

Effect of pit-and-fissure sealants on postbrushing simulation - A photogenic study

Akansha Kishen,
Vishnu Priya Veeraraghavan,
Jayalakshmi Somasundram,
R. Gayathri, S. Kavitha¹

Department of Biochemistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University,
¹Department of Biochemistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

J. Adv. Pharm. Technol. Res.

ABSTRACT

Pit-and-fissure sealants of the occlusal surfaces for the posterior teeth are well susceptible to develop dental caries compared to the smooth surfaces due to its complex morphology, which makes dental hygiene a challenging fact which give rise to increased plaque accumulation. The use of pit-and-fissure sealants is to provide inhibition toward microorganisms and aggregation of food particles, thereby inhibiting caries initiating and preventing caries progression. The study aimed to assess the effect of pit-and-fissure sealants postbrushing simulation through photography. For this photogenic original study, eight teeth were selected, with two groups each and four teeth present in each of the groups. Brushing simulator machines are well-established methods for analyzing the efficacy of toothbrushes. A total of 10,000 cycles were accounted for by the machine with linear X-axis and Y-axis = 2500 in each group. The clockwise and counterclockwise = 2500 in each group. From the research, it can be concluded that Group A is found to be more effective than Group B, where Group A is Clinpro sealant and Group B is YuSeal. This pit-and-fissure sealant application is very important in clinical practice to prevent the tooth from getting decayed. This research helps us to establish the amount of reduction in both the groups of sealants postbrushing as various brushing patterns influence the retention of pit-and-fissure sealants.

Key words: Brushing simulator, Clinpro, innovative technology, novel method, pit-and-fissure sealant, YuSeal

INTRODUCTION

Globally, about 3.6 billion people are affected by dental caries in permanent teeth as of the 2016 assessment (which is considered to be 48% of the population).^[1] The WHO evaluated that nearly every adult has dental caries on their

tooth surface at some point of life. In the case of pediatric patients, it affects approximately 0.62 billion people or approximately 9% of the population. Tooth decay is considered to be more prevalent in developed countries due to greater amounts of consumption of simple sugar and less often in developing countries.^[2]

Tooth decay, which is termed dental caries or dental cavities, is the degradation of teeth by the action of acids produced by bacteria.^[3] The cavities may be of several types and the colors range from yellow to black. Pain and eating difficulty are the symptoms associated. Complications are loss of the tooth, inflammation in the tissue surrounding the tooth, and abscess or infection formation. Dental caries progresses at

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Kishen A, Veeraraghavan VP, Somasundram J, Gayathri R, Kavitha S. Effect of pit-and-fissure sealants on postbrushing simulation – A photogenic study. *J Adv Pharm Technol Res* 2022;13:S402-6.

Address for correspondence:

Dr. Vishnu Priya Veeraraghavan,
Department of Biochemistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600 077, Tamil Nadu, India.
E-mail: drvishnupriyav@gmail.com

Submitted: 13-May-2022

Published: 30-Dec-2022

Accepted: 26-Oct-2022

Access this article online

Quick Response Code:



Website:

www.japtr.org

DOI:

10.4103/japtr.japtr_369_22

the occlusal surface of posterior teeth, in pits and fissures, and defects in enamel. At the base of pits and fissures, the enamel is found to be mostly thin. Moreover, the plaque collected from these areas cannot be removed easily by normal practices of hygiene like brushing.^[4]

Pits are like pinpoint depression that occurs on the occlusal surfaces, whereas fissures are the groove that naturally occurs on the posterior teeth. Tooth fissures are deep pits and grooves at the teeth surface. These are particularly common in the case of children and teenagers; due to its narrow morphology, it is difficult to clean inside them while brushing. The enamel in the pit-and-fissure sealants cannot be protected by the fluorides as it is obtained by the smooth surfaces of the enamel.^[5]

The worldwide use of pit-and-fissure sealants is to provide inhibition toward microbial growth and food particle lodgment, thereby preventing the initiation and progression of caries. The morphology of the posterior occlusal surfaces is deep invaginations of enamel which are diverse in shape including narrow or broad funnels, constricted hourglass, and several invaginations with inverted Y-shaped divisions. The various types of pits and fissures are as follows:^[6]

1. V type: These are broad at the occlusal surface and become narrow at the bottom. They are wide and shallow on the occlusal surface which tends to be self-cleansing and resistant to caries to some extent, and noninvasive technique can be recommended
2. U type: These are again wide and shallow, wide along with self-cleaning activity
3. I type: These are immensely narrow slits, which are quite constricted and look like a bottleneck having caries susceptible
4. IK type: These are narrow slits with a big shape at the bottom as compared to the top, ensuring a higher chance for caries development.

