

# Resin Composite Sealant with bis-GMA

## *In vitro* and *in vivo* Study

CATALINA IULIA SAVEANU<sup>1</sup>, ALICE MURARIU<sup>1\*</sup>, ONUTA CONSTANTIN<sup>1</sup>, OANA DRAGOS<sup>2</sup>, LOREDANA GOLOVCENCU<sup>1</sup>

<sup>1</sup> Grigore T. Popa University of Medicine and Pharmacy, Faculty of Dental Medicine, 16, Universitatii Str.t, Iasi, 700115, Romania

<sup>2</sup> National Institute of Research-Development for Technical Physics - IFT, 47 Dimitrie Mangeron Blvd., 700050, Iasi, Romania

*Selection of sealing material is a problem in terms of long-term durability. In this regard, we have been investigating the in vitro structure and in vivo retention of composite resin sealant with BIS-GMA. Bi-dimensional and three-dimensional analysis by AFM highlights a homogeneous structure with no structural retaining areas of the material. Comparative in vivo and vitro evaluation of sealing resin revealed a correlation of the analyzed aspects in terms of the retention of the material used.*

*Keywords: caries prevention; pit and fissure sealants; resin-based sealants, Bis-GMA*

Dental caries prevention is a desideratum that belongs to both dentists and patients and is represented by a complex of methods including, in addition to general or local fluoridation, buccal dental hygiene and diete hygiene, dental sealing. Sealing is a method of immunising dental hard surfaces with increased reliefs in patients with high carious risk. The primary objective of the seal is to close the coronary retention shields to newly erupted teeth to prevent the bacterial plate stagnation areas from turning into ecological niches of caries, favoring the cleaning and self-cleaning of retaining surfaces. Selection of sealant material is dependent on the patient's age, child's behavior, and the time of teeth eruption[1]. Dental sealants reduce the incidence of caries after some studies by 76% on sound occlusal surfaces, compared to the non-use of sealants during the two to three year follow-up period [2]. As a result of these the aim of the study, we have been investigating the *in vitro* structure and *in vivo* retention of sealings made with a composite resin sealant: DEFENSE CHROMA (ANGELUS®, Brasil). The objectives of this study are assessing the degree of oro-dental hygiene by analyzing the OHI index, caries risk assessment; the need for orthodontic treatment assessment by IOTN and seal integrity assessment 6 months after application.

### Experimental part

#### *Material and method*

A composite resin sealing material was used in the study: DEFENSE CHROMA (ANGELUS®, Brasil). The reasons for selection of this material were based on the properties of its composition and results obtained in the *in vitro* pre-study, namely: the degree of surface roughness assessed by AFM analysis [3], material shade: thermochromic sealant, changing color to temperatures lower than 37 degrees C (favoring clinical evaluation of sealant presence), fluoride content, filling degree - 50%, showing wear resistance. To conduct the *in vivo* study, a number of 17 patients were selected for 80 seals and then we evaluated the retention of preventive sealing material over time, 6 months after application. The criteria for selecting the observation sheets were as follows: clinical data on odontal status - permanent molars I and II, without cavitary carious processes; patients evaluated within 6 months of

application of the sealant to the occlusal surface of the permanent receiving molars. The parameters selected from the clinical exam were as follows: the patient's caries risk; OHI index; IOTN index; absence of carious lesions at first and second permanent molars; the initial sealing requirement; the presence / absence of the sealant at the evaluation made 6 months after the maneuver. The database was made using the software *SPSS 14.0*. Tooth sealing was performed according to the sealing protocol indicated by the manufacturer. After sealing, the patient reassessment was done every 6 months according to the CCS-SES System (Color Coverage Caries - System Evaluation Sealants): Evaluation of the sealants, is very important in the correct identification of the sealant and the diagnosis of the caries / in the incipient carious lesions, it is recommended to use a transparent sealing material to allow for the visualization of possible changes), the area covered by the sealant (because it indicates the degree of efficiency of the sealant) of the carious lesions on the tooth surface [3].

### Results and discussions

Concerning the caries risk of the selected patients, the highest percentage is given by an increased caries risk of 76.47%; the same frequency of caries for the patients with small and medium risk with 11.76%. Bi-dimensional and three-dimensional analysis by AFM highlights a homogeneous structure with no structural retaining areas of the material (fig. 1,2).

OHI oral hygiene index is made up of the following percentages: 5.88% of subjects have a proper hygiene (OHI-0), 29.41% have a mean oral hygiene (OHI-1), 64.71% of subjects have improper oral hygiene (OHI-2). Although the IOTN (Index of Orthodontic Treatment Need) index may interfere with good retention of the sealing material, and sealing is contraindicated in patients with occlusive disorders present in patients with dento-maxillary abnormalities, these have been performed to minimize RC patients. The calculated percentages are as follows: 11.76% of patients show normal occlusion with IOTN=0, 23.53% of patients have minor changes in IOTN=1, for 35.29% of patients have changes in occlusion reports of up to 2 mm with IOTN=2, and 5.88% of patients show

\* email: murariu\_alice@yahoo.com; Phone:0040746203437



results, through effective retention, resistance to mechanical and physico-chemical stresses, inhibition of bacterial plaque adherence, along with the presence of fluoride, thus preventing the appearance of dental caries.

