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Original article

ONE-YEAR CLINICAL EVALUATION OF THE CARIES-PREVENTIVE EFFECT OF GLASS-IONOMER SEALANT ON NEWLY ERUPTED FIRST PERMANENT MOLARS IN CHILDREN

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ABSTRACT

Background: Dental sealant is a material that is applied to pits and fissures in order to prevent the occurrence of occlusal dental caries. The caries-prophylactic effect of sealants on a glass-ionomer basis has not been sufficiently studied, which motivates us to conduct our research.

Purpose; To monitor the caries-preventive effect of a glass-ionomer-based sealant after silanization of the newly erupted first permanent molars in children aged 5-6 years.

Materials and methods: We started the study with 78 healthy, newly erupted first permanent molars (silanized with Fuji triage, GC), the follow-up was performed at 3,6 and 12 months by visual method on the ICDAS II system, diagnostics under magnification using VistaCam Macro and modified Ryge criteria. After recoding the data obtained from monitoring the occlusal surfaces of the newly erupted first permanent molars, we performed a frequency analysis of the data depending on the absence or presence of caries.

Results: In the group of 5-6-year-olds after the application of glass-ionomer-based sealant in the newly erupted first permanent molars, one year after application of the sealant, we assessed over 95% of the examined surfaces as healthy with all diagnostic methods that we used.

Conclusion: Glass-ionomer cements used for silanization are the main tool of choice when it is impossible to control moisture, as is the case with newly erupted molars. Despite their significantly low retention, they provide an excellent caries-prophylactic effect.

Keywords: pit and fissure sealants, types of sealants, glass-ionomer-based sealant, caries-preventive effect,

BACKGROUND

Dental caries is one of the most common diseases affecting children's general health [1, 2].

Deep pits and fissures can retain food debris and bacteria, making them difficult to clean, thereby causing them to be more susceptible to dental caries. The application of a pit and fissure sealant, a non-invasive preventive approach, can prevent dental caries by forming a protective barrier that reduces food entrapment and bacterial growth [3].

The application of a dental sealant on the pits and fissures of the masticatory teeth aims to prevent the appearance and development of caries on the occlusal surfaces, which prevails immediately after the eruption. The high prevalence of occlusal caries in newly erupted teeth and its rapid development is due to the incomplete mineralization of the enamel in the occlusal surface, as well as the anatomically determined retentive form of pits and fissures. These prerequisites require specific preventive measures to be taken for them [4, 5].

Different materials and techniques have been used for the silanization of pits and fissures over the years. Since the time of the invention of pit and fissure sealants, numerous scientific discoveries have led to the development of multiple generations of new sealant materials.

The caries-prophylactic effect of sealants on a glass-ionomer basis has not been sufficiently studied, which motivates us to conduct this clinical study.

PURPOSE

To monitor the caries-preventive effect of a glass-ionomer-based sealant after silanization of the newly erupted first permanent molars in children aged 5-6 years.

MATERIALS AND METHODS

The ethics committee report required for our study was obtained from the Clinical Research Ethics Committee of the Medical University of Plovdiv (Protocol 3/ 20.05.2021).

We started the study with occlusal surfaces that were sound and healthy, with no previous restorations. Children belonged to the high risk group of dental caries development. The examination was performed on an isolated and dried working field, previously performed professional oral hygiene with a brush, oxygenated water and a low speed heandpiece, no cleaning paste was used to avoid the risk of retention of its particles in the retentive arias of pits and fissures and subsequent deterioration of retention of the sealant.

We started the study with 78 newly erupting first permanent molars. Prior to silanization, all first permanent molars included in the study were subjected to visual di-

agnostics using the ICDAS II system, diagnostics with VistaCamiX Macro and a VistaProof fluorescent camera, and silanization was performed according to the indications (Fig.1, 2, 3, 4).

