Comparison of retentive qualities of two glass-ionomer cements used as fissure sealants

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When resin sealants are used, it is essential that they have an enduring quality, in order to gain full advantage of their preventive effects. Because of their fluoride-release, complete retention may be of less importance, however, when glass-ionomer materials are used as sealants.[1-3] This assumption is based on the observation of the remains of glass-ionomer cement, which were observed by scanning electron microscopy after a clinical loss of sealant had occurred; but it is unclear whether these remnants may still have a preventive effect.[1,4,5]

The results described in the literature concerning retention of glass ionomer cement sealants are somewhat conflicting. McLean and Wilson reported a retention rate of 84 percent after one year in selected fissures, with a fissure width of more than 100 µm.[6] Comparable results were reported in studies where a glass ionomer cement restoration, whether or not in combination with phosphoric etching of the enamel, was used.[7,8] Although when a specially formulated glass ionomer cement sealant material was used, lower retention rates (varying from 1.7 percent to 45 percent after six months) were reported by several authors.[1,9-11] Due to the lower overall retention of glass ionomer cement sealants, compared to resin-based materials and the uncertainty of the long-term caries preventive effect, glass ionomer cement sealants are reluctantly applied in daily dental practice.[1,9,11-13]

Nevertheless, there may be a need to protect occlusal surfaces before the molar is completely erupted. Then one is restricted in the use of resins, because complete isolation from saliva cannot always be obtained. In these cases glass ionomer cement can be an alternative and in view of rational practice management it is of interest whether 'special' glass ionomer cement sealant material is needed or whether a glass ionomer cement restorative material can be used instead.[14] Since the introduction of Fuji III® as a specially formulated sealant material, few developments regarding glass ionomer cement sealant materials have occurred. Nevertheless, new brands of restorative glass ionomer cement materials have frequently been marketed, of which the recently introduced Fuji Ionomer Type IX® is an example. Fuji IX is an improved version of Fuji II and was originally developed as the restorative material for the Atraumatic Restorative Treatment.[15]

The aim of this study is to compare, therefore, the retention rates of a glass ionomer cement designed as a sealant material with the glass ionomer cement restorative material.

MATERIAL AND METHODS

In a clinical trial using a split mouth design, 104 children (mean age 10.4 years, s.d. 1.2), all patients of the Centre

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Acknowledgement: Centre of Youth Dental Health (JTV), Paramaribo (Surinam) for the opportunity to perform the study, GIC for material supply and Dr. H.J. Groen for his statistical advice.

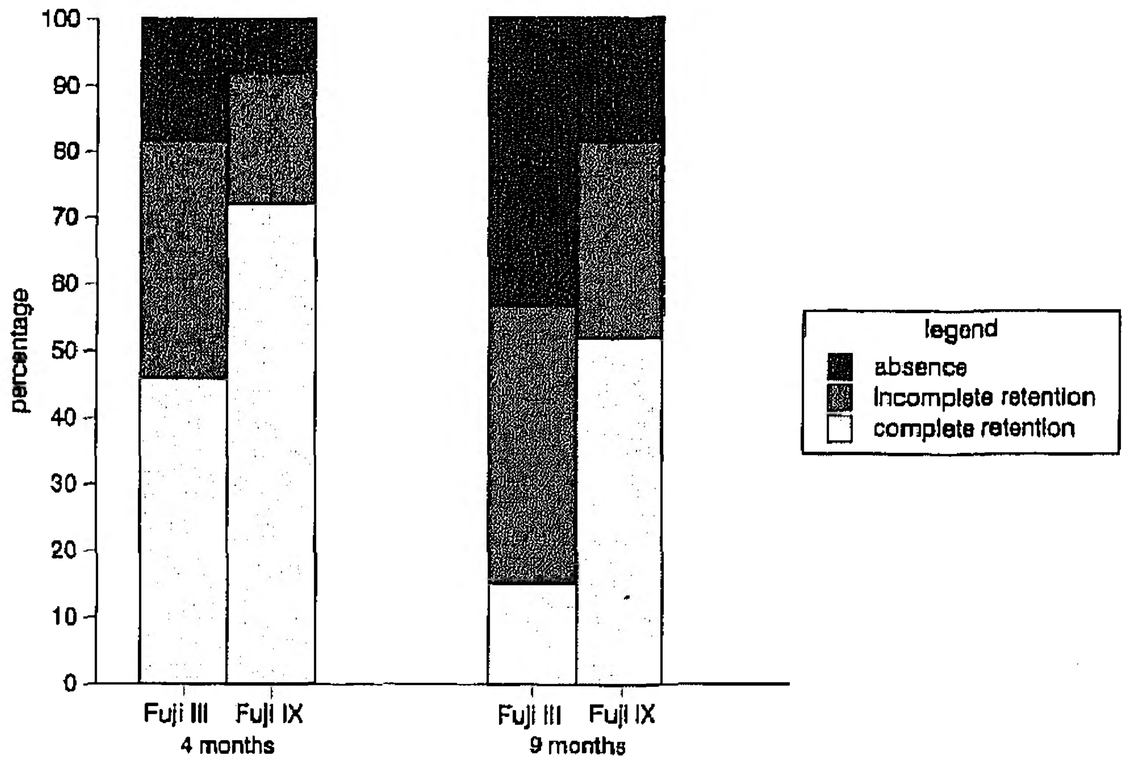

Figure. Retention percentages of Fuji III and Fuji IX.

