques

Criteria	Time (month)	Carisolv system			Hand excavation			*P* value
		A	B	C	A	B	C	
Color match	3	28	–	–	27	1	–	0.000
	6	27	1	–	26	1	1	0.407
	9	26	1	1	25	1	1	0.972
	12	24	2	2	22	3	2	0.772
Cavosurface marginal discoloration	3	28	–	–	27	1	–	0.000
	6	28	–	–	27	–	1	0.000
	9	28	–	–	26	–	1	0.491
	12	27	1	–	25	1	1	0.390
Anatomic form	3	27	1	–	27	1	–	0.000
	6	27	1	–	27	1	–	0.000
	9	25	3	–	25	2	–	0.000
	12	24	4	–	22	5	–	0.729
Marginal adaptation	3	28	–	–	27	–	1	0.000
	6	28	–	–	25	2	1	0.097
	9	27	1	–	23	4	–	0.193
	12	25	2	1	21	4	2	0.286
Secondary caries	3	28	–		27	1		0.000
	6	28	–		27	1		0.000
	9	28	–		26	1		0.491
	12	27	1		25	2		0.611

A Alpha, *B* Bravo, *C* Charlie

the caries-free status of the lesion [12, 24, 30]. Besides, several investigators indicated that due to low mineral density of cicumpulpal dentin and sound dentin at enamel-dentine junction, caries detector dye not only discloses caries, but dentine organic matrix is also stained. Therefore, healthy dentine tissue could be removed; even pulp exposure may occur [24, 36]. In addition, Diagno-DENT or radiographic evaluation methods could also be used to confirm that the carious dentine is completely removed. However, Carisolv do not remove remineralizable dentine; therefore, these two methods may give misleading results to operators.

Carisolv gel is supposed to act on and dissolve the outer carious dentine layer with substantially degraded collagen, but not to affect the inner layer with remineralizable dentine affected by caries. Previous studies using an explorer to determine the completeness of caries removal have found that the Carisolv method is effective for caries removal in most teeth [9, 12, 14, 21, 30].

It is known that the time the children spent in dentists' chair increases their level of stress. Clinical working time with the chemomechanical method is much more prolonged than that with the conventional mechanical method, as this has been previously found in permanent teeth [12, 21, 23] and in a limited sample of primary teeth [6, 26]. Munshi et al. [29], in a study, compared the time needed to remove active or arrested caries by Carisolv and found that more time is needed to remove arrested caries.

In our study, the mean time of caries removal by Carisolv was 9.03 min, while the time for the hand excavation group was 7.34 min. Although special heads were used to remove caries in Carisolv treatment group, the process was prolonged as the multimix gel was applied three times on average in our study. For the applied gel to remove the caries, each time, it should be kept in the caries cavity for 30 s. Therefore, the time for the removal of the caries in this group was a bit longer than the one in hand excavation group, though not statistically significant.

The chemomechanical method evaluated in this study was very successful in removing caries without causing pain and without the need to use local anesthesia. The mechanical method was as successful in removing caries, but less so in avoiding pain during caries removal, as in Nadanovsky et al. [30]. Similarly, Ansari et al. [2] indicated that chemomechanical caries removal is an effective alternative to conventional method and is advantageous in children who have a phobia to the dental handpiece and/or injections. The reason why the pain is more in the hand excavation group is the pressure exerted by the instruments for the removal of the caries and the exposure of the healthy dentin tubules with the mass-removal of the caries during the mechanical cutting with the excavator. This effect is eliminated with the use of specially designed Carisolv hand instruments so that children may not feel much pain. Our findings regarding pain during caries removal process by the Carisolv system

and hand excavation method is in accordance with several previous reports [12, 14].

The chemomechanical caries removal system is probably more efficient in eliminating bacteria from the treated dentinal surface than conventional methods, and this should provide a better long-term prognosis for the restoration of chemomechanically treated teeth [9, 22]. In a study, Azrak et al. [3] found that there is a significant reduction in the count of the cariogenic flora when early childhood caries is removed using Carisolv or rotary instruments.