Brushing simulator machines are able to perform as programmable three-dimensional brushing patterns. They are able to mimic the brushing pattern of normal individuals performed for years. In the present study, the machine was used to stimulate the brushing pattern for 10,000 cycles.

Based on certain previous studies, the liberation of sealant constituents like bisphenol A (BPA) inhibits health, development, and reproduction. Moreover, this controversial topic concluded by the American Dental Association and the U.S. Drug and Food Administration, that they have less exposure to BPA from the sealant, thereby possessing no known health risks.^[7]

Our team has deep knowledge and extensive experience in research that helped to produce several publications

of high quality.^[8-21] The study aimed to assess the effect of pit-and-fissure sealants postbrushing simulation through photography.

MATERIALS AND METHODS

Sample preparation

This study was conducted in the White Lab of Saveetha Dental College and Hospital. The samples used were different maxillary molars. About eight maxillary molars without any carious lesions (extracted for periodontal problems or any other trauma) were utilized for the study. These teeth were mounted on a single die stone for a stable base. They were categorized into two groups depending on the usage of pit-and-fissure sealant, Group A is Clinpro, and Group B is Yu Seal. Each group consisted of four sets of teeth.

Mounting of the sample

Mounting was done in the dry field at normal room temperature. Each molar tooth was mounted separately on top of the die stone with 5 cm as diameter.

Application of pit-and-fissure sealant

Each tooth was first etched with acid using 37% orthophosphoric acid gel for 20 s, and then it was washed for 20 s and completely dried in air. Then, on the occlusal surface of etched teeth was applied properly a fifth-generation bonding agent. A light-cure process was then followed for 20 s with a LED light-curing unit. Further, pit-and-fissure sealant was applied on the occlusal surface in the fissures and grooves. Group A was Clinpro and B was YuSeal. With the help of an LED light-curing unit, the sealant was light-cured for 20 s. Preoperative images of all eight samples were collected for this photogenic study.

Postbrushing simulation technique

The samples were then exposed to the brushing simulator machine ZM-3-SD Mechatronik, by applying Clinpro for four samples and the remaining four samples were applied by YuSeal. Ten thousand cycles with linear X-axis and Y-axis as 2500 each followed by clockwise and counterclockwise as 2500 each [Figure 1]. The postbrushing simulation was assessed and washed to remove the froth. The pictures were taken and photographs were assessed.

RESULTS

The photography details of the preoperative brushing simulation were compared with postoperative brushing simulation details. Each tooth was assessed by the presence of an amount of clinically reduced pit-and-fissure sealants. Two different types of sealants were used for both A and B groups, where A was Clinpro and B was YuSeal. Based on the photographic assessment, detailed

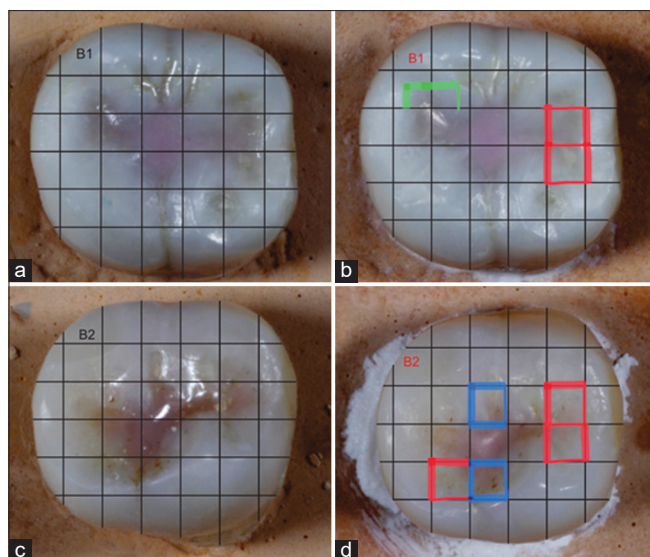


Figure 1: (a) Preoperative assessment of Group B (Sample 1), (b) postoperative assessment of Group B (Sample 1), (c) preoperative assessment of Group B (Sample 2), and (d) postoperative assessment of Group B (Sample 2)