Fig. 1. Before silanization of a mandibular first permanent molar in a 5-year-old child with a glass-ionomer-based sealant (Fuji Triage Pink, GC)

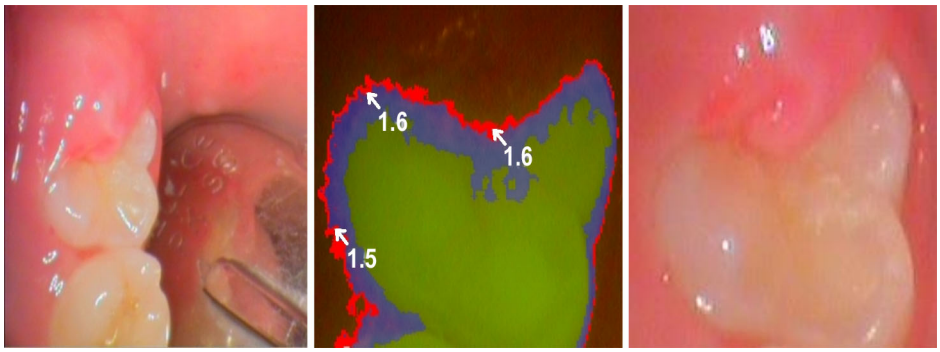


Fig. 2. After silanization of a mandibular first permanent molar in a 5-year-old child with a glass-ionomer-based sealant (Fuji Triage Pink, GC)

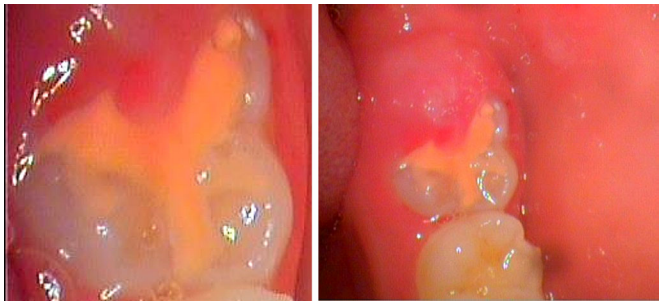
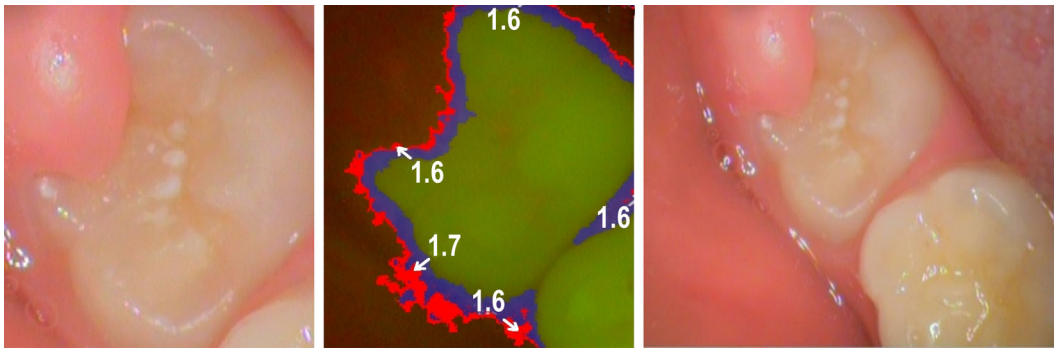


Fig. 3. Before silanization of the mandibular first permanent molar in a 5-year-old child with a glass-ionomer-based sealant (Fuji Triage Pink, GC)



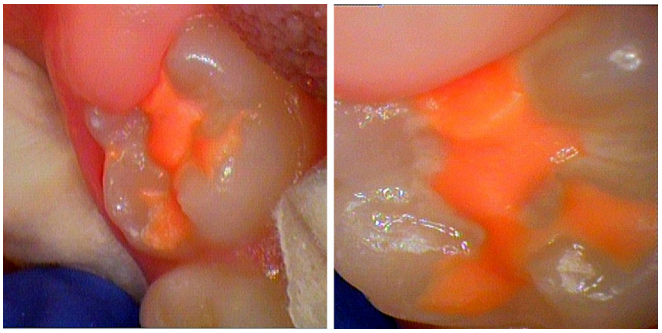
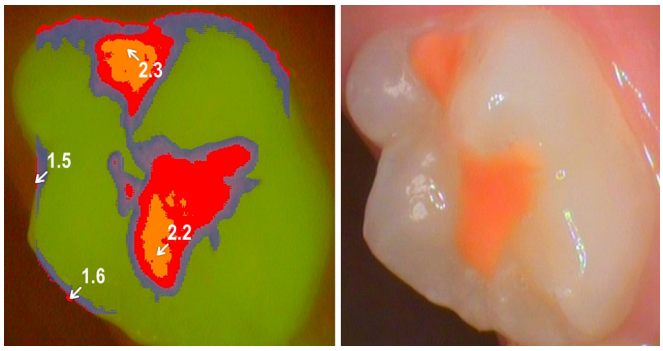


