On the use of fissure sealants in caries prevention

A clinical study

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The aim of the present study was to clarify in the light of a clinical investigation on 6–7 years old children, some questions concerning the use of fissure sealants in public dental care. The results of the study conducted with the Nuva-Seal R (L.D. Caulk, Milford, Del.) compound suggested a caries decrease of 84 per cent one year, and 53 per cent two years after sealant application to permanent teeth. In deciduous teeth the reduction was rather similar. Totally or partially lost sealants were not reapplied or repaired during the investigation. It is obvious that the sealants are, in most cases, apt to postpone the need of restorative treatment for a limited period of time only. Postponement may, however, be considered to achieve some advantages as compared with conventional or prophylactic filling procedures.

Key-words: Preventive dentistry; resin materials

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The use of fissure sealants had been observed to provide promising means in preventive dentistry (*Cueto & Buonocore*, 1967; *Buonocore*, 1970; *Ripa & Cole*, 1970; *Buonocore*, 1971; *McCune & Cvar*, 1971; *Rock*, 1973; *Luoma et al.*, 1973; *Risager & Poulsen*, 1974; *Meurman et al.*, 1975). The high percentage of caries reduction obtained in certain previous investigations appears to be partly explicable by frequent resealings of partially or completely lost sealants. Most investigators seem to agree that teeth with no losses of adhesive coverage have remained non-carious when evaluated 1–2 years after application.

The purpose of the present study was to evaluate the adhesive fissure sealants with regard to clinical aspects.

MATERIAL AND METHODS

A total of 163 children from Turku, mostly 6–7 years of age, participated in this clinical study. The individuals were called for the study randomly. Generally the children whose contralateral teeth were determined as clinically intact at a preliminary routine examination were included. For reasons subsequently encountered, the experiment had to be suspended on purpose for part of the

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children. Thus the number of subjects after a period of two years was 73 (33 boys and 40 girls).

The first permanent upper and lower molars as well as the first and second deciduous molars were selected for treatment. The sealants were applied to the teeth of the right or left quadrants only so as to leave one of the matching teeth unsealed. The matching teeth in the contralateral quadrants were used as controls. The criterion for sealing was that the contralateral teeth were recorded intact. This was asserted clinically and radiographically through bitewing radiographs.

The following techniques recommended by the manufacturer of the sealant (Nuva-Seal) was employed where applicable. The tooth to be sealed was carefully cleansed. Contrary to the manufacturer's recommendation no zircate treatment was used, the rolling brush being considered to cause packing of plaque and zircate into the fissure (*McLean & Wilson,* 1974). The tooth was rinsed, isolated with cotton rolls, and dried. Etching was performed with 50 % solution of phosphoric acid applied to the occlusal surface with a cotton pellet. The solution was allowed to remain on the enamel for 1.5 – 2.5 minutes. The conditioning was repeated as described above if the surface had not received an opaque appearance indicating successful etching. After conditioning, rinsing, and drying the liquid adhesive resin was applied to the fissures with a brush. After this the adhesive material was polymerized by ultra violet light (Nuva-Lite, UV-lamp, L.D. Caulk, Milford, Del.). Each tooth was first exposed to the light for 20 seconds, but very soon the time was prolonged to almost 60 seconds as it was observed that the exposure recommended by the manufacturer appeared to be inadequate. Finally the entire surface was examined with an explorer to reveal any flaws or incomplete coverage.

Clinical examinations of the retention of the sealant and caries recordings were carried out at 6-month intervals from application. No replacements were performed if the adhesive had been lost between the examinations. Even partial losses of the adhesive were recorded as lost sealants. In most cases the loss of the sealant was complete and, as a rule, partial losses were in later examinations found to have become complete. The loss usually started at one end of the fissure. All the procedures and evaluations described were performed by the members of the team. It was agreed that the view of one investigator (R.B.) was decisive if any suspicions should arise as to the diagnosis of caries. During the investigation the children received regular dental treatment, and fissures diagnosed as carious were filled according to conventional methods. The dentists carrying out the treatment were kept informed about the present investigation. The formula generally accepted for the evaluation of caries reduction was employed in the present study.

RESULTS

Retention of the sealants and caries

All teeth diagnosed as carious as well as all filled teeth were regarded as carious in Table I. Also the exceptional cases (the «control» tooth was filled already in the first examination) were included in the results. In these cases the intact tooth was treated in order to investigate solely the bonding behaviour of the sealant. These pairs were not considered in the estimation of the caries reduction. The values for the caries reduction in permanent teeth are given in brackets in Table I. Table II shows the results obtained for deciduous teeth.

