
Assessment of the success rate of conservative adhesive resin restoration (CAR) in first permanent molar teeth treatment in Hamadan, Iran

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Abstract: Background & aim: Dental caries is one of the most common childhood diseases in the world. Pit and fissure caries constitute more than 80% of all caries in children and adolescents. Although occlusal surfaces account for only 12.5% of tooth surfaces, approximately 60% of dental caries are observed in these surfaces. Caries preventive methods include fluoride therapy, fissure sealant, and conservative adhesive restoration (CAR). Although CAR method has been increasingly applied for the prevention of dental caries progression, little research has been conducted so far. Despite the advantages of CAR method, this technique is time-consuming and uneconomical for the patient and health care system. In this study, we aimed to assess the one year success rate of CAR in caries prevention at Hamadan Dental School, Hamadan, Iran. Methods & Patients: In this cross-sectional study, the estimated sample size was 150 treated first permanent molar teeth. We examined variables such as CAR success or failure (retention and caries prevention), need for re-treatment, frequency of tooth brushing, previous history of fluoride therapy, Decayed-Missing-Filled Permanent Teeth (DMFT) index, decayed-missing filled deciduous teeth (dmft) index, dental visit, and current dental treatment. Data were analyzed using SPSS version 16. Results: Fifty-seven patients were examined, among whom 24 (42%) were male and 33 were female (58 %). The age range of the subjects was 7-13 years. A total of 125 molar teeth were studied, of which 88 (70.4%) and 37 (29.6%) belonged to female and male subjects, respectively. According to the results, the association between CAR and the patient's age was significant ($P<0.05$); also, there was a significant difference in using fluoride and CAR success ($P=0.001$). Conclusion: There is a significant association between the patient's age, use of fluoride mouth rinse, and treatment success rate. In addition, older cases showed better response to CAR.

Keywords: Conservative Adhesive Resin Restoration (CAR), Molar Teeth, Dental Sealants

1. Introduction

Dental caries is one of the most common childhood diseases in the world. Caries incidence has increased in recent years and seems to be strongly influenced by one's diet (1). Considering the high expenses of caries treatment, early performance of preventive dental care programs and medical care management seem essential for all children (2-4).

Pit and fissure caries account for more than 80% of all caries in children and adolescents. Although occlusal

surfaces constitute only 12.5% of tooth surfaces, approximately 60% of dental caries are observed in these surfaces (5). Due to the special morphology of pits and fissures and lack of mechanical tooth cleaning for these sites, they are among the most susceptible areas to caries.

Today, increasing attention is being paid to dental caries prevention and progress has been made in this regard. Caries preventive methods include fluoride therapy, fissure sealant, and conservative adhesive resin restoration (CAR) (6). Fluoride therapy including fluoridated water and fluoride-containing toothpaste only affect the smooth surfaces of the teeth and have insignificant effects in the

prevention of pit and fissure caries (7).

Sealants are one of the most effective methods of preventing pit and fissure caries. They were firstly used in the 1960s to prevent dental caries in the pits and fissures of mainly occlusal surfaces (8, 9). Sealants have been reported as an effective and sensitive technique, and if properly performed, they can play a significant role in preventing caries (10). However, lack of complete dental isolation and treatment techniques, as well as inefficient fissure sealant, may lead to the loss of sealing and creating cavities (11).

Preventive resin restoration (PRR), recently known as CAR, is another technique for repairing caries (12). Application of CAR method for the prevention of the progression of dental caries has significantly increased. This method is performed with maximum preservation of tooth structure, without any attempts to remove the undermined enamel or affected dentin. However, little research has been conducted so far.

Despite the advantages of CAR method, this technique is time-consuming and uneconomical for the patient and health care system. Therefore, we aimed to assess the one year success rate of CAR in caries prevention at Hamadan Dental School, Hamadan, Iran, for the first time.

2. Patients and Methods

2.1. Patients

In this cross-sectional study, we assessed all permanent molars of children, who underwent preventive and restorative resin treatment in the Pediatric Department of Hamadan Dental School, in years 2011 and 2012. The estimated sample size was 150 subjects, and all demographic data such as age and gender were recorded. We examined variables such as CAR success or failure, need for re-treatment, brushing teeth, previous history of fluoride therapy, Decayed-Missing-Filled Permanent Teeth (DMFT) index, decayed-missing filled deciduous teeth (dmft) index, dental visit, and current dental treatment.

