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Original article ■

Clinical Comparasion of the Quality of Fissure Sealing With Fisural® and Ionosit®-Seal in the Observation Period of up to Two Years

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SUMMARY

There is nearly a unanimous standpoint that fissure system is the "region sensitive to caries". These difficulties imposed the consideration of efficient protection of the fissure system from caries. For final realization of this method, both adequate selection and comprehensive planned application of contemporary materials is necessary (composite light-initiated sealants as well as latest glass-ionomers resin fortified) as well as adequately performed technique of their application.

The aim of the paper was to estimate the clinical successfulness of application of the two types of sealants, Fissural®-Galenika-composite sealant, representative of III generation and Ionosit®-seal-DMG Hamburg, glass-ionomer resin fortified, on the basis of determined clinical criteria as per Cvar and Ryge in the function of time from one week to two years.

Clinical investigations were carried out on 72 teeth of transcanine sector with 36 patients of both genders aged 18-25 years, by the method of invasive technique. Upon sealing fissures, teeth were monitored by clinical method - probing of edge attachment of the sealant, as per Cvar and Ryge criteria (retention of the sealant, marginal adaptation, change of surface structure, edge coloring and secondary caries).

The results of analysis of all adopted criteria did not show any changes after the observation period of 7 days for both preparations. There was evident continued declining trend of the quality of Fissural after two years, which confirmed the declining values of all adopted criteria: full retention of preparations (77.77%), full marginal adaptation (77.77%), edge coloring (11.12%), change of surface structure (88.88%) and appearance of secondary caries (11.12%). With Ionosit® seal, high relative values of all adopted criteria were retained, with a slight decline.

The results confirmed that Ionosit-seal®, a hybrid glass-ionomer sealant showed better qualities than Fissural®, a composite sealant of III generation, in all analyzed criteria after observation period of two years.

Key words: caries, fissure, sealing

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INTRODUCTION

It is well known that the development of early caries is closely related to the morphology of the fissure system, which is both physically and physiologically different from the smooth surface of the teeth. Fissures and pits are an enamel fault, in the form of narrow notches or termini of different lengths, at shorter or longer distances from the enamel-dentine junction. There is an almost unanimous opinion that the fissure system is the „area susceptible to caries". The way in which early caries occurs within the fissure system and the magnitude of susceptibility is still a matter of scientific debate. It has not been established which part of the fissure is affected first, nor the fissure shape most susceptible to caries (1-3).

Moreover, the morphology of the fissure system is not a resolved issue. Studies have demonstrated that there are significant differences in the morphology among the same, and among different types of teeth (4, 5). As the consequence of such big differences, there has been a suggestion that the site of initial caries lesion in the fissure has to be considered in the light of a number of morphometric information (6-8).

These difficulties have led to the quest after an effective protection of the fissure system from caries (9, 10). Various approaches have been utilized during all these years with the principal aim to avoid destruction of healthy dental tissue and to provide an effective protection of the fissure system (11, 12).

For the final realization of the method, adequate selection and comprehensive, planned application of modern materials is necessary (composite light activated sealants, as well as resin - modified glass ionomers), as well as an appropriate application technique.

AIM

The aim of the paper was to assess clinical success of the application of two types of sealants,

Fisural® by Galenika, Serbia, (a composite, III generation sealant) and Ionosit®-Seal by DMG, Hamburg, Germany (a resin-modified glass ionomer) based on the clinically established criteria by Cvar and Ryge, in the function of time, from one week to two years.

MATERIAL AND METHODS

Clinical examinations were done at the Clinic of Dentistry in Niš, on 72 teeth of the trans - canine sector, in 36 patients of both genders, aged 18 to 25 years. Using the invasive technique method, the fissures in 36 teeth were treated with Fisural® and 36 teeth were treated with Ionosit®-Seal (Table 1).