assessment criteria for scoring were formulated in a table [Table 1]. On the other hand, colors were denoted to assess the loss of sealant postbrushing simulation after the division of pre- and postoperative through grids [Table 1]. Figures 1-2 represent the preoperative and postoperative photography of sample A. Figures 3 and 4 represent the preoperative and postoperative photography of sample B. The scoring evaluation of both groups is depicted in Table 2.

DISCUSSION

A previous study conducted on the assessment of the properties of broccoli, especially its antibacterial effect as compared to other cruciferous vegetables, enables its usage along with pit-and-fissure sealant.^[22] It increases the longevity of the sealant as compared to other normal chemical sealants, like that of Clinpro used in this study (Group A mostly used in the clinical setup).^[22]

The technique of pit-and-fissure sealants is found to be a part of first prevention, anteceding with the initiation of caries or secondary measure for prevention by stopping the progression of disease. It is a key tool for preventing the caries in case of a particular individual or as a part of the measure of public health. Therefore, it is crucial that professionals of various dental specialties are aware of pit-and-fissure caries prevalence and that dental sealants could be recommended for the patient based on his/her caries risk evaluation.

Various published researches were assessed and Clinpro and YuSeal sealants were highly used sealants in

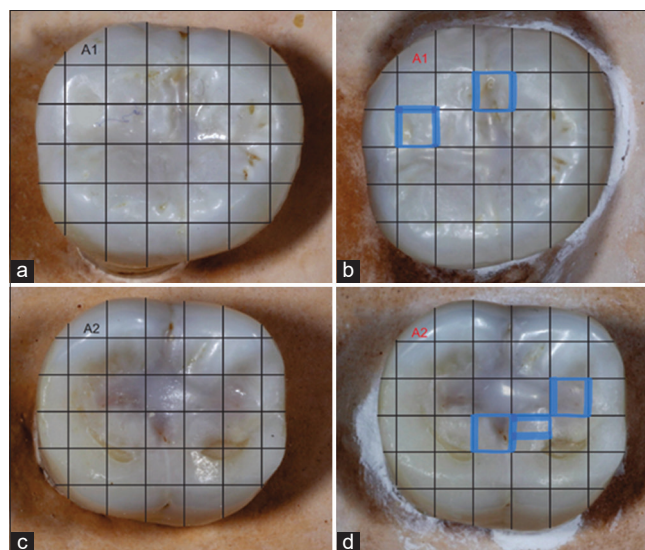


Figure 2: (a) Preoperative assessment of Group A sealants (Sample 1), (b) postoperative assessment of Group A sealant (Sample 1), (c) preoperative assessment of Group A (Sample 2), and (d) postoperative assessment of Group A (Sample 2)

Table 1: Criteria for photographic assessment

Score	Color	Features
0	Red	Sealant absent
1	Blue	Sealant partially present
2	Green	Sealant completely present

Table 2: Scoring evaluation of both the groups

Figures	Score
B1	1
B2	1
B3	0
B4	0
A1	1
A2	1
A3	2
A4	2

clinical practice, thus enabling it to be selected for this photogenic study. Clinpro sealant includes a patented soluble organic fluoride source, making its usage level higher in the market. The mechanism of action of this sealant is by releasing the fluoride from the sealant inside a diffusion-restricted process by exchanging hydroxide in the place of fluoride ion. The composition will be homogeneous throughout for a long period and permit the release of fluoride ions by the cured sealant. It has high wear resistance and excellent strength as compared to other sealants, enabling it to be the most effective sealant to be used in the clinical, also being the effective one in this photogenic research. On the other hand, YuSeal is pink in color when uncured and changes to opaque white color when light-cured. It has highly thixotropic