Table 1 ☐ RR Fuji III and Fuji IX after four months.

Retention	Fuji III	Fuji IX	Relative risk	(95% confidence-interval)
Complete	46	71		
Incomplete	35	20	.571	(.394−.829)
Absence	18	8	.444	(.247−.799)
	99	99		

Table 2 ☐ RR Fuji III and Fuji IX after nine months.

Retention	Fuji III	Fuji IX	Relative risk	(95% confidence-interval)
Complete	15	51		
Incomplete	41	30	.732	(.534−1.004)
Absence	43	18	.419	(.387− .453)
	99	99		

of Youth Dental Health, Paramaribo (Surinam), received 104 Fuji Ionomer Type III® (G-C Corporation) and 104 Fuji Ionomer Type IX® (G-C Corporation) sealants. After cleaning with pumice, the materials were randomly placed in caries-free maxillary or mandibular first or second molars by five experienced dental auxiliaries. Moisture control was achieved by cotton rolls. Fuji IX was applied to the fissure with a ball burnisher and, to enhance adherence, finger pressure of a gloved finger with petrol jelly was used. Fuji III was applied with an Ash 49® instrument and covered with varnish according to the manufacturer's instructions. After initial hardening of the materials, the occlusion and articulation were checked by thin foil and, if necessary, corrected, using a round burr.

The sealants were evaluated 'blind' by calibrated dental auxiliaries other than those who applied the sealants. After four and again after nine months, the retention of the sealants was checked clinically (by visual inspection and in case of doubt a probe was used) and recorded as *complete retention*, *incomplete retention* or *absence of the material.*

As suggested by Riordan and FitzGerald, for split mouth designs besides retention percentages, also relative risks (RR) were estimated.[16] The 95 percent confidence intervals were determined, using a modified estimate of the standard deviation, since retention was classified in three categories instead of two as described by Riordan and FitzGerald. All other statistical analyses were performed by using SPSS/PC + V5.01.[17] Wilcoxon matched-pairs rank tests were used to calculate for the differences in success rates between pairs. The differences between female or male, maxillary or mandibular jaw, first or second molar, and operator effect were tested by means of a Chi-square test, for each material separately.

RESULTS

During the period of the study, 99 patients with 198 treated molars were available for evaluation at four and nine months. Due to change of residence and illness five patients with ten sealants could not be assessed for both evaluation times.

Figure 1 shows the retention percentages after four and nine months. The difference in success rates of the two materials was significant on both evaluation occasions (Wilcoxon matched-pairs, signed-ranks test 2-tailed $p<.001$). The relative risks for Fuji III and Fuji IX after four months and nine months are shown in Tables 1 and 2, respectively. Converted to chance to total absence, the chance for Fuji IX was about 60 percent less than that for Fuji III.

At the four-month recall as well as the nine-month recall no significant difference in retention per material was found between female or male, upper or lower jaw, first or second molar. Also no operator effect was noticed, according to the retention rates for the five operators.

After nine months caries was diagnosed in nine (5 percent) of the 198 originally caries-free molars. In all these molars (treated with either Fuji III or Fuji IX) the sealant showed incomplete retention or absence of the material after nine months, while in one of these molars the sealing was judged clinically to be absent after four months.

DISCUSSION

The high rate of material loss for Fuji III in this study is confirmed in other studies.[1,9,12,13] After four months 46 percent of the Fuji III® and 72 percent of the Fuji IX® sealants showed complete retention with a further decline in retention to 15 percent and 52 percent, respectively, after nine months. Although not perfect, the retention rate of the restorative (Fuji IX) was significantly better than the sealant material (Fuji III). This better performance of the glass ionomer cement restorative material may be due to a higher strength, while the use of finger pressure can be advantageous in adherence and mechanical retention. The difference cannot be attributed to a difference in handling experience, since the dental auxiliaries were familiar with the handling of both glass ionomer cement materials. The percentage of retention of the restorative material was lower, however, than the results of Ketac Fil® as reported by McKenna and Grundy.[7] A reason for this difference could be the fact that the present study was carried out as a field study, whereas the operators in the study of McKenna and Grundy were student dental therapists working under training conditions.

Differences in retention rates are reported between operators and between mandibular and maxillary molars.[1,7,10,12] In our study, operator variability as a factor in retention of sealants was not noticeable. Also no favor in retention of the material for mandibular molars compared to maxillary molars was found.

The continuous fluoride release from the material may lead to a more mature and acid-attack resistant enamel at the fissures.[2,18] In the literature, caries preventive effects are reported to prevail even after visible loss of the glass ionomer cement sealant.[1,3,5,14] But in a recent study hardly any caries reduction was found with glass ionomer cement sealants after two years; while Shimokobe found inferior effectiveness in caries resistance for the glass ionomer cement-treated group compared to the resin-treated group after three years.[11,19] Thus it seems that there is still not enough knowledge of the caries-reducing effect of glass ionomer cement compared to resin-based materials. More long-term research, therefore, is needed.

CONCLUSION

When glass ionomer cement is used as a sealant material, the results of this study showed the glass ionomer cement restorative material to be more retentive than the glass ionomer cement sealant material.

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