

Resin-based sealants longevity: a clinical evaluation

Longevidade dos selantes à base de resina: uma avaliação clínica

Longevidad de los selladores a base de resina: una evaluación clínica

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Abstract

Introduction: The occlusal surface of the molars are more susceptible to dental caries because of their anatomy, so in some cases, the sealants are indicated. **Objective:** The objective of this study was to evaluate the efficacy, retention, presence of caries and marginal discoloration of resinous sealants (Fluoroshield and Prevent) in first permanent molars. **Methods:** Ninety - one children aged 7 to 9 years were selected from a municipal institution Regente Feijó, SP, Brazil, for the application of resinous sealants to first permanent lower first molars. The application of Fluoroshield and Prevent resin sealants was performed according to the manufacturer's recommendations. The evaluation was performed after 6 and 12 months by double-blind examiners and followed the criteria: alpha (total sealant, absence of caries and absence of pigmentation) charlie (partial sealing, superficial caries and light pigmentation) charlie complete sealing, presence of cavitation and pigmentation) after 12 months of application by two previously calibrated examiners. **Results:** Using Fischer's exact test, no significant difference ($p > 0.05$) was observed between the resin-based sealant groups. In the evaluated criteria, both sealants after three years were similar, and may therefore be suitable materials for sealing grooves and fissures in permanent molars.

Descriptors: Pit and Fissure Sealants; Dental Caries; Dentition, Permanent; Oral Health.

Resumo

Introdução: As superfícies oclusais dos molares são mais suscetíveis à cárie dentária devido à sua anatomia, por isso em alguns casos, os selantes são indicados. **Objetivo:** O objetivo deste estudo foi avaliar a eficácia, retenção, presença de cárie e descoloração marginal de selantes resinosos (Fluoroshield e Prevent) em primeiros molares permanentes. **Métodos:** Noventa e uma crianças de 7 a 9 anos foram selecionadas em uma instituição municipal Regente Feijó, SP, Brasil, para a aplicação de selantes resinosos em primeiros molares inferiores permanentes. A aplicação dos selantes resinosos Fluoroshield e Prevent foi realizada de acordo com as recomendações do fabricante. A avaliação foi realizada após 6 e 12 meses por examinadores duplo-cegos e obedeceu aos critérios: alfa (selante total, ausência de cárie e ausência de pigmentação) charlie (selamento parcial, cárie superficial e pigmentação clara) selamento completo de charlie (presença cavitação e pigmentação) após 12 meses de aplicação, por dois examinadores previamente calibrados. **Resultados:** Usando o teste exato de Fischer, não foi observada diferença significativa ($p > 0,05$) entre os grupos de selante à base de resina. Nos critérios avaliados, os dois selantes após três anos foram semelhantes, podendo, portanto, ser materiais adequados para selar ranhuras e fissuras em molares permanentes.

Descritores: Selante de Fossas e Fissuras; Cárie Dentária; Dentição Permanente; Saúde Bucal.

Resumen

Introducción: La superficie oclusal de los molares es más susceptible a la caries dental debido a su anatomía, por lo que en algunos casos, los selladores están indicados. **Objetivo:** El objetivo de este estudio fue evaluar la eficacia, retención, presencia de caries y decoloración marginal de los selladores resinosos (Fluoroshield y Prevent) en los primeros molares permanentes. **Métodos:** Noventa y un niños de 7 a 9 años fueron seleccionados de una institución municipal Regente Feijó, SP, Brasil, para la aplicación de selladores resinosos a los primeros primeros molares inferiores permanentes. La aplicación de los selladores de resina Fluoroshield y Prevent se realizó de acuerdo con las recomendaciones del fabricante. La evaluación se realizó después de 6 y 12 meses por examinadores doble ciego y siguió los criterios: alfa (sellante total, ausencia de caries y ausencia de pigmentación) charlie (sellado parcial, caries superficial y pigmentación ligera) charlie sellado completo, presencia de cavitación y pigmentación) después de 12 meses de aplicación por dos examinadores previamente calibrados. **Resultados:** Utilizando la prueba exacta de Fischer, no se observaron diferencias significativas ($p > 0.05$) entre los grupos de selladores a base de resina. En los criterios evaluados, ambos selladores después de tres años fueron similares, por lo que pueden ser materiales adecuados para sellar ranuras y fisuras en molares permanentes.

Descriptores: Selladores de Fosas y Fisuras; Caries Dental; Dentiación Permanente; Salud Bucal.