The invasive method is a method which is used during whole life, where sealing is not limited by time in proportion to postoperative period of six months. The slight fissure system increase gives multiple advantages: better fissure system overview, possibility of sealing carries is eliminated and better sealant retention is accomplished. Before applying the sealant, the enamel is conditioned using 37% orthophosphoric acid - 30 seconds, washed out and dried out with air. After that, the sealant is applied and illuminated using halogen light. After sealing, the teeth were observed during the period extending from one week, three months, six months, one year, 1,5 years and two years, using the clinical method of probing of sealant attachment to the marginal ledges, by the Cvar and Ryge criteria: sealant retention (total retention, partial retention, total loss), marginal adaptation (total and partial), change of surface structure (smooth and slightly rough), marginal color, and secondary caries. Statistical importance of the results is shown using the χ^2 test between Fisural® and Ionosit®-Seal in observation time intervals, for d.f = 1, possibility level $p=0,05$ and marginal value $\chi^2=3,841$.

Table 1. Reviews of number of examinees as per age and number of treated premolars by method of invasive technique of sealing of fissure, with preparations: Fisural® and Ionosit®-seal

Group of teeth	Number of teeth	Number of patients	Preparation for teeth sealing	
			FISURAL®	IONOSIT®-seal
Upper premolars	36	18	18	18
Lower premolars	36	18	18	18
Total	72	36	36	36

RESULTS

The results of the analysis of all the adopted criteria did not demonstrate any changes after the observation period of 7 days for both sealants.

In Fisural[®], there were minor changes in complete sealant retention (94.44%) and marginal adaptation (94.44%), and the results of the analysis of the remaining three criteria did not show any changes. Already after the 6th month marginal coloring occurred in 5.56% of cases, and after a year there were significant changes in all segments of the adopted clinical criteria with Fisural[®]. After 1.5 years, a declining quality trend was observable for all the adopted criteria: sealant retention (83.33%), marginal adaptation (86.11%), marginal coloring (11.12%), change of surface structure (91.66%), and secondary caries (8.33%). The last observation period, two years, still showed a declining quality trend of all the adopted criteria and occurrence of caries in 11.12% of cases (Table 2; Figures 2.1.1 and 2.1.2).

With Ionosit[®]-Seal there were no changes in all adopted criteria in a three-month period. First minimal

changes occurred after six months in sealant retention (97.22%), and the remaining criteria were present in 100%. After 1.5 years, Ionosit[®]-Seal showed high values for all the adopted clinical criteria: sealant retention (94.44%), marginal adaptation (97.22%), change of surface structure (97.22%), without marginal coloring and secondary caries. The last observation period was just one more confirmation of the high quality of Ionosit[®]-Seal, as shown by high relative values of all the adopted clinical criteria, without marginal coloring and secondary caries (Table 3; Figures 3.1.1 and 3.1.2).

Table 4 demonstrates the values of χ^2 for both Fisural[®] and Ionosit[®]-Seal in the observed intervals, for S.S=1, level of probability $p=0.05$, and cut-off $\chi^2=3.841$. It is evident that a statistically significant difference does not exist for the adopted clinical criteria in the observation period from 7 days to 1,5 year. After 1,5 year, a statistically significant difference appears only in marginal coloring, and after two years such difference appears, apart marginal coloring, in marginal adaptation and secondary caries (Table 4). Values that show statistically significant values are marked in the table using arrows.

Table 2. Fissural from 1 week to 2 years

Period	Sealant retention			Marginal adaptation		Marginal colouring	Change in surface structure		Secondary caries
	Total	Partial	Total loss	Total	Partial		Smooth	Slightly rough	
1 week	36 100%	0	0	36 100%	0	0	36 100%	0	0
3 months	34 94.44%	2 5.56%	0	34 94.44%	2 5.56%	0	36 100%	0	0
6 months	34 94.44%	0	2 5.56%	33 91.66%	3 8.33%	2 5.56%	36 100%	0	0
1 year	34 86.11%	2 5.56%	3 8.33%	33 91.66%	3 8.33%	3 8.33%	34 94.44%	2 5.56%	2 5.56%
1.5 years	30 83.33%	3 8.33%	3 8.33%	31 86.11%	5 13.89%	4 11.12%	33 91.66%	3 8.33%	3 8.33%
2 years	28 77.77%	4 11.12%	4 11.12%	28 77.77%	8 22.23%	4 11.12%	32 88.88%	4 11.12%	4 11.12%