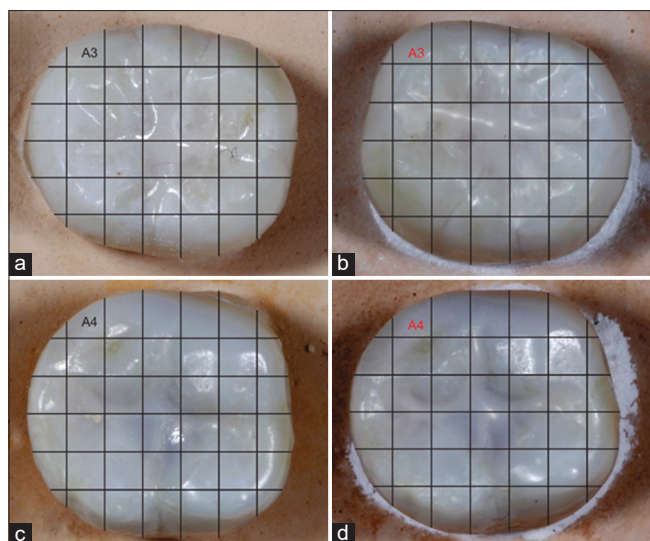


Figure 3: (a) Preoperative assessment of Group A (Sample 3), (b) postoperative assessment of Group A (Sample 3), (c) preoperative assessment of Group A (Sample 4), and (d) postoperative assessment of Group A (Sample 4)

properties enabling it to have ideal viscosity. These are radiopaque with high anticaries effects along the margins of the restoration.

There are not many kinds of photogenic research in the past year. The usage of different materials for the photogenic basis is very crucial for analyzing the clinical properties and its composition.

CONCLUSION

The study can be concluded that Group A is more effective than Group B, where Group A is Clinpro and Group B is YuSeal. This pit-and-fissure sealant application is very important in clinical practice to prevent the tooth from getting decayed. This research helps us to establish the amount of reduction in both the groups of sealants postbrushing as various brushing patterns influence the retention of pit-and-fissure sealants. More research needs to be published based on the photogenic assessment of pit-and-fissure sealants.

Acknowledgment

The authors would like to thank the Saveetha Institute, Department of Biochemistry and Management as well as the staff of the White Lab Department for their participation and kind cooperation throughout the study.

Financial support and sponsorship

The present study was supported by the following agencies:

- Saveetha Dental College
- SIMATS, Saveetha University
- Sameer Decorative Corner.

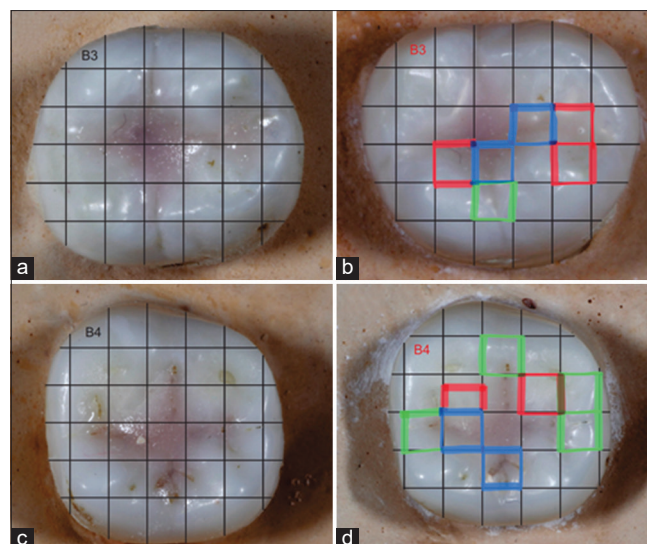


Figure 4: (a) Postoperative assessment of Group B (Sample 3), (b) postoperative assessment of Group B (Sample 3), (c) preoperative assessment of Group B (Sample 4), and (d) postoperative assessment of Group B (Sample 4)

