

Retention of a flow able unfilled composite resin in comparison to a dual staged conventional posterior restorative and flow able unfilled resin-based sealant

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Abstract

Introduction: Dental caries in pits and fissures lead to various preventive inventions and creativity as blocking the pit and fissures and fluoride treatment. This effort against pit and fissure caries continues, and latest innovations in new materials and technologies tested each year. Keeping this these points in view a study was designed to assess the retention of flowable unfilled composite resin in comparison to a dual staged flowable unfilled and conventional resin-based sealant.

Materials and methods: The experimental study was conducted in 30 children aged 6 and 10 years, who visited the Public Health Dentistry Department, Vyas Dental College and Hospital. Screening was carried out by trained examiners using plain mouth mirrors, explorers, tweezers and pit and fissure sealants (Clinpro™ Sealant Fissure and filtek P 60 posterior restorative), and light cure. The statistical analysis was done by using SPSS version 21 (Chicago, USA). The p value ≤ 0.05 was found to be statistically significant.

Result: When retention was compared between Clinpro and Clinpro + Filtek P60 after 3 months and 6 months, the difference was statistically significant ($p = 0.039$ and 0.026 respectively, S.) shows when compared the mean surface retention and standard deviation it was found that the mean surface retention was in Clinpro then Clinpro + Filtek P60 higher after 6 months (0.600), as compared to 3 months (0.466).

Conclusion: The resin-based unfilled pit and fissure sealant (Clinpro) clinically performed better when compared to and Clinpro (unfilled) resin-based pit and fissure sealants+ Filtek P60 (posterior restorative).

Keywords: Pit and fissure sealants, Surface retention, Filled and unfilled resin, Dental caries, Marginal integrity

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Introduction

In dentistry, battle against dental caries in pits and fissures has a long and creative past that includes various preventive inventions as early blocking of fissures with zinc phosphate cement¹ mechanical fissure eradication,² prophylactic odontotomy³ and chemical treatment with silver nitrate.⁴ Inventions and Creativity in this effort against pit and fissure caries continues, with the latest innovations in new materials and technologies tested each year. At the time that acid etch bonding to enamel was first described by Buonocore in 1955.⁵

Although fluorides are highly effective in prevention of dental caries on smooth surfaces, but are not effective in protecting the occlusal surfaces at the same pace⁶. 90 percent of permanent posterior teeth develops carious lesions of pits and fissures⁷. Molars are the most vulnerable tooth for such type of defect⁸. The application of pit and fissure sealants is considered as the most appropriate treatment modality for prevention of occlusal caries⁹. Sealants are rarely retained completely

over the tooth's lifetime and must be reapplied. Even under proper application conditions, 5 to 10 percent of sealants are lost annually¹⁰. In order to enhance the longevity of pit-and-fissure sealants, several materials and techniques have been evolved, among which is the use of flowable composite resins as pit and fissure sealants¹¹.

The application range for the flowable composites is expected to include larger or deeper cavities and in higher thicknesses, similar to the conventional composites. The purpose of this study, therefore, was to evaluate the marginal integrity and wall adaptation of deep cavities restored with flowable unfilled composites in comparison to a dual staged flowable unfilled and conventional resin-based sealant a flowable composite, with low expanding steadily as the properties of composite materials improve and the bond strength of resin adhesives to dental substrates increase. On the longevity of composite resin restorations, clinical trials have shown that they are acceptable for long-term use.^{12,13}

The "first generation" of flowable composites was introduced in late 1996¹⁴. Flowability is regarded as a desirable handling property which allows the material to be injected through small-gage dispensers, thus simplifying the placement procedure and amplifying the range of clinical applications¹⁵. The flowable composites can be easily inserted into small cavities and are

expected to exhibit better adaptation to the internal cavity wall compared to the conventional restorative composites which are more viscous. Flowable composites are characterized in a greater proportion of diluent monomers in the formulation¹⁶.

For this reason, flow able composites have been suggested to be filling materials for low-stress applications and in situations with difficult access or those requiring good penetration such as amalgam, enamel defects; incisal edge repairs in anterior sites; and for small Class III and Class V restorations¹⁴.

Keeping these points in view a study was designed to assess the retention of flowable unfilled composite resin in comparison to a dual staged flowable unfilled and conventional resin-based sealant.