2.2. Methods

The records of patients, who underwent CAR for permanent molar teeth, were studied after obtaining permission from the authorities of Pediatric Dentistry Department. The parents of children were contacted in order to obtain their consents. After completing the consent forms, they were informed about the study procedures. We performed dental examination by using a sharp explorer and a dental mirror under unit light. The observations were recorded in a specific examination form.

In the current study, the following conditions were considered as success in the treatment: fully-retained restoration without occlusal caries, complete or partial loss of sealant without occlusal caries.

We did not consider the incomplete loss of sealant as treatment failure. The following conditions were considered as treatment failure: complete loss of sealant with occlusal

caries, partial loss of sealant with occlusal caries, and defects in composite resins. Also, the teeth was considered decayed if they have brown-black or black discoloration or contained cavities.

In this study, all examined teeth received CAR type 3. First, the decays were removed and the entire tooth was washed, dried, and finally isolated. Then, the prepared cavity and all susceptible pit and fissure were etched with 37% phosphoric acid for 20 seconds. The tooth was then washed and dried by an air syringe until the chalky enamel surface appeared. Afterwards, a bonding agent was applied and light cured. The cavity was restored with composite resin and light-cured for 20 seconds. By preserving the isolation, the restored site and remaining pit and fissures were coated by a sealant material and light-cured for 20 seconds. All restored and sealed sites were checked by an explorer before removing isolation material; also, the patient's occlusion was checked.

2.3. Ethical Consideration

The permission for conducting the study was obtained from the authorities of Hamadan Dentistry School, and the subjects' parents were ensured about the confidentiality of the data.

2.4. Data Analysis

The obtained data were entered to SPSS version 16. All subjects were described using descriptive statistics including mean, standard deviation, frequency, and percentile. To compare the rates of complete success, based on the studied variables, Chi-square test was used.

3. Results

3.1. Demographic Data

In this study, 57 patients were examined, among whom 24 (42 %) were male and 33 were female (58 %). A total of 125 teeth were studied, of which 88 (70.4%) and 37 (29.6%) teeth belonged to female and male subjects, respectively. The subjects were within the age range of 7 to 13 years. Age of 10 years was the most frequent (n=31, 26.4%) and age of 7 years was the least frequent age (n=4, 3.2%) among the cases.

In the examination of first permanent molar teeth, the upper right molar teeth and the lower right molar teeth had the highest (45, 36%) and the lowest (14, 11.2%) frequencies, respectively. *Insert table1*

Table 1. Distribution of the examined first permanent molar teeth

Position of tooth	Frequency (%)
Upper left molar	33 (26.4%)
Upper right molar	14 (11.2%)
Lower right molar	45 (36%)
Lower left molar	33 (26.4%)
Total	125 (100%)

Regarding age and the ratio of the number of permanent teeth to deciduous teeth, DMFT was calculated if the number of the patient's permanent teeth was greater than the number of deciduous teeth; dmft was calculated if the number of deciduous teeth was higher than the permanent teeth. In 96 (76.8%) cases, DMFT and in 29 patients (23.2%) dmft were calculated.

3.2. CAR Treatment

We assessed the status frequency of CAR treatment in the examined teeth. Completely-bonded restoration without occlusal caries (n=45, 36%) was the most frequent status of PRR and complete lack of sealant without occlusal caries (n=6, 4.8%) had the lowest frequency. *Insert table 2*

Table 2. The status of CAR treatment

Status of PRR	Frequency (%)
Completely retained restoration without occlusal caries	45 (36%)
Partial loss of sealant without occlusal caries	16 (12.8%)
Partial loss of sealant with occlusal caries	33 (26.4%)
Complete loss of sealant without occlusal caries	6 (4.8%)
Complete loss of sealant with occlusal caries	12 (9.6%)
Defects in composite resins	13 (10.4%)
Total	125 (100%)

CAR treatment was successful in 67 (53.6%) cases, though for 58 (46.4%) patients, CAR did not provide satisfactory results. Frequency distribution of re-treatment showed that 51 (40.8%) patients did not require re-treatment, whereas 61(48.8%) cases needed PRR; also, 13 (10.4%) individuals required a composite or amalgam restoration. None of the examined subjects needed more (two or more surfaces) amalgam or composite restoration.

According to the results, 60 (48%) cases brushed their teeth once on a daily basis; however, 65 (52%) subjects did not regularly brush their teeth. Three (2.4%) patients had referred to dentists, but 122 (97.6%) cases did not. Use of fluoride mouth rinse was reported in 34 (27.2%) cases, and fluoride therapy was performed in only 4 (3.2%) patients.