Fig. 4. After silanization of a mandibular first permanent molar in a 5-year-old child with a glass-ionomer-based sealant (Fuji Triage Pink, GC)

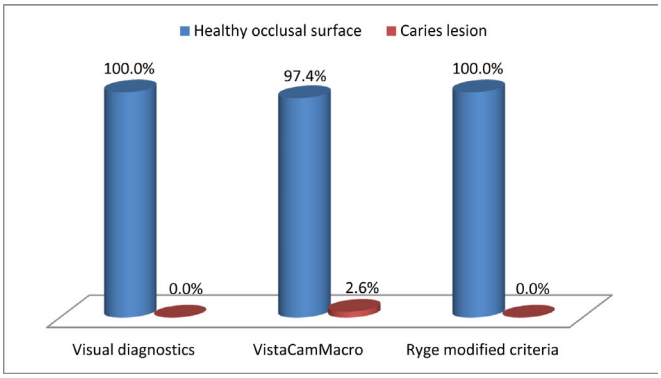
According to the accepted methodology for the diagnosis of occlusal dental surfaces, the same methods were used for follow-up on the 3rd, 6th and 12th month as in the initial diagnosis, except for the laser diagnosis with Vista proof (FC). The reason why we did not use Vista proof in the follow-up of Fuji Triage Pink, GC is that its composition is not suitable for fluorescent diagnostics, and we always received false-positive results, i.e. the device showed the presence of deep caries, while there were no changes in the tooth structures, detectable by other diagnostic methods. Subsequently, we decided to exclude the fluorescent diagnostics when monitoring the glass-ionomer-based sealant. Also, teeth whose sealant had fallen out completely or those with caries were excluded from the study and were not further monitored (Fig. 5).

Fig. 5. After silanization of a maxillary first permanent molar in a 6-year-old child with glass-ionomer-based sealant (Fuji Triage Pink, GC)



After recoding the data obtained from monitoring the occlusal surfaces of the newly erupted first permanent molars and performing a frequency analysis of the data depending on the absence or presence of caries for the group of 5-6-year-olds, the results of the 3rd month showed that the visual diagnostics according to the ICDAS II system and the modified Ryge criteria determine 100% of the occlusal surfaces as healthy. Diagnosis with VistaCamiX Macro revealed caries in 2,60% of occlusal surfaces, and the remaining 97.4% were diagnosed as healthy (Diagram1).

Diag. 1. Caries-prophylactic effect at 3 months in 5-6-year-olds

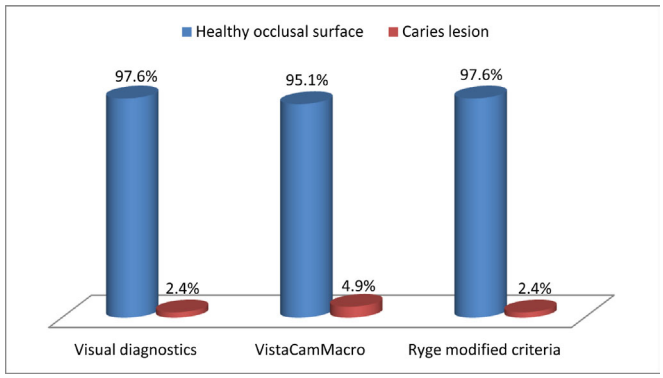


At 6 months, the ICDAS II visual diagnostic criteria again assessed 100% of the occlusal surfaces as healthy.