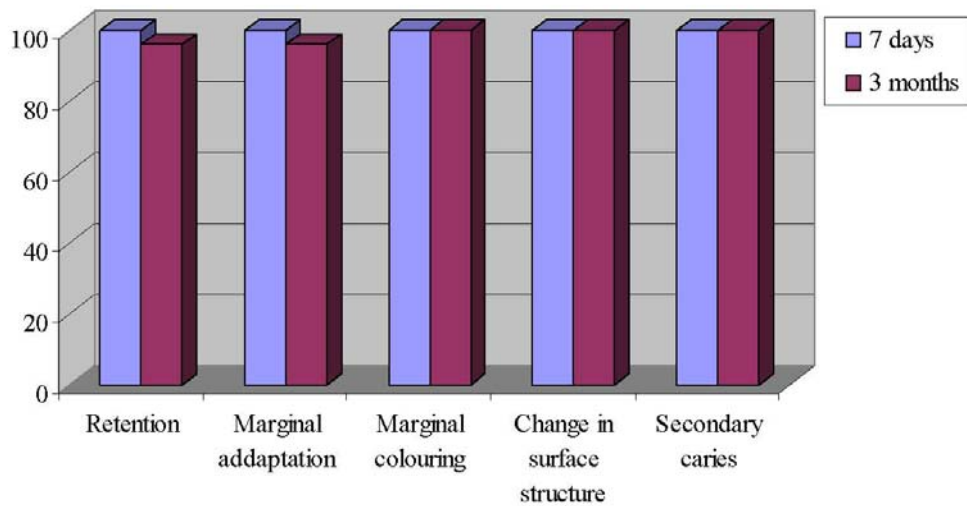


Figure 2.1.1. Percentual representation of criteria of quality of sealing fissures with Fissural after 1 week and 3 months

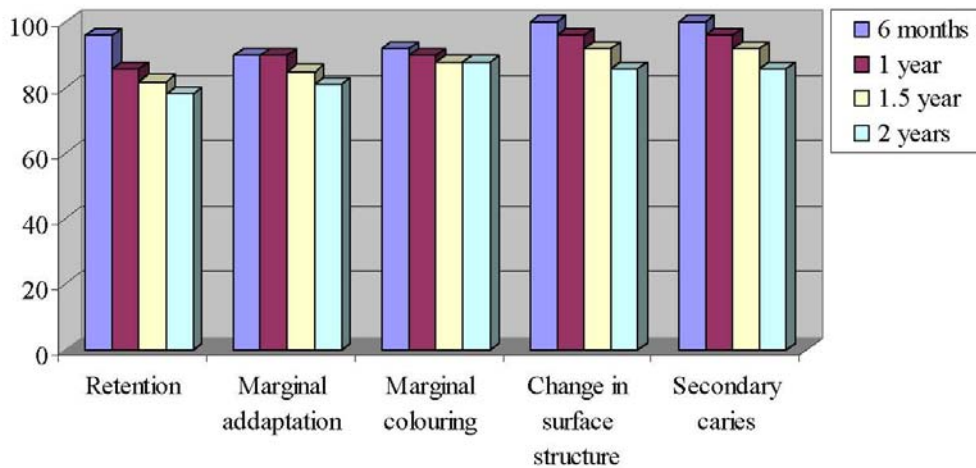
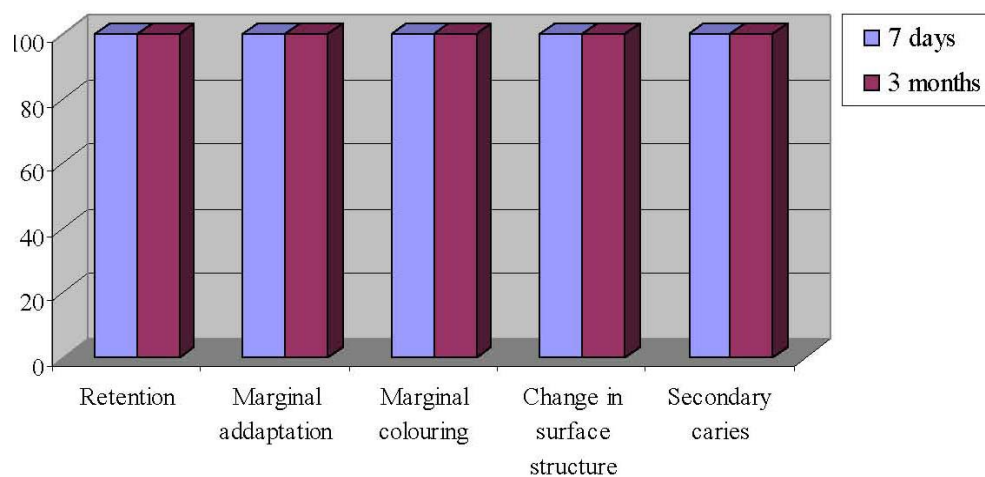