In the evaluation of the relationship between complete CAR success and gender, there was no significant difference (P>0.05). We divided all subjects into three groups according to their age: less than 8 years (n=24), 8-10 years (n=64), and more than 10 years old (n=37). We assessed the association between CAR success and age, and a significant difference was observed (P<0.05); in fact, the success rate of CAR treatment was high in older ages. *Insert table3 and diagram1*

Table 3. Relationship between CAR, success/failure of the treatment, and age

CAR		Age			Total	P-value
		<8	8-10	10<		
Treatment	Success	24 (64.9%)	23 (35.9%)	20(83.3%)	67 (53.6%)	0.001
	Failure	13 (35.1%)	41 (64.1%)	4(16.7%)	58 (46.4%)	
Outcomes	Completely retained restoration without occlusal caries	13 (35.1%)	16 (25%)	16 (66.7%)	45 (36%)	
	Complete loss of sealant without occlusal caries	3 (8.1%)	3 (4.7 %)	0 (0%)	6 (4.6 %)	
	Complete loss of sealant with occlusal caries	4 (10.8%)	4 (6.2%)	4 (16.7%)	12 (9.8%)	
	Partial loss of sealant without occlusal caries	8 (21.6%)	4 (6.2%)	4 (16.7%)	16 (12.8%)	
	Partial loss of sealant with occlusal caries	4 (10.8%)	29 (45.3%)	0 (0%)	33 (26.4%)	
	Defects in composite resins	5 (13.5%)	8 (12.5%)	0 (0%)	13 (10.4%)	

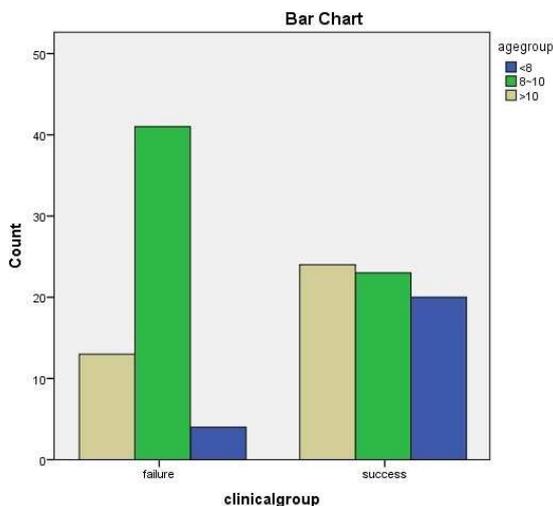


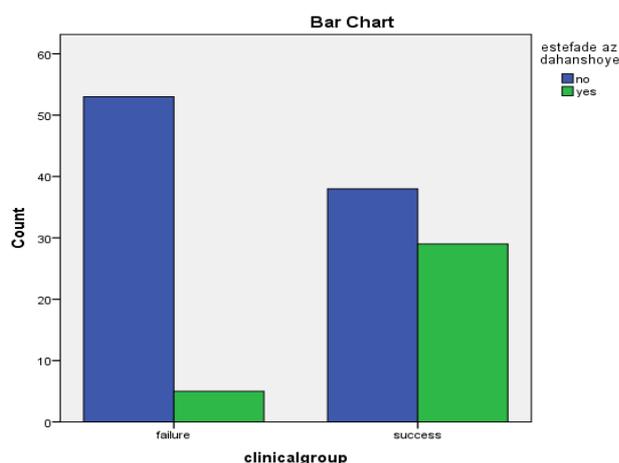
Diagram 1. Bar graphs of age and CAR outcomes

Considering dmft/DMFT, we divided all cases into three groups: score 0, scores 1-4, and scores higher than 4. Of all 125 examined patients, seven cases had a score of zero; ninety-three cases had scores 1-4, and twenty-five subjects had scores higher than four. No significant association was found between success/failure of the treatment and dmft/DMFT (P>0.05). Also, there was no significant correlation between brushing and success of CAR treatment; i.e., brushing did not affect CAR outcomes.