When diagnosed with VistaCamiX Macro, dental caries was diagnosed in 2.9% of occlusal surfaces, and the remaining 97.1% were assessed as healthy. In diagnostics with the modified Ryge criteria, the results were similar to those obtained from the diagnostics with VistaCamiX Macro.

At the last follow-up examination on the 12th month, the visual diagnosis showed the presence of caries in 2.4% of the occlusal surfaces and the absence of such in 97.6% of them. Again, these results are identical to the Ryge diagnostic. Diagnosis with VistacamiX Macro evaluates 4.9% of occlusal surfaces as carious and 95.1% as healthy. In the group of 5-6-year-olds after the application of glass-ionomer-based sealant in the newly erupted first permanent molars, one year after application of the sealant, we observed healthy dental surfaces in over 95% of the examined surfaces with all diagnostic methods used (Diag.2).

Diag. 2. Caries prophylactic effect at 12 months in 5-6-year-olds



DISCUSSION

A number of studies on the prophylactic effect of glass-ionomer-based sealants confirm the results obtained by us, namely the presence of a high caries-prophylactic effect, despite their poor retention due in part to their high viscosity and inability to penetrate the fissure depth [6, 7, 8].

The ability of glass ionomer sealants to release fluoride ions over a long period of time is a major factor playing a role in the prevention of dental caries and greater resistance to demineralization of hard dental tissues [9, 10, 11, 12, 13, 14].

In addition to emitting fluorine ions for a long time, the glass ionomer sealant can be recharged [15].

Its tolerance to moisture makes it a leading choice in silanization of not fully erupted teeth, as well as in non-cooperative children. The caries-prophylactic effect of the glass-ionomer cement used as a sealant may continue even after it can no longer be observed visually, but particles of it remain retained in the depth of the fissure and continue their remineralizing activity [16].

Studies show 97% of caries prophylactic effect of glass ionomer sealants after a 3-year follow-up period [16, 17].

The better results after the use of glass-ionomer cement used for silanization of partially erupted occlusal surfaces are also confirmed by a study published in J Am Dent Assoc in 2012. The study involved 39 children aged 5-9 years. In which partially erupted molars are observed, the composite-based sealant is placed on one side (left or right) of the upper and lower molars, and the opposite upper and lower jaw molars are silanized with a glass-ionomer-based sealant. The marginal adaptation of the sealants, as well as their caries-prophylactic effect, was estimated at 3, 6, 12 and 24 months. After 2 years, in 40.7% and 44.4% of the teeth, the presence of completely retained sealant was found, respectively, for the groups of resin-based and glass-ionomeric sealant. In the group of molars silanized with glass-ionomeric cement used as a sealant, the authors did not detect the presence of carious lesions, while in the group of molars silanized with composite-based sealant, they observed areas with demineralization.

The authors conclude that glass ionomer sealants are the better choice when saliva field contamination is expected, therefore, glass ionomer based sealants are the better choice for silanization of partially erupted molars [16, 18].

The results that the authors obtained were comparable with our study and were published in 1995. They silanized 148 first permanent molars of 47 children using composite and glass ionomer sealants, and the results obtained after three years showed the presence of only 1.4% of carious dental surfaces in tooth surfaces silanized with glass ionomer sealant. In contrast to the good result of caries prevention, the authors observed partial loss of sealant in 34.7% and complete loss of sealant in 37.5% of the studied surfaces [19].

CONCLUSION

Glass-ionomer cements used for silanization are the main material of choice when it is impossible to control moisture, as is the case with newly erupted molars. Despite their significantly low retention, they provide an excellent caries-prophylactic effect.