## References

1. NAAMAN R, EL-HOUSSEINY AA, ALAMOUDI The Use of Pit and Fissure Sealants-A Literature Review. *N.Dent J (Basel)*. 2017 Dec 11; 5(4). Epub 2017.
2. JUMANCA ,D., GALUSCAN,A , POPESCU, L.A. , GHIORGHE,A., ANDRIAN,S , SINESCU,C., Comparative Study On Available Sealing Materials, *Rev.Chim.(Bucharest)*,**67**,no.2,2016
3. Evidence-based Clinical Practice Guideline for the Use of Pit-and-Fissure Sealants.*Pediatr Dent*. 2016 Oct; 38(6):263-279.
4. CATALINA IULIA SAVEANU, OANA DRAGOS Characteristics Analysis Of Sealants Resins Materials With Nanometric Parameters AFM and SEM DJNB, Issue 4, Vol.11, No.2, April - June 2016, p. 643-649 ISSN:1842-3582
5. CATALINA IULIA SAVEANU, OANA DRAGOS, Atomic Force Microscopy Study For Assessing The Characteristics Of News Materials Sealants, *Indian Journal Of Applied Research*, 2015, Vol.V, Issue III, March, pg.562-564, ISSN: 2249-555X.
6. SAVEANU, C.I., CONSTANTIN O., DANILA, C., DANILA, V., ANISTOROAEL, D., Microleakage Of Sealants Resin Composite Materials- An In Vitro Study, *Mat. Plast.*,**53**,no.4 ,2016
7. DEERY C, FYFFE HE, NUGENT ZJ, NUTTALL NM, PITTS NB. A Proposed Method For Assessing The Quality Of Sealants-The Ccc Sealant Evaluation System. *Community Dent Oral Epidemiol*. 2001 Apr;29(2):83-91.PMID:11300176
8. DEAN J.A. McDonald and Avery's Dentistry for the Child and Adolescent. 10th ed. Elsevier Health Sciences; Amsterdam, The Netherlands: 2016.
9. DHAR V, CHEN H. Evaluation Of Resin Based And Glass Ionomer Based Sealants Placed With Or Without Tooth Preparation-A Two Year Clinical Trial. *Pediatr. Dent*. 2012;34:46-50. American Academy of Pediatric Dentistry Guideline on Restorative Dentistry. *Pediatr. Dent*. 2016;38: 250-262. [PubMed]
10. BEAUCHAMP J.,CAUFIELD P.W.,CRALL J.J.,DONLY K.,FEIGAL R.,GOOCH B., ISMAIL A.,KOHN W.,SIEGAL M.,SIMONSEN R.Evidence-Based Clinical Recommendations For The Use Of Pit-And-Fissure Sealants:A Report Of The American Dental Association Council On Scientific Affairs. *J.Am.Dent. Assoc*.2008;139:257-268.doi:10.14219/jada.archive.2008.0155.[PubMed][Cross Ref].
11. KLOUKOS D., PANDIS N., ELIADES T. In vivo bisphenol-a release from dental pit and fissure sealants: A systematic review. *J. Dent*. 2013;41:659-667. d10.1016/j.jdent.2013.04.012. [PubMed] [Cross Ref]
12. WHEATON OB, CALAFAT AM, RANGANATHAN G, KIM HY, HAUSER R.J Changes in urinary bisphenol A concentrations associated with placement of dental composite restorations in children and adolescents. *Maserejian NN, Trachtenberg FL, Am Dent Assoc*. 2016 Aug; 147(8):620-30. Epub 2016 Apr 13.
13. LABAUVE JR, LONG KN, HACK GD, BASHIRELAHI N.What every dentist should know about bisphenol A. *Gen Dent*. 2012 Sep-Oct; 60(5):424-32; quiz 433-4.
14. SÖDERHOLM KJ, MARIOTTI A.BIS-GMA-based resins in dentistry: are they safe? *J Am Dent Assoc*. 1999 Feb; 130(2):201-9.
15. KANUGA S.Bisphenol A (BPA) may be released in the oral cavity after sealant placement. *J Am Dent Assoc*. 2014 Dec; 145(12):1272-3.
16. ZEGAN, G., ANISTOROAEL, D., GOLOVCENCU, L., CERNEI, E.R., DASCALU, C.G., CARAUSU, E.M., Physicochemical Properties of Advanced Nanostructured Materials for Dental Microimplant Coatings *Rev.Chim.(Bucharest)*, **68**, no. 9, 2017, p.2052
17. ZEGAN, G., GOLOVCENCU, L., CERNEI, E.R., CARAUSU, E.M., ANISTOROAEL, D., Structural and Morphological Characteristics of Hybrid Nanomaterials Type Ascorbic Acid-hydroxycalcite Used for Stimulating Salivary Secretion , *Rev.Chim.(Bucharest)*, **69**, no.5, 2018, p.1244-1246
18. SAVEANU IULIA, Restaurari odontale bioadezive. Fundamente teoretice și practice, Editura Gr. T. Popa, Iasi, 2009.