Figure 2.1.2. Percentual representation of criteria of quality of sealing fissures with Fissural after 6 months, 1 year, 1,5 years and 2 years

Table 3. *Ionosit-seal from 1 week to 2 year*

Period	Sealant retention			Marginal addaptation		Marginal colouring	Change in surface structure		Secondary carries
	Total	Partial	Total loss	Total	Partial		Smooth	Slightly rough	
1 week	36 100%	0	0	36 100%	0	0	36 100%	0	0
3 months	36 100%	0	0	36 100%	0	0	36 100%	0	0
6 months	35 97.22%	1 2.78%	0	36 100%	0	0	36 100%	0	0
1 year	34 94.44%	1 2.78%	1 2.78%	35 97.22%	1 2.78%	0	35 97.22%	1 2.78%	0
1.5 years	34 94.44%	0	2 5.56%	35 97.22%	1 2.78%	0	35 97.22%	1 2.78%	0
2 years	33 91.66%	1 2.78%	2 5.56%	34 94.44%	2 5.56%	0	34 94.44%	2 5.56%	0

**Figure 3.1.1.** *Percentual representation of criteria of quality of sealing fissures with Ionosit-seal after 1 week and 3 months*

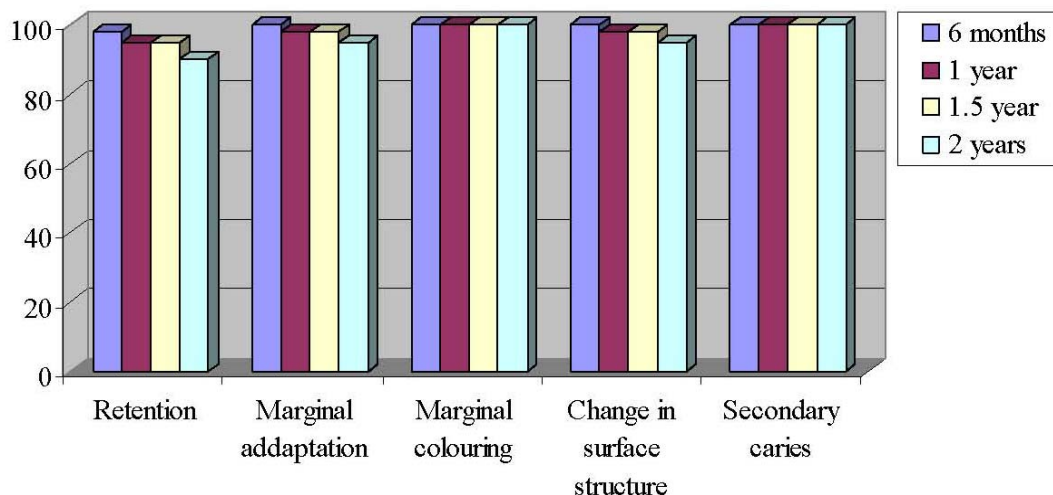


Figure 3.1.2. Percentual representation of criteria of quality of sealing fissures with Ionosit-seal after 6 months, 1 year, 1,5 years and 2 years

Table 4. Values of χ^2 test for Fissural and Ionosit-seal in observation time intervals from 7 to 2 years

FISSURAL® → IONOSIT® SEAL					
Sealants	Sealant retention	Marginal adaptation	Marginal colouring	Change in surface structure	Secondary carries
Opservation period	χ^2	χ^2	χ^2	χ^2	χ^2
7 days	0	0	0	0	0
3 months	2.06	2.06	0	0	0
6 months	0.35	3.13	2.06	0	0
1 year	1.42	1.06	3.13	0.35	2.06
1.5 years	2.25	2.91	4.24	1.06	3.13
2 years	2.68	4.18	4.24	0.73	4.24

p=0.05, df=1, $\chi^2=3.841$

DISCUSSION

In preventive dentistry, fluor is a powerful tool in the prevention of caries, with other prevention measures involved, too. However, when occlusal surfaces are concerned, and especially those with unfavorable anatomic morphology (deep, narrow, the so - called pathologic fissures), where mechanical cleaning is difficult, fissure sealing is the method of choice.