Aim

To assess the retention of flowable unfilled composite resin in comparison to a dual staged conventional posterior restorative and flow able unfilled resin-based sealant.

Objectives

- To evaluate the retention rate of the flowable unfilled composite resin based pit and fissure sealant after 3 and 6 months.
- To evaluate the retention rate of the dual layered conventional posterior restorative and flowable unfilled resin-based sealant after 3 and 6 months.
- To compare the retention rate between flowable unfilled resins based pit and fissure sealant with dual cured conventional posterior restorative and flowable unfilled resin-based sealant after 3 and 6 months.

Material and Method

Study design: The present study was an experimental study conducted in Jodhpur city among the children who were visiting the department of public healthy dentistry. The ethical clearance for the study was obtained from the Vyas Dental College and Hospital and informed written consent from parents was obtained prior to the onset of the study.

Study Population/ study sample and Study area: 6 and 10 years children, who were visiting the Public Health Dentistry Department, had participated in the study. 30 children were selected on the basis of inclusion and exclusion criteria.

Armamentarium: The armamentarium used for diagnosis included (Plain mouth mirrors, explorers, tweezers) and for experiment included pit and fissure sealants (Clinpro™ Sealant Fissure and filtek P 60 posterior restorative), light cure.

Data collection: The screening was carried out by one examiner who was trained and calibrated in the department of public health dentistry. The intra-examiner reliability was found to be 94% by kappa

value. A split-mouth design was used in which the two fissure sealants (Clinpro™ Sealant Fissure and Filtek P 60 Posterior Restorative) were randomly placed in 60 matched contra lateral pairs of permanent molar teeth. The application was done in the following order first of all Clinpro™ Sealant Fissure Sealant was used on one tooth and on other tooth Clinpro sealant was used as liner and later it was covered with filtek P 60 posterior restorative.

Inclusion criteria

1. Age of the patient was between 6 and 10 years.
2. Presence of all four caries-free permanent first molars.
3. Evidence of an acceptable home dental cleaning regimen.
4. Patient cooperation and acceptance for the treatment.
5. Absence of class I clinical carious lesion.
6. No prior dental therapy.
7. Possibility to get proper isolation with cotton rolls.
8. No fluoride mouth rinse program practiced in the school.
9. No central fluoride water supply in the school/community where the students live.

Exclusion criteria

1. History of any medical disease that might interfere with the study.
2. Long-term regimen of medication that could affect the salivary flow and diet modification.
3. Current participation in other studies.
4. History of any adverse reaction to any of the restorative materials used.
5. History of abnormal Para functional activity.
6. Heavy occlusal contacts on the teeth to be restored.
7. Patients undergoing fluoride application regimen.
8. Highly uncooperative child.

Application Procedure: The enamel was conditioned by etching with 35–37% phosphoric acid and then washed and dried carefully to obtain a chalky-white enamel surface. Manufacturer's instructions were consulted for recommended etch and rinse times. A minimum amount of sealant that was required to adequately cover the pit and fissure network was applied. Any air bubbles or voids were removed before curing. The entire procedure was performed under cotton roll isolation. The restoration was checked for high points using articulating paper.

In Dual stage, the enamel was conditioned by etching with 35–37% phosphoric acid and then washed and dried carefully to obtain a chalky-white enamel surface. Clinpro was placed as a liner and later Filtek P 60 posterior restorative was placed on top of it. Manufacturer's instructions were consulted for recommended etch and rinse times. A minimum amount of sealant that was required to adequately cover the pit

and fissure network was applied. Any air bubbles or voids were removed before curing. The entire procedure was performed under cotton roll isolation. The restoration was checked for high points using articulating paper.

Clinical evaluation

Sealants were evaluated by a single trained and calibrated examiner using the mouth mirrors and probes following the US public health service criteria. The reason for opting for this criterion was due to its simplicity, easy to record the data in a presentable form

and easy communication. The retention rate was assessed based on the criteria proposed by Tonn and Ryge (1982)¹⁸. The examination results were categorized into three groups as follows:

- TR: Total retention-total retention of the sealant on the occlusal surface (score 0).
- PL: Partial loss-presence of sealant with fractures and loss of material (score 1).
- TL: Total loss-absence of the sealant on the occlusal surface (score 2).