INTRODUCTION

Caries be defined as a microbial disease of the calcified tissues of the teeth, characterized by demineralization of the inorganic part and organic destruction of the dental tissues¹. It's a disease mediated by diet and according to various scientific evidence, free sugars are the main factor necessary in the development of dental caries. Acid-producing bacteria, as well as other factors, facilitate the development of caries disease, but free sugars are the main cause of the disease². It is one of the most important problems in the field of Dentistry and Public Health³.

The anatomy occlusal is deep and winding, the pits and the fissures are considered the areas at greatest risk of dental caries incidence^{4,5}. Sealants act as a physical barrier that prevents food/biofilm from

accumulating in pits and fissures and therefore prevents the growth of bacteria that can lead to dental decay⁶. Their complex morphology is considered a site for harboring bacteria and food remnants, which render mechanical debridement inaccessible. They also reduce the effectiveness of fluoride's remineralizing activity due to inadequate salivary access to fissures^{7,8}.

Resin sealants require good moisture control, which is difficult to achieve during a dental eruption. Therefore, greater care should be taken when isolating teeth, which is an occlusion period, which is at a higher risk for caries⁹.

When referring to caries prevention in wells and fissures, based-resin sealants are as an effective solution to caries prevention, are valuable and

effective in preventive dentistry programs¹⁰. In terms of retention, the sealants resin-based are the materials that give more guarantees of success to 12 months⁵.

According to Baldini et al 2010¹¹, children initially classified as high risk and who had not been submitted to sealant placement had a higher risk of developing caries lesions within a two-year period. The previous caries experience was an excellent indicator of possible future caries and this knowledge can easily be used in oral health programs.

With proper use of science and the application of preventive methods, dental caries can be avoided, diagnosed early or even controlled. It is necessary, however, that the distance between knowledge regarding prevention, diagnosis and treatment, and how it is practiced, be improved¹.

The evaluation and comparative analysis of the clinical efficacy of resinous sealants (Fluroshield and Prevent) applied to permanent first molars may represent a major step in the search for an effective way to prevent dental caries, which would lead to a huge advance in dentistry, and since it is a low-cost and easy-to-apply method, it may be a method used in public health.

The objective of this study was to evaluate retention, prevalence of caries and marginal pigmentation of resinous sealants (Fluroshield and Prevent) in the prevention of dental caries in first permanent molars.

MATERIAL AND METHOD

The Ethics Committee of Universidade do Oeste Paulista (UNOESTE), under registration number 2283, has previously approved all procedures described here.

o Study Design

This was a longitudinal comparative experimental clinical trial.

o Sample Selection

This study included 91 children from the Municipal School of Education Professor Anna de Mello Castriani from the city of Regente Feijó (Sao Paulo State, Brazil). As the total value (91) of children participated in the evaluation of 6 months and only 79 participated in the evaluation of 12 months because of change or quitting. A total of 182 healthy teeth (first permanent molars) were selected from children aged 7 to 10 years, with a clinical indication for preventive sealants, presenting teeth with deep grooves that pose a risk to the development of dental caries, and patients with high risk of dental caries. The children were included in the research after signing the free and informed consent form by the parents or guardians, and by the assentment term, signed by them. The resinous sealant with load - Fluroshield® (Dentsply, Petrópolis, RJ, Brazil) and the resinous sealant with load - Prevent® (FGM, Joinville, SC, Brazil) were evaluated. Sealing was

performed by two previously trained operators, and evaluated by previously calibrated operators (Kappa = 0.82). The children necessarily had to have both lower molars first, without caries and restoration and the application was carried out at random. The conventional technique of application with relative isolation was used, in which the prophylaxis with pumice stone and water was carried out before the application of the material. Then acid conditioning was performed with 37% phosphoric acid (Dentsply on the teeth sealed with Fluroshield and FGM on the teeth sealed with Prevent) in the enamel for 30 seconds, and the surface was then washed for 30 seconds and subjected to 30 seconds drying for application of the material according to the manufacturer's recommendations. After the application of the sealants the oral hygiene orientation was done for the children and sessions of supervised brushing were carried out on days apart.

o Clinical Evaluation

The clinical evaluation of based-resin sealant was evaluated according to the WHO criteria. After six, twelve and thirty- six months of application of the sealants, visual-tactile clinical examination was carried double-blind out with the aid of buccal mirror and exploratory probe n°5 under a light reflector with a clean surface. Prophylaxis was performed with pumice and water. The tooth was then rinsed with water for 10 seconds, isolated and dried. The methodology was based on the Provenzano 2010¹² criteria in which the retention, the presence of secondary and the marginal discoloration were evaluated (Table 1).