The only prerequisite for fissure sealing, i.e. the indication for the procedure, is a fissure without caries.

That is an imperative allowing no exceptions, in spite of the findings (13) demonstrating that the number of bacteria is reduced by 75%, as well as caries penetration into the fissure after the procedure of conditioning and sealing of a fissure. These beneficial effects should not justify the sealing of a carious fissure, not even in cases of initial caries. Fissure sealing indications using invasive sealing techniques evolved to include deep, discolored fissures as well. The advantage of the treatment, the use of which has been advocated in the literature (8, 14, 15), is that the sealing is not limited in time compared to postoperative period (from six months

to one year). The method can be used in any age, in teeth with pronounced fissure system, and in fissures with signs of initial caries. The fissure is slightly extended, becoming clearer for inspection, with the risk of sealing a carious fissure being eliminated.

A slight extension of fissures increases the retention ability of a sealant, which more easily penetrates and adheres to the fissure walls, and sealant retention is a matter of dispute for many authors. Fisural® belongs to the group of single component photopolymerizing composite sealants of the third generation, providing good penetration into the pits and fissures due to its low viscosity and surface charge (14, 16, 17). It also fulfills esthetic requirements and demonstrates significant resistance to pressure and abrasion, good resistance to water and dehydration, but a rather significant number of authors warn of its insufficient adhesivity (1, 2).

Adhesivity of a sealant is an essential determinant of its marginal stability, but also of its other significant characteristics. This property has been most extensively studied, with variable results (24). In a group of 196 molar teeth with Universal-microfill®, after five years, there were 73% teeth with complete sealant retention, 15% with partial retention, 12% with complete loss, and 77% with caries reduction.

In our nine-year clinical study of 240 permanent molars, using the Prisma-fill® sealant and the criteria of Cvar and Ryge, we found complete sealant retention in 54%, marginal coloring in 12%, and 25% of teeth with secondary caries (18). Some authors (13) stated that after 4-year observation of 96 premolars sealed with Esthetic-microfill®, there were 88.9% with complete sealant retention, 9.1% with partial retention, 2% with complete loss, and 10% with secondary caries. Our results with Fisural®, after two-year observation, were partially comparable to the above authors' results, demonstrating a declining trend in complete sealant retention from initial 100% after a week, to 77.77% after two years, as well as a rising trend of the relative values for other adopted criteria - 11.12% for marginal coloring and secondary caries.

The difference between our results and the results of the cited authors can be explained by the use of non-uniform assessment criteria, different observation periods, non-uniform sample size, and the degree of oral hygiene. However, in spite of a significant percentage of caries reduction, numerous studies have shown good adhesivity only in the entry part of a fissure, and insufficient between the sealant and fissure walls, where the adhesion is weak and allows the occurrence of micro-fissures, resulting in the loss of the sealant (11, 14, 19).

Ionosit®-Seal is a glass-ionomer, resin-modified sealant. It is a single component system in the form of paste, which is photopolymerizing and represents a sublimation of beneficial properties of composite and glass-ionomer sealants. The results achieved with

hybrid glass-ionomer sealants are very favorable. With most sealants, a high degree of retention is achieved (94-100%) after 1.5 years (16). With hybrid glass-ionomers, wear is not more pronounced than the wear of the adjacent enamel, providing satisfactory durability in clinical conditions. Light polymerization induces the development of momentary toughness and resistance, reaching the top values only after 24 hours.

Fluoride-releasing dynamics is similar - in all hybrid sealants there is a rise in the first 24 hours, with an abrupt fall after the second day (19). Further during the course, in the period of up to a year, the released concentrations gradually decrease, reaching a plateau maintained at a level of 0.5-7 ppm (20).

