

# Sealing of Fissures with Compomer Material: Retention After 12 Months

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## Summary

*Compomer materials combine some properties of glass ionomer cements as well as composite materials. The aim of this study was to evaluate the retention rate of compomer, used as a fissure sealing material after a clinical trial of twelve months. Eighty teeth, divided into three groups were sealed with compomer material (Compoglass, Vivadent) after different treatment of the occlusal surfaces. Group A comprised 24 teeth, sealed according to the manufacturer's recommendations. Group B consisted of 36 teeth, etched with 37% phosphoric acid and original adhesive system applied. In Group C 27 teeth were sealed after etching of occlusal surfaces with 37% phosphoric acid following application of adhesive system (Optibond, Kerr). After twelve months the retention rate in Group A was 87.5%. Sealant was completely or partially missing in 3 teeth. In Group B retention rate was 86.1% with sealant completely or partially missing in 5 teeth while in Group C 77.8% of the teeth were completely sealed and in 6 teeth the sealant was completely or partially missing. Student t-test did not reveal statistically significant difference between the groups and techniques of sealing. Generally, retention rate of 87 teeth sealed with compomer material after 12 months of clinical service was 83.9% (sealant intact in 73 teeth) with no new caries lesions. Results are comparable with results obtained using classic composite sealant materials and can be recommended in everyday practice. However, long-term evaluation is still needed to obtain more reliable data.*

**Key words:** *compomer material, sealant, fissure.*

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## Introduction

Over the last twenty years there has been a decrease in the incidence of carious lesions in children and young adults, as a result of different preventive measures (1-4). However, 85-90% of carious lesions still occur in pits and fissures of occlusal

surfaces. Since 1967, when Cueto and Buonocore introduced into dental practice the sealing of pits and fissures of occlusal surfaces with adhesive resin as a preventive measure, many studies have evaluated their effectiveness (5-8). Moreover, the investigations of Simonsen (9) Ismail and Gagnon (10) showed average loss of sealant of 5-10% annually.

The disadvantages of classic materials for sealing on the basis of composite resin, without the addition of filler, are low resistance to wear and poorer marginal strength compared to composite materials, which contain a filler (5). Powell (11) and Strang et al (12) demonstrated the greater resistance to wear of materials which contained filler of different sized particles and percentage share. Numerous materials and methods have been introduced in clinical practice with the aim of achieving better retention and preventive effect (1,7,8,13-17).

Glass ionomer materials have shown a relatively low degree of retention compared to classic composite materials for sealing. However, there is contradiction as to their effect on the prevention of occlusal caries in cases of complete or partial loss of sealant (17-20).

Compomers, or composite resins, modified with acids incorporate some of the characteristics of glass ionomer materials, such as the release of fluorides, and the characteristic of composite materials - low susceptibility to abrasion due to the existence of filler (21-23). Compomers consist of fluoroaluminosilicate glass, acid modified methacrylates, anorganic filler and pigment (22-24, 25).

The reaction of hardening of the compomer includes light polymerisation of the composite part of the material and acidic reaction due to adsorption of water from the surrounding tissue, and ions of fluor are released as a result of the acido-basic reaction (21,22). Laboratory research of the marginal leakage of compomer materials for sealing showed marginal leakage comparable with composite resins (26-30).

The object of this study was the clinical evaluation of compomer sealants in pits and fissures of molars, 12 months after application.

## Material and methods

Eighty-seven first and second molars with marked morphology of the occlusal surfaces, were divided into three groups and sealed with compomer material Compoglass (Vivadent, Schaan, Liechtenstein) by application of different methods of occlusal surface preparation. Before sealing the teeth were cleaned

with prophylactic paste, Protect prophy paste (Butler, Chicago, USA) and isolated with cotton roll.

Group A consisted of 24 teeth, sealed in accordance with the manufacturer's instructions by the application of the original adhesive system. The adhesive system was applied with a brush to the enamel surface and after 20s dried by compressed air and polymerised for 20s. Application of the adhesive system was repeated once more. After polymerisation of the adhesive system for 20s the compomer material was applied in the fissure system.

Group B included 36 teeth, etched with 37% phosphoric acid for 20s, rinsed and dried for 20s and the original adhesive system applied as described for Group A, and the fissures sealed with compomer material.

Group C consisted of 27 teeth, etched with 37% phosphoric acid for 20s, rinsed and dried for 20s and the adhesive system Optibond (Kerr, Romulus, USA) applied in accordance with the manufacturer's instructions. The compomer sealing material was applied in the fissure after the application of the adhesive system.

Polymerisation in all three groups lasted for 40s, using the standard technique of polymerisation with an apparatus for polymerisation Elipar II (ESPE GmbH, Seefeld, Germany).

Criteria according to Kilpatrick et al were used for clinical evaluation (1).

For statistical analysis Student's t-test of proportion was used for comparison of the degree of retention between the different sealing techniques.

## Results

In Group A complete retention of the compomer sealant after 12 months was 87.5%. Loss of one third of the sealant occurred in one case, two thirds of the sealant in one case and in one case the sealant had completely disappeared (Table 1) (Figure 1).

In Group B retention of the compomer sealant after 12 months was 86.1%. Partial loss of the sealant occurred in four teeth, in two cases one third of the sealant was missing and in two cases two thirds of the sealant, and in one case the sealant had completely disappeared (Table 2) (Figure 2).