Results

Table1: Evaluation of sealants after 3 months and 6 months

Sealants	Total Retention		Partial Retention		Total Loss		p-value
	3 months	6 months	3 months	6 months	3 months	6 months	
Clinpro	18(60%)	13(43.3%)	10(33.3%)	16(53.3%)	2(6.7%)	1(3.3%)	0.039
Clinpro + Filtek P60	17(56.7%)	9(30%)	11(36.7%)	15(50%)	2(6.7%)	6(20%)	0.026

(p ≤ 0.05 – Significant, CI = 95%)

Table 2: Comparison of mean scores between 3 and 6months for each sealant

Sealants	3 months		6 months		F-value	p-value
	Mean	SD	Mean	SD		
Clinpro	0.466	0.628	0.60	0.563	3.768	0.036
Clinpro + Filtek P60	0.50	0.629	0.90	0.711	5.313	0.025

(p ≤ 0.05 – Significant, CI = 95%)

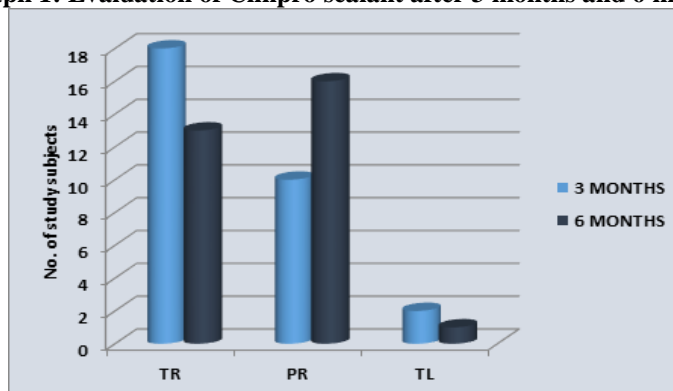
Table 3: Comparison of Mean Retention and standard Deviation after 3 months and 6 months when Clinpro was used

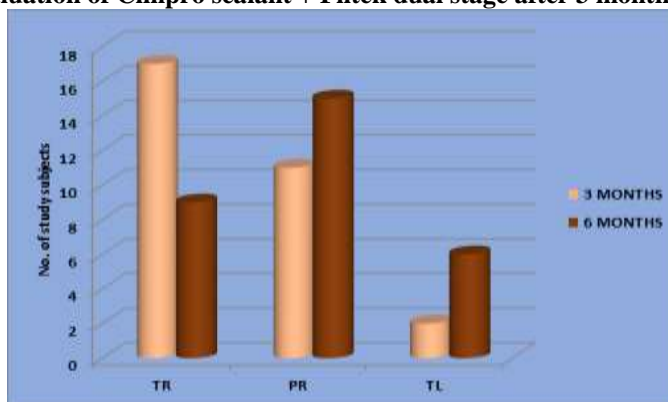
Clinpro	N	Mean	Std. Mean	SD
3 months	30	0.466	0.114	0.628
6 months	30	0.600	0.102	0.563

Table 4: Comparison of Mean Retention and standard Deviation after 3 months and 6 months when Clinpro + Filtek P60 was used

Clinpro	N	Mean	Std. Mean	SD
3 months	30	0.500	0.115	0.629
6 months	30	0.900	0.129	0.711

Graph 1: Evaluation of Clinpro sealant after 3 months and 6 months



Graph 2: Evaluation of Clinpro sealant + Filtek dual stage after 3 months and 6 months

Results

Table 1, Graph 1, 2: Shows evaluation of sealants after 3 and 6 months.

After 3 months teeth which were filled by using Clinpro among them, 18 (60%) were having Total Retention, 10 (33.3%) were having Partial Retention and 2 (6.7%) were having Total Loss whereas those teeth which were filled by Clinpro + Filtek P60 among them, 17 (56.7%) were having Total Retention, 11 (36.7%) were having Partial Retention and 2 (6.7%) were having Total Loss.

After 6 months teeth which were filled by using Clinpro among them, 13 (43.3%) were having Total Retention, 16 (53.3%) were having Partial Retention and 1 (3.3%) were having Total Loss whereas those teeth which were filled by Clinpro + Filtek P60 among them, 9 (30%) were having Total Retention, 15 (50%) were having Partial Retention and 6 (20%) were having Total Loss.

When retention was compared between Clinpro and Clinpro + Filtek P60 after 3 months and 6 months, the difference was statistically significant ($p= 0.039$ and 0.026 respectively, S.).