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Kühnisch J, Mansmann U, Heinrich-Weltzien R, Hickel R. Longevity of materials for pit and fissure sealing results from a meta-analysis. *Dent Mater* 2012;28:298-303.
2. Andrysiak-Karmińska K, Hoffmann-Przybylska A, Przybylski P, Witkowska Z, Walicka E, Borysewicz-Lewicka M, *et al.* Factors affecting dental caries experience in 12-year-olds, based on data from two polish provinces. *Nutrients* 2022;14:1948.
3. Korolenkova MV, Khachatryan AG, Poberezhnaya AA, Krechetova MS. Dental caries prevention program in children and adolescents living in residential institutions. *Stomatologija (Mosk)* 2022;101:61-7.
4. Simonsen RJ, Neal RC. A review of the clinical application and performance of pit and fissure sealants. *Aust Dent J* 2011;56 Suppl 1:45-58.
5. Paris S, Lausch J, Selje T, Dörfer CE, Meyer-Lueckel H. Comparison of sealant and infiltrant penetration into pit and fissure caries lesions *in vitro*. *J Dent* 2014;42:432-8.
6. Beun S, Bailly C, Devaux J, Leloup G. Physical, mechanical and rheological characterization of resin-based pit and fissure sealants compared to flowable resin composites. *Dent Mater* 2012;28:349-59.
7. Chi DL, van der Goes DN, Ney JP. Cost-effectiveness of pit-and-fissure sealants on primary molars in Medicaid-enrolled children. *Am J Public Health* 2014;104:555-61.
8. Jain RK, Kumar SP, Manjula WS. Comparison of intrusion effects on maxillary incisors among mini implant anchorage, j-hook headgear and utility arch. *J Clin Diagn Res* 2014;8:C21-4.
9. Keerthana B, Thenmozhi MS. Occurrence of foramen of Huschke and its clinical significance. *Res J Pharm Technol* 2016;9:1835-6.
10. Thejeswar EP. Educational research iPad system versus textbook system. *Res J Pharm Technol* 2015;8:1158-60.
11. Krishna RN, Nivesh Krishna R, Yuvaraj Babu K. Estimation of stature from physiognomic facial length and morphological facial length. *Res J Pharm Technol* 2016;9:2071.

12. Muthukrishnan S, Krishnaswamy H, Thanikodi S, Sundaresan D, Venkatraman V. Support vector machine for modelling and simulation of heat exchangers. *Therm Sci* 2020;24:499-503.
13. Nandhini NT, Rajeshkumar S, Mythili S. The possible mechanism of eco-friendly synthesized nanoparticles on hazardous dyes degradation. *Biocatal Agric Biotechnol* 2019;19:101138.
14. Ezhilarasan D. Oxidative stress is bane in chronic liver diseases: Clinical and experimental perspective. *Arab J Gastroenterol* 2018;19:56-64.
15. Rajagopal R, Padmanabhan S, Gnanamani J. A comparison of shear bond strength and debonding characteristics of conventional, moisture-insensitive, and self-etching primers *in vitro*. *Angle Orthod* 2004;74:264-8.
16. Neelakantan P, Sharma S, Shemesh H, Wesselink PR. Influence of irrigation sequence on the adhesion of root canal sealers to dentin: A Fourier transform infrared spectroscopy and push-out bond strength analysis. *J Endod* 2015;41:1108-11.
17. Sahu D, Kannan GM, Vijayaraghavan R. Carbon black particle exhibits size dependent toxicity in human monocytes. *Int J Inflamm* 2014;2014:827019.
18. Jose J, Ajitha P, Subbaiyan H. Different treatment modalities followed by dental practitioners for Ellis class 2 fracture – A questionnaire-based survey. *Open Dent J* 2020;14:59-65.
19. Wu F, Zhu J, Li G, Wang J, Veeraraghavan VP, Krishna Mohan S, *et al.* Biologically synthesized green gold nanoparticles from *Siberian ginseng* induce growth-inhibitory effect on melanoma cells (B16). *Artif Cells Nanomed Biotechnol* 2019;47:3297-305.
20. Dua K, Wadhwa R, Singhvi G, Rapalli V, Shukla SD, Shastri MD, *et al.* The potential of siRNA based drug delivery in respiratory disorders: Recent advances and progress. *Drug Dev Res* 2019;80:714-30.
21. Patil SB, Durairaj D, Suresh Kumar G, Karthikeyan D, Pradeep D. Comparison of extended nasolabial flap versus buccal fat pad graft in the surgical management of oral submucous fibrosis: A prospective pilot study. *J Maxillofac Oral Surg* 2017;16:312-21.
22. Kishen A, Somasundaram J, Muralidharan NP. Broccoli and its Anti cariogenic effect review. *J Arch Egyptol* 2020;17:421-32.