The results obtained in our study with Ionosit®-Seal, based on the clinical criteria by Cvar and Ryge, were satisfactory. Two years after treatment, complete sealant retention was 91.66%, partial retention was found in 2.79%, complete loss occurred in 5.56%, and complete marginal adaptation and smooth surface of the teeth were found in 94.44%. In any of the observation periods, we did not find either marginal coloring or secondary caries. Similar results were obtained by other authors who sealed fissures with hybrid glass-ionomers (21), with much higher retention rate of 97% after two years with Magic®-seal (22). Clinical assessment of hybrid glass-ionomers demonstrated retention rate of 90% after 2.5 years with Magic®-seal. Some authors (23) obtained excellent results with Photac-fill® for complete sealant retention around 90% after 2.5 years, with partial retention around 5%, and sealant loss rate was as low as 5%. There was neither marginal coloring nor caries. Others (24) have used Vitremer® (3M Brazilian), with a high degree of resistance and adhesion to the enamel - 95.5% after a year.

CONCLUSION

The results demonstrated that Ionosit®-Seal, a hybrid glass-ionomer sealant, was of higher quality when compared to Fisural®, a composite sealant of the third generation, in all of the analyzed outcomes after the observation period of two years.

References

1. Charbeneau GT, Dennison JB, Ryge G. A filled pit and fissure sealant: 18-month results. *J Am Dent Assoc* 1977; 95: 299-306.
2. Hickel R. Indications and materials for fissure sealants. *ZWR* 1989; 98(11): 944-46, 948-51.
3. May R. Ästhetisch-adhessive Füllungstherapie im Seitenzahngewebe eine Illusion. *Dtsch Zahnarzt Z* 2004; 463-70.
4. Boksman L, Gratton DR, McCutcheon E, Plotzke OB. Clinical evaluation of a glass ionomer cement as a fissure sealant. *Quintessence Int* 1987; 18: 707-9.
5. Cvar JF, Ryge G. Criteria for clinical evaluation of dental restorative materials. Dental Health Center, San Francisco, California, 1991: 244.
6. Going RE, Haugh LD, Grainger DA, Conti AJ. Four-year clinical evaluation of a pit and fissure sealant. *J Am Dent Assoc* 1977; 95(5): 972-81.
7. Della Volpe M. Molaren-Kunststoff-Füllungen Molaren-Kunststoff-Füllungen durch die Hintertur Preventive Resin Restoration. durch die Hintertur Preventive Resin Restoration. *Der Zahn-Arzt* 1998; 8: 458-61.
8. De Craene GP, Martens C, Dermaut R. The invasive pit-and-fissure sealing technique in pediatric dentistry: an SEM study of a preventive restoration. *ASDC J Dent Child* 1988; 55(1): 34-42.
9. Fajen VB, Duncanson MG, Nanda RS, Currier GF, Angolkar PV. An in vitro evaluation of bond strength of three glass ionomer cements. *Am J Orthod Dentofac Orthop* 1990; 97: 316-22.
10. Forsten L. Short-and long-term fluoride release from glass ionomers and other fluoride-containing filling materials in vitro. *Scand J Dent Res* 1990; 98: 179-85.
11. Garcia-Godoy F. The preventive glass ionomer restoration. *Quintessence Int* 1998; 19: 617-19.
12. Houpt M, Fuks A, Eidelman E. The preventive resin (composite resin/sealant) restoration: Nine-year results. *Quintessence Int* 1994; 25(3): 155-59.
13. Handelman SL, Leverett DH, Solomon ES, Brenner CM. Use of adhesive sealants over occlusal carious lesions: radiographic evaluation. *Community Dent Oral Epidemiol* 1981; 9(6): 256-59.
14. Bader JD, Shugars DA, Bonito AJ. A systematic review of selected caries prevention and management methods. *Community Dent Oral Epidemiol* 2001; 29(6): 399-411.
15. Feigal RJ. Sealants and preventive restorations: review of effectiveness and clinical changes for improvement. *Pediatr Dent* 1998; 20(2): 85-92.
16. Rykke M. Dental materials for posterior restorations. *Endod Dent Traumatol* 1992; 8(4): 139-48.
17. Šutalo J. Kompozitni materijali u stomatologiji. Grafički zavod Hrvatske, Zagreb, 1988: 129-46.
18. Houpt M, Eidelman E, Shey Z, Fuks A, Chosack A, Shapira J. Occlusal restoration using fissure sealant instead of "extension for prevention". *ASDC J Dent Child* 1997; 63(1): Abst No 39.
19. Mitra SB. Adhesion to enamel and physical properties of a light-cured glass ionomer liner/base. *J Dent Res* 1995; 90: 70-2.
20. Morphis TL, Toumba KJ, Lygidakis NA. Fluoride pit and fissure sealants: a review. *Int J Pediatr Dent* 2000; 10: 90-8.
21. Seppä L, Forss H. Resistance of occlusal fissures to demineralization after loss of glass ionomer sealants in vitro. *Pediatr Dent* 1991; 13(1): 39-42.
22. Mejare I, Mjör I. Glass ionomer and resin based fissure sealants; a clinical study. *Scand J Dent Res* 1990; 98: 345-50.
23. Johnson LM, Duke ES, Camm J, Hermes CB, Buikema DJ. Examination of a resin-modified glass-ionomer material as a pit and fissure sealant. *Quintessence Int* 1995; 26(12): 879-83.
24. Forss H, Saarni M, Seppä L. Comparison of glass ionomer and resin based sealants. *Community Dent Oral Epidemiol* 1994; 22: 21-4.