Table 1 - Criteria used for the evaluation of sealants after 6 and 12 months of application

	Score	
	Retention	Alpha
	Bravo	Partial Fissure Exposure
	Charlie	Complete loss
Secondary caries	Alpha	Absence of tooth decay
	Bravo	Surface caries
	Charlie	Cavitation in Dentine
Marginal pigmentation	Alpha	Absence of marginal pigmentation
	Bravo	Marginal pigmentation
	Charlie	Pigmentation under sealant

The collected data were annotated in a Microsoft Office Excel spreadsheet, and then analyzed using Fisher's exact test, at a significance level of P> 0,05. The test was performed with the aid of software R.

RESULTS

Analyzes did not show significant differences between the Prevent and Fluroshield sealants, in the two experimental periods, regarding retention, secondary caries and pigmentation (p> 0.05).

At 6 months, of the 91 sealed teeth, 73 (80.2%) of the Prevent group showed total retention, whereas 70 (76.9%) of the Fluroshield group. Of the two experimental groups, complete loss of the material was obtained in 2 patients (2.2%). At 12

months, 79 children were evaluated, 42 (53.2%) of the Prevent group obtained total retention, while 55 (69.7%) of the Fluroshield group. In relation to the total loss, 9 (11.4%) were recorded in the Prevent and 6 (7.5%) in the Fluroshield, so that, in the evaluated question, there were no statistical differences (Table 2).

Regarding secondary caries in the 6 month evaluation, their absence was observed in 88 (96.7%) in Prevent in 85 (93.4%) in Fluroshield. In the case of caries with cavitation, none was found in the Prevent, and in Fluroshield 1 (1.1%) was found; in the 12 months evaluation it was noticed that there were no caries in 74 (93.7%), In Prevent and Fluroshield 77 (97.4%) and in relation to caries with cavitation were observed that in Prevent 1 (1.3%) and in Fluroshield none were observed (Table 3).

In the marginal pigmentation score, in the 6-month evaluation no discoloration was observed in 88 (96.7%) in Prevent and in Fluroshield 89 (97.8%), and in relation to the discoloration under the sealant, it can be noted that both sealants presented 1 (1.1%) and at 12 months it was observed that in 74 (93.7%) in Prevent and 72 (91.1%) there was no pigmentation. And in relation to the discoloration under the sealant, it was observed that both behaved in the same way, both of which had the pigmentation in 2 (2.6%) of the evaluated sealants. Therefore, there was no statistical difference between the groups evaluated (Table 4).

Table 2 – Retention of sealant according to sealant and classification. Regente Feijó, 2016.

Months	Retention					
	6 months			12 months		
	Alpha	Bravo	Charlie	Alpha	Bravo	Charlie
Prevent	73 (80.2%)	16 (17.6%)	2 (2.2%)	42 (53.2%)	28 (35.4%)	9 (11.4%)
Fluroshield	70 (76.9%)	19 (20.9%)	2 (2.2%)	55 (69.7%)	18 (22.8%)	6 (7.5%)

6 months- total of 91 evaluated; 12 months total of 79 evaluated;
 Alpha- No crevice; Bravo- Partial Fissure Exposure ; Charlie- Complete loss

Table 3- Prevalence of secondary caries according to sealant and classification. Regente Feijó, 2016.

Months	Secondary Caries					
	6 months			12 months		
	Alpha	Bravo	Charlie	Alpha	Bravo	Charlie
Prevent	88 (96.7%)	3 (3.3%)	0 (0%)	74 (93.7%)	4 (5.1%)	1 (1.3%)
Fluroshield	85 (93.4%)	5 (20.9%)	1 (1.1%)	77 (97.4%)	2 (2.6%)	0 (0%)

6 months- total of 91 evaluated; 12 months total of 79 evaluated;
 Alpha- Absence of tooth decay ; Bravo- Absence of tooth decay; Charlie- Surface caries.

Table 4 - Prevalence of discoloration according to sealant and classification. Regente Feijó, 2016.

Months	Marginal Discoloration					
	6 months			12 months		
	Alpha	Bravo	Charlie	Alpha	Bravo	Charlie
Prevent	88 (96.7%)	2 (2.2%)	1 (0%)	74 (93.7%)	3 (3.8%)	2 (2.6%)
Fluroshield	89 (97.8%)	1 (1.1%)	1 (1.1%)	72 (91.1%)	5 (6.4%)	2 (2.6%)

6 months- total of 91 evaluated; 12 months total of 79 evaluated;
 Alpha- No crevice; Bravo- Partial Fissure Exposure ; Charlie- Complete loss

DISCUSSION

Scientific knowledge about etiopathogenesis of dental caries shows that it is a disease that can be prevented and, when diagnosed early, guide the use of resources that make it possible to stop the process, thus avoiding conventional restorative treatment. In addition, due to the growing awareness of the importance of prevention and the development of new dental materials, dental surgeons are taking a more careful approach in the evaluation and intervention as conservative as possible in the treatment of incipient lesions¹³.