One year after application ¾ of the sealants applied to permanent teeth were found to be in good condition and no carious development could be detected (Table I). If the condition of the coverage was good two years after application, the fissures had remained clinically non-carious. 60 per cent of lost coverage was recorded in the examination conducted two years after the application. During the second year, the relative proportion of lost sealants was higher than during the first year. One third of the teeth

Table I. *The retention of adhesive fissure sealants, incidence of caries and caries reduction on the first permanent molars of Finnish school children. Results one and two years after application. The sealants were not reapplied or repaired during the investigation. The values in brackets are used in calculating caries reduction, see material and methods*

	Experimental group						Control group			Caries reduction
	Tot.no. of sealed teeth	Good retention of the sealant, no caries		Total or partial loss of the sealant, no caries		Total or partial loss of the sealant, caries detectable	Tot.no. of teeth	Incidence of carious teeth		
		No.	%	No.	%	No. %		No.	%	%
One year after application	126 (115)	93 (83)	74 (72)	22 (22)	17 (19)	11 (10) 9 (9)	115	64	56	84
Two years after application	120 (112)	48 (44)	40 (39)	24 (23)	20 (21)	48 (45) 40 (40)	112	94	84	53

Table II. *The retention of adhesive fissure sealants, incidence of caries, and caries reduction on the first and second primary molars of Finnish school children. Results one and two years after application. The sealants were not reapplied or repaired during investigation*

	Experimental group						Control group			Caries-reduction
	Tot.no. of teeth	Good retention of the sealant, no caries		Total or partial loss of the sealant, no caries		Total or partial loss of the sealant, caries detectable	Tot.no. of teeth	Incidence of carious teeth		
		No.	%	No.	%	No. %		No.	%	%
One year after application	32	21	67	10	30	1 3	32	6	19	84
Two years after application	29	13	45	12	41	4 14	29	7	24	42

whose sealant were lost within two years after application, remained non-carious while two thirds displayed carious development. Outside the data given in the tables it should be mentioned that almost ¾ of the teeth whose coverage was partially or totally lost within one year after application, showed carious development by the end of the second year. One year after application the proportion of non-carious teeth was 90 per cent, after two years the percentage was 60. Thus, two years after the beginning of the study, 40 per cent of the teeth belonging to the experimental group were carious.

In the control group the corresponding percentages were after one year 56 per cent and after two years 84 per cent. It seems that in this group the relative caries incidence has been much the same during the first and second year. During the first year the use of

adhesive sealants had achieved a caries reduction of 84 per cent which percentage, however, during the second year declined to 53 per cent. The most conspicuous differences between permanent and deciduous teeth (Tables I and II) can be recorded in the incidence of caries; the incidence in the experimental group two years after application was 40 per cent for permanent but only 14 per cent for deciduous teeth. This observation is well in agreement with that of the control teeth. The caries reduction for deciduous teeth during the first year was, however, the same as for permanent teeth, but during the second year the reduction declined to 42 per cent which percentage was lower than that recorded for permanent teeth. No significant differences could be demostrated between deciduous and permanent teeht in the bonding behaviour of the coverage.

DISCUSSION

The results of the present study are in accordance with previous investigations in which sealants have been reputed to keep the fissure of the teeth caries-free for a longer period than if no sealants had been applied. On the other hand, the results obtained reveal that the reduction of caries achieved was lower than e.g. in the investegations by *Buonocore* (1971) and *Meurman et al.* (1975) whose approach, however, was more metodical than purely clinical.

It is possible that in some cases the loss of the sealant was due to the fissures being carious prior to the application of the coverage. Furthermore, even with all possible attention paid to keeping the occlusal surface dry during the treatment, the effects of humidity on sealant losses cannot be totally excluded, in particular when the tooth was sealed shortly after eruption. On the other hand, it seems conceivable on the basis of the investigation conducted by *Meurman et al.* (1975) that neither the consistency of food nor any dietary habits can influence the retention properties of the sealant.

The results obtained show that a carious process alone might have resulted in sealant losses during the first year in no more than one third of all the losses in permanent teeth. It is thus reasonable to assume that complete adhesive coverage retains the teeth caries-free for one year, and, moreover, it seems that in most cases the fissures remain caries-free for a period of two years. Considerable caries reduction, for comparatively long periods, seems possible with the sealing materials available today once the retention of the sealant is checked at sufficient intervals and the uncovered intact fissures are resealed. Routine reexaminations every six months seem to be of essential importance because one fourth of the sealant in permanent teeth were lost one year after application, and one third of the uncovered fissures had become carious within that time. It should be mentioned that the low caries incidence observed during the investigation in the deciduous teeth of the controls, which subsequently was reflected in the degree of caries reduction, is very likely a result of selection.

The main advantage of the sealant is that in most cases restorative procedures in fissures could be avoided during a certain period. Within a certain period after eruption the tooth would, however, show caries attacks on its interprocimal surfaces and restorative procedures are thus needed. Thus it seems obvious that at a certain stage most of the protection provided by the sealants would be lost. However, by using the sealants, the preservation of the tooth substance is evident, and there are no risks of pulp damages. Frequent reexaminations are necessary particulary during expected tooth eruption. It is still probable that costs due to working time, materials, units and instruments, would be lower for every single procedure of sealant application than for filling treatment.

No particular problems were encountered in the management of the children, good cooperation was achieved and maintained rather soon in most cases. Altough the sealing procedure was found to be rather mono-

tonous, the absence of the stress caused by the use of the drill was experienced as a positive result.

The attitudes of the children's parents towards the use of sealants were, very positive and hopeful, which can be recorded as an encouraging result. However, the hopefulness may involve a precarious factor. The use of sealants alone is believed to guarantee the preservation of dental health. Therefore it is necessary that particular attention should be paid to distributing realistic information about the sealants.

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