KLINIČKA KOMPARACIJA KVALITETA ZALIVANJA FISURA FISURAL®-om I IONOSIT®-SEAL-om U OPSERVACIONOM INTERVALU DO DVE GODINE

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Sažetak

Postoji gotovo jedinstveno mišljenje da je fisurni sistem "područje osetljivo na karijes". Ove poteškoće navele su na razmišljanje o efikasnoj zaštiti fisurnog sistema od karijesa. Za finalnu realizaciju ove metode neophodan je kako adekvatan izbor tako i sveobuhvatna i planska primena savremenih

materijala (kompozitni svetlosno inicirani zalivači kao i najnoviji smolom ojačani glas-jonomeri), ali i adekvatno sprovedena tehnika aplikacije.

Cilj rada bila je ocena kliničke uspešnosti primene dva tipa zalivača: Fisural®-Galenika-kompozitni zalivač predstavnik III generacije i Ionosit®-seal-DMG Hamburg-glas-jonomer ojačan smolom, na osnovu utvrđenih kliničkih kriterijuma po Cvar-u i Ruge-u u funkciji vremena (od jedne nedelje do dve godine).

Klinička ispitivanja obavljena su na 72 zuba transkaninog sektora, kod 36 pacijenata, oba pola, uzrasta od 18 do 25 godina, metodom invazivne tehnike. Nakon zalivanja fisura, zubi su praćeni kliničkom metodom-sondiranja rubnog pripoja zalivača, po kriterijumima Cvar-a i Ryge-a (retencija zalivača, marginalna adaptacija, promena površinske strukture, rubno prebojavanje i sekundami karijes).

Rezultati analize svih usvojenih kriterijuma nisu pokazali promene nakon opservacionog perioda od 7 dana, za oba preparata. Međutim, evidentan je dalji nastavak opadajućeg trenda kvaliteta Fisural®-a i posle dve godine, što potvrđuju opadajuće vrednosti svih usvojenih kriterijuma: potpuna retencija preparata (77,77%), potpuna marginalna adaptacija (77,77), rubno prebojavanje (11,12%), promena površinske strukture (88,88%) i pojave sekundarnog karijesa (11,12%). Kod Ionosit®-a-seal zadržane su, sa neznatnim padom, visoke relativne vrednosti svih usvojenih kriterijuma.

Rezultati su potvrdili da je Ionosit®-seal, hibridni glas-jonomer zalivač pokazao bolje kvalitete u odnosu na Fisural®-kompozitni zalivač III generacije, kod svih analiziranih kriterijuma nakon opservacionog perioda od dve godine.

Ključne reči: karijes, fisura, zalivanje