Table 2 shows comparison of mean scores between 3 and 6 months for each sealant (One way ANOVA).

It was found that there was significant difference in the mean surface retention among the sealants, when they were evaluated after 3 months and 6 months ($p= 0.036$ (Clinpro), 0.025 (Clinpro + Filtek P60)).

Table 3 shows the comparison of mean surface retention and standard deviation when Clinpro was used. It was found that the mean surface retention was higher after 6 months (0.600), as compared to 3 months (0.466).

Table 4 shows the comparison of mean surface retention and standard deviation when Clinpro + Filtek P60 was used. It was found that the mean surface retention was higher after 6 months (0.900), as compared to 3 months (0.500).

Discussion

Sealants have been developed to prevent dental caries in the pits and fissures by avoiding impaction of food and bacteria, which results in an acidic condition that further initiate dental caries. It was highly considered that these pit and fissure sealants are largely accepted as effective noninvasive treatment to prevent or arrest occlusal caries for more than two decades^{19,20}. The efficacy of sealants in preventing dental caries has been associated with various factors such as the duration and degree of sealant retention.^{21,22}

Retention of sealants is the dependable upon resin penetration into pits and fissures and etched enamel surface which gets porous forming micromechanical tags²³ here the sealant viscosity plays a crucial role in penetrating and forming micromechanical tags for their retention on the etched surface.²⁴ Resin sealants that possess both low viscosity and excellent wetting properties have been recommended for dental use.²³ Addition of filler particles lowers the sealant's ability to penetrate into fissures and micro porosities of etched enamel.²⁴ As there were less clinical studies comparing the retention rate of resin-based unfilled and dual staged conventional posterior restorative and flowable unfilled resin-based sealant, the present study was conducted to evaluate and compare the retention ability of commercially available Clinpro (unfilled) and Clinpro (unfilled) resin-based pit and fissure sealants + Filtek P60 (posterior restorative).

Following the split-mouth design, this study used Clinpro (unfilled) and Clinpro (unfilled) resin-based pit and fissure sealants + Filtek P60 (posterior restorative). This design was undertaken in which both sealant materials were to be applied in the same mouth on contralateral teeth to directly compare the material performance under similar environmental conditions.

It can be argued that the property of having decreased viscosity allowed the conventional pit and fissure sealant to penetrate deeper into the fissure and may therefore having better retention^{21,22} However, a study by Kakaboura et al²⁵ showed that a low viscosity

resin composite also penetrates more in shallow wide fissures compared to the conventional resin sealant.

Our study supports the findings from earlier studies that the retention rate was similar between the two materials²⁶⁻²⁸.

Various authors have used different criteria to assess sealant retention. The use of varying criteria with lack of clear definitions led us to select Tonn and Ryge criteria for evaluation of sealant retention, which are relatively simple to follow. In most of the studies, evaluation of the sealant was done at 3rd, 6th, 9th and 12th month²⁹ or at 6th and 12th month³⁰ or at 12th month³¹ during 1-year follow-up period. In this study, sealants were evaluated for retention at 3rd and 6th, month to ensure the complete retention of the sealant at short regular intervals and provide the necessary treatment if required.

At the final month evaluation, the results showed that there was statistically significant difference in total retention, partial retention, or total missing ($P > 0.05$) between resin-based filled and unfilled pit and fissure sealants. This result was in accordance with other similar study done.³⁰ The resin-based unfilled pit and fissure sealant (Clinpro) clinically performed better when compared to and Clinpro (unfilled) resin-based pit and fissure sealants+ Filtek P60 (posterior restorative). And partial retention of sealants was 53.3% and 50% in resin-based unfilled pit and fissure sealant (Clinpro) clinically performed better when compared to Clinpro (unfilled) resin-based pit and fissure sealants+ Filtek P60 (posterior restorative) respectively, which is better when compared to other studies.

Limitations and Recommendations

In the present study caution must be applied to the interpretation of those results and conclusion by the fact that the study population was not selected from a universe but was selected from a captive population visiting the hospital. Specifically the sample size was small. Therefore, further research must be carried out with more sample size as well as for longer period as per the literature the retention rate for sealants is in between 2-3 years minimum. So, that may affect the results and make the comparison more evident regarding the material retention rate.

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