REFERENCES:

1. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C. The global burden of oral diseases and risks to oral health. *Bull World Health Organ.* 2005 Sep;83(9):661-9. [PubMed]

2. Al-Jobair A, Al-Hammad N, Alsadhan S, Salama F. Retention and caries-preventive effect of glass ionomer and resin-based sealants: An 18-month-randomized clinical trial. *Dent Mater J.* 2017 Sep 26;36(5):654-661. [PubMed]

3. Ramamurthy P, Rath A, Sidhu P, Fernandes B, Nettem S, Fee PA, et al. Sealants for preventing dental caries in primary teeth. *Cochrane Database Syst Rev*. 2022 Feb 11;2(2): CD012981. [PubMed]

4. Peneva M, Kabakchieva R, Tsolova E, Rashkova M. [Prevention of oral diseases.] Textbook. Publisher East-West, Sofia. 2009. 30-60. [in Bulgarian]

5. Welbury R, Raadal M, Lygidakis NA. EAPD guidelines for the use of pit and fissure sealants. *Eur J Paediatr Dent.* 2004 Sep;5(3):179-184. [PubMed]

6. Tyas MJ. Clinical performance of glass-ionomer cements. *J Minim Interv Dent.* 2008; 1(2):88-94.

7. Alirezaei M, Bagherian A, Sarraf Shirazi A. Glass ionomer cements as fissure sealing materials: yes or no?: A systematic review and meta-analysis. *J Am Dent Assoc.* 2018 Jul;149(7): 640-649e9. [PubMed]

8. Jaafar N, Ragab H, Abedrahman A, Osman E. Performance of fissure sealants on fully erupted permanent molars with incipient carious lesions: A glass-ionomer-based versus a resin-based sealant. *J Dent Res Dent Clin Dent Prospects.* 2020 Winter;14(1): 61-67. [PubMed]

9. Oliveira L, Mickenautsch S, Yengopal V, Bezerra A, Bonecker M. [Up to date about the longevity of glass ionomer sealants.] [in Portuguese] *Rev Bras Pesq Saude*, 2009; 11(3):52-58. [Internet]

10. Pereira AC, Pardi V, Mialhe FL, Meneghim C, Ambrosano GM. A 3-year clinical evaluation of glass-ionomer cements used as fissure sealants. *Am J Dent*. 2003 Feb;16(1):23-7. [PubMed]

11. Sacramento PA, Papa AMC, Carvalho FG, Puppin-Rontani RM. [Antibacterial properties of lining materials - a review.] [in Portuguese] *Rev Odontol UNESP.* 2008; 37(1):59-64. [Internet]

12. Veiga NJ, Ferreira PC, Correia IJ, Pereira CM. Fissure sealants: A review of their importance in preventive dentistry. *Oral Health Dent Manag.* 2014 Dec;13(4):987-993. [Internet]

13. Yengopal V, Mickenautsch S, Bezerra AC, Leal SC. Caries-preventive effect of glass ionomer and resin-based fissure sealants on permanent teeth: a meta analysis. *J Oral Sci.* 2009 Sep;51(3):373-82. [PubMed]

14. Colombo S, Beretta M. Dental Sealants Part 3: Which material? Efficiency and effectiveness. *Eur J Paediatr Dent*. 2018 Sep;19(3):247-249. [PubMed]

15. Rusnac ME, Gasparik C, Irimie AI, Grecu AG, Mesaros AS, Dudea D. Giomers in dentistry - at the boundary between dental composites and glass-ionomers. *Med Pharm Rep.* 2019 Apr;92(2):123-128. [PubMed]

16. Naaman R, El-Housseiny AA, Alamoudi N. The Use of Pit and Fissure Sealants-A Literature Review. *Dent J (Basel).* 2017 Dec 11;5(4):34. [PubMed]

17. Amorim RD, Leal SC, Frencken JE. Survival of atraumatic restorative treatment (ART) sealants and restorations: A meta-analysis. *Clin Oral Investig*. 2012 Apr;16(2): 429-41. [PubMed]

18. Antonson SA, Antonson DE, Brener S, Crutchfield J, Larumbe J,

Michaud C, et al. Twenty-four month clinical evaluation of fissure sealants on partially erupted permanent first molars: Glass ionomer versus resin-based sealant. *J Am Dent Assoc.* 2012 Feb;143(2):115-22. [PubMed]

19. Karlzén-Reuterving G, van Dijken JW. A three-year follow-up of glass ionomer cement and resin fissure sealants. *ASDC J Dent Child.* 1995 Mar-Apr;62(2):108-10. [PubMed]

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