In total, 122 individuals did not refer to dentists (only 3 cases did); there was no association between dental visit and status of CAR treatment (P>0.05). On the other hand, there was a significant association between using fluoride and CAR success (P=0.001). Therefore, fluoride mouth rinse could increase CAR success rate. *Insert table4 and diagram 2.*

Table 4. The association between CAR outcomes and fluoride mouth rinse

CAR	Fluoride mouth rinse		Total	P-value	
	Yes	No			
Treatment	Success	29 (85.3%)	38 (41.8%)	67 (53.6%)	0.001
	Failure	5 (14.7%)	53 (58.2%)	58 (43.4%)	
Outcomes	Completely retained restoration without occlusal caries	17 (50%)	28 (30.8%)	45 (36%)	
	Complete loss of sealant without occlusal caries	0 (0%)	6 (6.6%)	6 (4.8%)	
	Complete loss of sealants with occlusal caries	4 (11.8%)	8 (8.8%)	12 (9.6%)	
	Partial loss of sealant without occlusal caries	12 (35.3%)	4 (4.4%)	16 (12.8%)	
	Partial loss of sealant with occlusal caries	1 (2.9%)	32 (35.2%)	33 (26.4%)	
	Defects in composite resins	0 (0%)	13 (14.3%)	13 (10.4%)	

**Diagram 2.** Bar graphs of fluoride mouth rinse and CAR outcomes

In total, 121 cases did not undergo fluoride therapy, of whom 63 (52.1%) subjects obtained successful results. In addition, in all 4 patients, who received fluoride therapy, CAR results were successful (100%). Although all cases, who received fluoride therapy, showed successful treatment results due to low frequency; there was no significant relationship between this variable and CAR results. We also assessed the association between CAR outcomes and the restored tooth site and no significant difference was observed ($P > 0.05$).

4. Discussion

Over the past 30 years, substantial progress has been made in dental materials and reconstructive techniques due to significant scientific advances. Moreover, the attitude towards improving mouth health has changed with an emphasis on caries prevention. Based on current principles, non-invasive methods are preferred to invasive treatments (13).

The major problem of permanent teeth is occlusal caries, which constitutes 60% of all caries in children and adolescents. Pit and fissure caries are among the most common types of caries. It seems that sealant decreases the need for restoration of occlusion by 75% (14). In these cases, dental restoration with composite is preferred to amalgam, since cavity preparation is more conservative. In contrast to amalgams, these restorations do not require extension for prevention, strengthen the tooth structure, require smaller and thinner cavity preparation; also, they can cover the adjacent

non-carious but susceptible pit and fissures, too (15, 16).

Several studies have been conducted on factors contributing to the success of CAR method and its preventive role in caries progress. This study was designed to evaluate the success rate of PRR treatment in first permanent molars. The main objective was successful and complete sticking of CAR resin material and lack of occlusal caries in the examined teeth.

Our findings showed that CAR success rate was 53.6% for the treated teeth, while Subramanya et al. (2006) reported 7.5% success rate of CAR in one year (17). In addition, the calculated success rate was not consistent with the results of Welbury' study (1990), who reported complete CAR achievement for 95% of the cases; the results were also inconsistent with the findings of Walker (1996), who reported a success rate of 83% over 6.5 years (18, 19).

In terms of requirement for re-treatment, 48.8% of the cases needed CAR treatment while 40.8% of the cases did not; also, 10.4% of the patients required a composite or amalgam repair and did not require more (two or more) surface restorations. This indicates lack of deep penetration in the restored decayed teeth in many subjects.

There was no significant correlation between the success rate of CAR and gender ($P\text{-value} > 0.05$), which is consistent with the studies by Memarpour (2011) and Folke et al. (2004) (20, 21). On the other hand, this study showed a significant relationship between the age of the examined individuals and treatment success ($P=0.001$); in fact, treatment was less successful in early ages. That seems due to lesser patients' cooperation in the younger children. Contrarily, Oulis et al. (2009) studied the fissure sealant retention and caries development after resealing on first permanent molars of children with low, moderate, and high caries risk (22). They did not report any association between age and CAR, which is inconsistent with our results.

Bravo et al. (1996) showed that dmft reduction could increase the success of treatment (23); however, we did not observe a significant correlation between complete success of the treatment and dmft/DMFT. Also, the obtained data showed that there was no relationship between dental visits and the success rate of the treatment, which is in line with Oulis's results (22).

We reported that the application of fluoride mouth rinse increases the treatment success, ($P < 0.05$), but there was no significant association between fluoride therapy and treatment success. Later finding do not correspond with

Folke's study (21). Folke et al. reported that fluoride therapy could result in a double-fold increase in treatment success.

There was no significant relation between the site of tooth and success rate; correspondingly, Memarpour reported similar results (20).

5. Conclusion

The success rate of CAR treatment for first permanent molars was moderate in the current study. Also, there was a significant association between the patients' age, use of fluoride mouth rinse, and treatment success rate. In addition, older cases showed better response to CAR.

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