19. ARIO SANTINI, VESNA MILETIC, DERI KOUTSAKI, Degree of conversion of three fissure sealants cured by different light curing units using micro-Raman spectroscopy, *Journal of Dental Sciences*, 7, 26-32, 2012.
20. SUSAN O. GRIFFIN, PHD; SHELLIE KOLAVIC GRAY, DMD, Caries risk in formerly sealed teeth, *JADA* 2009;140(4):415-423.
21. SAVEANU IULIA, DANILA, I., Preventie oro-dentara. Materiale si tehnici, Editura Gr. T. Popa, Iasi, 2009.
22. SIMONSEN R.J. From prevention to therapy: Minimal intervention with sealants and resin restorative materials. *J. Dent*. 2011;39:S27-S33. doi: 10.1016/j.jdent.2011.11.001. [PubMed] [Cross Ref]
23. MICKENAUTSCH S., YENGOPAL V. Retention loss of resin based fissure sealants—A valid predictor for clinical outcome? *Open Dent. J*. 2013;7:102-108. doi: 10.2174/18742106201305130001.[PMC free article] [PubMed] [Cross Ref]
24. MICKENAUTSCH S., YENGOPAL V. Validity of sealant retention as surrogate for caries prevention-A systematic review. *PLoS ONE*. 2013;8 doi: 10.1371/journal.pone.0077103. [PMC free article] [PubMed][Cross Ref].
25. ALHAREKY M.S., MERMELSTEIN D., FINKELMAN M., ALHUMAID J., LOO C. Efficiency and Patient Satisfaction with the Isolite System Versus Rubber Dam for Sealant Placement in Pediatric Patients. *Pediatr. Dent*. 2014;36:400-404. [PubMed]
26. WELBURY R., RAADAL M., LYGDIAKIS N. EAPD guidelines for the use of pit and fissure sealants. *Eur. J. Paediatr. Dent*. 2004;5:179-184. [PubMed].
27. IOVAN G, DANILA I, CABA M, TOPOLICEANU C, GHIORGHE A, ANDRIAN S. The influence of hygroscopic expansion on nanohybrid composite restorations]. *Rev Med Chir Soc Med Nat Iasi*. 2009 Jan-Mar;113(1):235-40.Romanian.PMID:21495325
28. GEORGESCU A, IOVAN G, STOLERIU S, TOPOLICEANU C, ANDRIAN S.ROM Atomic force microscopy study regarding the influence of etching on affected and sclerotic dentine. *J Morphol Embryol*. 2010;51(2):299-302.PMID:20495747
29. SAVEANU, I., TODIRASCU, A., MAFTEL I & DANIAL, The influence of The Etching Time On The Enamel Hybridization In Preventive Sealing. In vitro study *Romanian Journal of Oral Rehabilitation Dec.*;3(4):2011,ISSN 2066-7000 p.84-9 30.
30. BERESESCU, L., PACURAR, M., Clinical assessment of the efficiency of two pit and fissure sealants. *AMT*; 2(1):2013, p.301-3. 656 *Mat.Plast.*, **53**, no.4,2016
31. SAVEANU C.I., DRAGOS O., CHIRIAC H. Correlation between morphology, structure and composition at the glass ionomer bioadhesive materials, *JOAM*, 14(7-8): 2012, p.826-34.
32. \*\*\* American Academy of Pediatric Dentistry Guideline on Restorative Dentistry. *Pediatr. Dent*. 2016; 38: 250-262. [PubMed][Ref list].
33. MONEA, M., STOICA, E.AL, BECHIR, E.S., BURCEA , AL., PANGICA, A.M., In Vitro Study on the Sealing Ability of Mineral Trioxide Aggregate, *Mat.Plast.*, **53**, no.1, 2016, p.6 37.
34. SAVA ROSIANU, R., SINESCU, C., NEGRUTIU, M.L., HOSSZU, T., TUDOR, A., PODARIU, A. C., Microscopic Assessment of the Enamel Etching Pattern According to Different Etching Times Using Orthophosphoric Acid Gels *Mat.Plast.*, **53** no.1, 2016, p.138
35. MUNTEAN, A., MESAROS, A., FESTILA, D., MOLDOVAN, M., MESAROS, M., In Vitro Microleakage Evaluation Around Three Types of Dental Sealants *Mat.Plast.*, **53**, no.1, 2016, p.166
36. REDDY V.R., CHOWDHARY N., MUKUNDA K., KIRAN N., KAVYARANI B., PRADEEP M. Retention of resin-based filled and unfilled pit and fissure sealants: A comparative clinical study. *Contemp. Clin.Dent*.2015;6:S18-S23.[PubMed][CrossRef].

Manuscript received: 19.09.2018