There is a strong association between the stage of eruption of the permanent tooth, biofilm stagnation and the occurrence of dental caries¹⁴. Until an erupting tooth fully reaches the occlusal plane, occlusal fissures act as a perfect niche for biofilm stagnation, justifying the use of sealants associated with biofilm control methods and fluoridated dentifrices¹¹. The first permanent molar requires special attention in relation to the risk of caries disease, since it shows a lack of eruptive maturation and a lack of contact with the antagonist, favoring the onset of the disease¹⁵. The application of sealants in high risk children to caries was more effective in the prevention of permanent first molars than in permanent premolars and second molars¹⁶.

Regarding caries risk, studies have shown that factors such as previous experience of dental caries in the primary dentition, dental biofilm, presence of enamel defects, absence of oral hygiene habits, mothers' level of education and socioeconomic status are related to the risk in children and adolescents¹⁷. This is in line with our work, since we selected children in a school in the public school system, with a low socioeconomic status and poor oral hygiene.

The first clinical study on sealants was performed by Cueto, Buonocore 1967, cited by Silva et al., 1996¹⁸ in which the authors reported 86.3% reduction of caries after one year of sealant application. Meanwhile, the indication of sealing, including the type of material to be indicated, depends on the risk of caries, the individual characteristics of the patient and the certainty in the diagnosis of occlusal caries by the professional¹⁹.

Sealants of pit and fissures are known as an effective method for the prevention of caries due to their properties that favor the prevention of this disease, since they act in the release of fluoride, also acting as a physical barrier between the tooth and the external environment and biocompatibility²⁰. Therefore, longitudinal clinical studies should be encouraged to evaluate the efficacy of these methods²¹.

In a study where resinous sealants were clinically evaluated after 7 days, at 18 and 36 months and 11 years, marginal changes occurred over time,

but even after 11 years of application, they state that the material does not require reapplication²². The findings in our work after 12 months demonstrate the presence of these marginal changes, but in a low percentage.

In a longitudinal evaluation of sealants after 10 years of application, it was verified that the failure is related to some factors: fluoride use, caries experience, operative technique, child behavior, tooth type and age²³. The application of resinous sealants may appear as bubbles, however, in a longitudinal evaluation of 11 years, it was verified that these bubbles dissolve over time²⁴.

According to the findings of Heyduck¹⁶, analyzing resinous sealants applied in schoolchildren, there was complete loss of material in 19% and secondary caries in 18%. While in our work after 12 months there was a total loss of 11.4% in Prevent and of 7.5% in Fluroshield, which represents a smaller percentage. In relation to secondary caries, our findings had a lower caries index in relation to the work of Heyduck¹⁶, both Prevent that was 1.3%, and Fluroshield (which presented without secondary caries after 12 months).

In this work the use of the relative isolation of the operative field with the use of cotton rollers associated to the sucker was used. Both absolute and relative isolation can be used because several previous clinical studies have demonstrated similar retention rates in applications made with the two types of isolation²⁵. Other works have also carried out the application of resinous sealants in their patients with relative isolation^{9,25}. In addition, we are working with children, in which a situation of absolute isolation could require anesthetic procedures and consequently a greater behavioral adaptation. Permanent molars in this age group erupt, posing a challenge or even impossibility to place a clamp for absolute isolation²⁶.

Photopolymerizable sealants offer some advantages, such as a reduction in working time, because it requires a polymerization time of about 40 seconds against the 60 seconds of the chemically activated ones, and allows the professional to choose the appropriate moment for activation²².

In the present study, it was observed, through statistical analysis, that there was no significant difference between these materials used as sealants, in agreement with the results found by other authors^{24,26}. Regarding the composition of the resinous sealants used in the research, it is possible to observe similarity between the materials, which may be the reason for not having statistical differences between the sealants in the researched criteria.

It is extremely important to note that the sealing of fossils and fissures must be associated with dietary and oral hygiene care, use of fluoridated dentifrices and biofilm control, as preventive

measures of dental caries in permanent posterior teeth of schoolchildren at high risk for caries²⁷.

CONCLUSION

It may be concluded that both resinous sealants have been shown to be statistically similar in the evaluated criteria, but should be combined with other preventive measures such as biofilm control, diet and hygiene guidelines and fluoride use.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interests.

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