The Bravo values observed in the Carisolv and hand excavation groups may have resulted from the failure to form a sound bondage due to the inability of NRC conditioner to etch the enamel adequately, which was applied before the application of dentin-bonding system. Also, Dyract AP, though a material of fluoride content, might have been unable to remineralize the demineralized areas, which could have lead to fractures on the enamel wall of the cavity during the course of time. In such cases, it might be inevitable to observe failure in the restored teeth. If the teeth to be restored had been etched by a phosphoric agent or the cavity enamel edges had been smoothed by the enamel cutting implement, such a problem might not have occurred.

A Charlie value was observed only in one tooth in the Carisolv group during the evaluation period. The reason for this may be a failure in the removal of caries from the dentin tissue. In this case, the caries would keep advancing.

There were three Charlie values observed in the hand excavation group. This might have resulted from the fact that the caries might not have cleaned well enough in the dentin tissue, especially in the enamel–dentine junction. It has been reported in the previous studies that during the process of caries removal by these instruments, there may remain some carious tissues in some areas due to the difficulty of applying these instruments to the enamel–dentine junction [7, 27, 38].

In our study, the marginal adaptation success rate of the restorative materials placed in the Carisolv group during the first 6 months was found as 100%, whereas it was 89% in the second 6 months. For the whole 12 months, the marginal adaptation success rate was found to be 89%.

In our review of literature, we could not find a long-term study concerning the marginal adaptation evaluation of the restorations placed after the caries removal by Carisolv. However, a success rate of 85% was reported in the marginal adaptation evaluation carried out 2 years after the caries removal by Caridex system, one of the earliest versions of Carisolv caries removal system, by modifying USPHS criteria of the restorations in the teeth restored with GIC [25].

Marginal adaptation protection rate was 89% in the hand excavation group at the end of the first 6 months, while it was found to be 82% at the end of the second 6 months. For the 12 months, however, the marginal adaptation success rate was found to be 75%. The marginal adaptation change between the Carisolv and the hand excavation groups was not found statistically significant at the end of the first year ($P>0.05$).

In this study, at the end of the 12-month evaluation period a secondary caries in the Carisolv group and two secondary caries in the hand excavation group were observed. The release of fluoride from the restorative materials used in dentistry is either through the dissolution of the material or through the diffusion mechanism. Aboush and Torapzadeh [1] reported that the release of fluoride in GIC's was more often through dissolution mechanism, though it was possible with both mechanisms while it was carried out in composite resins and compomers through diffusion mechanism. Therefore, the fluoride release of the composite resins and compomers was lower than that of the GIC's. If the restoration had been done with GIC, the result might have been different for this reason.

Mandari et al. [25] observed no secondary caries at the end of 2 years in any of the glass ionomer restorations that they placed after the application of Caridex, a chemo-mechanical caries removal system. Cehreli and Altay [8] reported secondary caries at the end of a year only in one tooth in the compomer materials placed after the removal of the caries by the rotary instruments. Fure et al. [15] found in their study, where caries were removed using two types of Carisolv gel, that in the reexamined teeth after 1 year, most of the fillings were intact and nine of 177 teeth were affected by secondary caries. The findings by the researchers show harmony with the results of our study.

Conclusions

1. The Carisolv system is an effective clinical alternative treatment for the removal of occlusal dentinal caries in cavitated primary molars; it is more conservative of dental tissue, although it is much more time-consuming than hand excavation.
2. Marginal adaptation between restorative material and tooth hard tissue was better in teeth, which caries removal was performed with Carisolv compared to hand excavation.
3. Chemomechanical treatment is more effective than hand excavation method, which causes less pain and lowers the need for anesthetics.
4. Restorative treatment with Carisolv gel and hand excavation method was an acceptable and viable alternative in the restorative dental treatment of active carious lesions in clinical pediatric dentistry.

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