In Group C the degree of retention of the compomer sealant was 77.8%. Partial loss of the sealant occurred in 6 teeth, in three teeth one third of the sealant was missing and in another three cases two thirds of the sealant (Table 3).

No new carious lesions on the occlusal surfaces were registered in any of the examined groups after 12 months. Student's t-test for proportion did not show statistically significant differences between the groups and sealing techniques. The degree of retention of the compomer sealant in 87 teeth after 12 months was 83.9% (the sealant was intact in 73 teeth) (Table 4).

## Discussion

For successful prevention of caries of occlusal surfaces the goal is to prevent retention of remaining food and plaque in pits and fissures. Cueto and Buonocore (6) were the first to apply adhesive resin to the occlusal surfaces of teeth. Garcia-Godoy et al (16) demonstrated that by sealing the occlusal surfaces by applying unfilled resin it is possible to stop demineralisation of the initial carious lesions. According to Walker et al (5) the degree of retention of resin sealant after 8 years in a sample of 7838 sealed molars was 78%. Lygidakis et al (7) showed that the degree of retention of the sealant after 4 years ranged from 81 to 93%, regardless of the method of tooth isolation. Better results were obtained when the treated teeth were isolated with rubber dam, compared to the results when the teeth were isolated with cotton roll, although the difference was not statistically significant. Straffon et al (31) and Eidelman et al (32) obtained similar results. Futatsuki et al (8) report success in 14.7% of sealed teeth after the first three months following application and a further 7% failure after 6 months. In their investigation of the success of Fluroshield and Delton sealing materials, Lygidakis and Oulis determined the degree of retention after two years of 92% and 90% respectively, and after 4 years the degree of retention of the sealant was 77% and 89% (33).

Numerous authors have recommended various techniques of micromechanical preparations of occlusal surfaces for improvement of sealant retention. According to Xalabarde et al (15) adaptation of the sealant to the occlusal surface is better after

carrying out enameloplasty, because in this way obstruction of the spreading of the sealing material is avoided due to inclusion of small air bubbles. Lygidakis et al (7) and Shapir and Eidelman (34) also showed similar results. According to Pope et al (14) the use of air polishing with aluminium oxide increases sealant adhesion to the enamel. In their investigation of the penetration of prophylactic paste into fissures, Asquinazi et al established that etching with 37% phosphoric acid for 30s and rinsing for 30s enables the removal of paste from the fissure (35). Remains of the paste in the fissure system can effect retention of the sealant to the occlusal surface. Also, microleakage around the sealant is less when the sealing material is used with filler and adhesive system (36).

Glass ionomer materials have a powerful preventive effect because of their characteristic of releasing fluorides. However, the degree of retention of glass ionomer sealing materials is very low. Weerheijm et al (17) showed that the degree of retention of Fuji II glass ionomer material after 9 months was 15%, and Fuji IX 51%. Forss et al (37) determined 26% retention of the sealant after two years. The degree of retention after seven years was only 10% (18). Regardless of the degree of retention it was found that the remains of the sealant and ability to release fluorides have a powerful preventive effect on the development of carious lesions (38-40). However, Weerheijm et al (17) and Forss & Halme (18) showed greater incidence of caries in teeth with complete or partial loss of sealants of glass ionomer material. Mass et al report reduced presence of *S. mutans* on sealed occlusal surfaces with composite resin immediately after carrying out the sealing up to 6 months later (41).

Because of their better mechanical characteristics than resin for sealing and the characteristic of releasing fluorides, compomers may also be valuable for sealing fissures. According to Millar et al (21) the release of fluorides from compomers is less than from glass ionomer cements. However, when the degree of retention of the sealant is high, even a smaller amount of released fluorides can have significant preventive effect. In an investigation of the retention of Dyract Sealant compomer sealing material Fuks et al determined complete retention of 80% in permanent molars and 85% in primary molars

after 12 months' clinical application (42). Treatment of the enamel prior to the application of material was carried out by NRC technique (non-rinse conditioning) without the classic procedure of etching. Autio Gold (43) found that the degree of complete retention for Cu-Ray-Match liquid/flowable composite material after 18 months of only 40% compared with Delton composite resin of 64.4%. The foregoing values of retention in both groups of materials appear to be very low. In this investigation the degree of retention of sealants made with compomer material was 83.9% after 12 months. Such a degree of sealant retention can be compared with the results obtained by using conventional resin for sealing. The best retention is realised when the material used is compatible with the manufacturer's instructions, although a very high percentage of success was obtained in the group of teeth which were etched prior to application of the sealing material. Although not statistically significant the lowest degree of retention was obtained in the group which were etched and in which a different adhesive system than

the original was used. Application of a material which, with a higher percentage share of filler, has greater viscosity its distribution in the fissure system is difficult. Because of the greater viscosity penetration of the material into the fissure system is impeded and in clinical practice it is good to enable penetration of the material for 20s and then to polymerise it.

### Conclusion

Sealing with a compomer material by different techniques achieved a high degree of sealant retention of 83.9% after 12 months. The obtained degree of retention can be compared with the degree of retention of composite resin and can be recommended for everyday clinical practice. However, further clinical research is needed which will include longer evaluation of the material after fabrication of the sealant. This will enable more reliable data on the value of compomer materials for sealing fissures.