A Comparative Clinical Study of Three Fissure Sealants on Primary Teeth: 24-Month Results

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Aim: *The purpose of this study was to evaluate the clinical success of three fissure sealants(FSs) with different contents on primary teeth.* ***Study design:*** *Three FSs were used to seal 150 primary molars in 75 children aged 4–7 years. All FSs were placed on occlusal surfaces in a split-mouth and randomized clinical trial. For patients in Group1,amorphous calcium phosphate(ACP) containing resin-based sealant(RBS)(Aegis) was applied to a primary molar tooth on one side ,and non-fluoride RBS(Helioseal) FS was applied to symmetrical molar tooth. For patients in Group2, fluoride-containing RBS(Helioseal F) was applied to a primary molar tooth on one side, and Helioseal FS was applied to symmetrical molar tooth. For patients in Group3,Helioseal FS was applied to a primary molar tooth on one side, and Aegis FS was applied to symmetrical molar tooth. Clinical evaluation of FSs was carried out to assess retention, marginal discoloration, marginal adaptation,and the presence of caries in months 1,3,6,12,18 and 24 after FS application.* ***Results:*** *There were no significant differences for all criteria in groups 2 and 3(p>0.05). In group 1,cumulative success rates according to 24 months' follow-up were statistically insignificant during the comparisons performed in terms of retention, marginal adaptation, and presence of caries(p>0.05). Marginal discoloration was found to be statistically significant(p<0.05).* ***Conclusion:*** *RBS containing ACP or fluoride may be more effective than conventional RBS for caries prevention.*

Key words: *Primary teeth, fissure sealant, caries.*

INTRODUCTION

In epidemiological studies decrease in caries does not show a homogenous distribution for all tooth surfaces; while interproximal decay ratios are decreasing, occlusal surface caries still show high prevelance[1]. The incidence of caries in the occlusal surfaces of the teeth constitutes more than two-thirds of all caries types[2]. The tendency of occlusal surfaces to develop caries is closely associated with the depth and morphology of the pit and fissures. Caries development is triggered by the fact that food particles and bacteria can easily be accumulated in the deep pits and fissures, and these areas cannot be cleaned sufficiently due to the lack of both the cleansing effect of saliva and routine mechanical cleaning processes[3].

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In pediatric dentistry, fissure sealants (FSs) have been used to prevent dental caries since the 1960s[4]. FSs have been proven to be effective preventive aids that dramatically reduce caries in occlusal surfaces of primary and permanent posterior teeth[3-5].

The composition of FSs is important for their success. There are two main types of FSs: resin-based sealant (RBS) and glass-ionomer sealant (GIS). RBSs form a micromechanical-bonded resin layer that acts as a physical barrier between the enamel surface and the oral environment and thus changes the occlusal morphology[6]. A majority of clinical studies have indicated lower retention rates with GISs compared with RBSs.[7] However, GISs may be an effective choice for partially erupted molars and inadequate moisture control[8]. GISs, which were developed for their ability to release fluoride, can also bond directly with enamel[8].

RBSs are classified according to their filler and fluoride contents. Helioseal FS is considered an unfilled and non-fluoride-containing FS; on the other hand, Helioseal F FS is a filled and fluoride-containing FS. A filled sealant material may have a higher viscosity than an unfilled resin. However, a study conducted to compare fluoride-containing and non-fluoride-containing fissures demonstrated no statistical difference in the penetration ability of the resin into fissures[9].

New FSs with the capacity of releasing calcium and phosphate due to the presence of amorphous calcium phosphate (ACP) (Aegis) have been marketed. The suggestion behind these sealants is that during caries formation at or below pH 5.8, hydroxyapatite (HAP) is leached from the enamel surface[10]. At this low pH value, ACP is capable of being broken down and releasing saturating levels of Ca^{2+} and PO_4 ions[11]. These concentrations are conducive to the formation of HAP, which in turn can be used by the tooth for enamel remineralization[12]. ACP is not only considered an indication of HAP, but it also exhibits anti-cariogenic properties with remineralization potential[13]. Although *in vitro* microleakage and microtensile studies have been conducted with Aegis FS[14-16], the lack of *in vivo* studies demonstrating clinical success enhances the importance of the results of this study[16].

In previously conducted clinical studies evaluating the success of FSs, generally only their retention on the tooth surface and caries-preventing effects have been considered[3,6,17]. However, when these aimed to reveal the factors that affect the clinical success of the FSs, it has been observed that marginal adaptation and marginal discolorations along with the retention are taken within the scope of the evaluation[3,4,18]. For this reason, the aim of the present study was to evaluate clinical performance (retention, marginal discolorations, marginal adaptation, and caries) of three FSs with different contents: Aegis (ACP containing), Helioseal F (fluoride-containing sealant), and Helioseal (non-fluoride-containing sealant) on the mandibular primary second molar teeth.

MATERIALS AND METHOD

Ethical approval was obtained from Cumhuriyet University Clinical Research Ethic Committee to collect samples for this study (2010-03/20) and informed consent was obtained from patients and their parents according to the Declaration of Helsinki.

A total of 75 healthy, cooperative children (39 girls and 36 boys) aged between 4 and 7 (average age of 4.88) were recruited to the study. Demographic breakdown of the subjects according to the age and gender are shown in Table 1. In total, 150 mandibular primary second molar teeth of 75 children meeting specified criteria were included in the study. These criteria were;

- nonexistence of caries, previously applied fissure sealant, fillings, and developmental defects such as hypomineralization, hypoplasia, and fluorosis
- occlusal surfaces of the teeth had to be fully erupted and free of mucosal tissue
- occlusal surfaces had to have deep and retentive pits and fissures

The teeth were examined using a mouth mirror under standard dental lighting, and the occlusal surfaces of all teeth were cleaned using pumice prophylaxis to remove dental biofilm and stains. The teeth that satisfied the criteria were included in this study.

Table 1. Demographic breakdown of the subjects according to the age and gender

	Grup I (n:25)	Grup II (n:25)	Grup III (n:25)	p-value
Age	5,00±1,04	4,68±0,75	4,96±1,06	0,443[a]
Gender				0,852[b]
Girl	14 (%56)	13 (%52)	12 (%48)	
Boy	11 (%44)	12 (%48)	13 (%52)	

a: One-Way Analysis of Variance, b: Pearson's chi-square test.

Treatment Procedures in Groups

The 75 children were randomly divided into three groups (n = 25). Aegis (Bosworth Co, Illusiana, USA), Helioseal (Ivoclar Vivadent, Liechtenstein, Germany), and Helioseal F (Ivoclar Vivadent, Liechtenstein, Germany) FSs were used in this study. FSs were placed on mandibular second molars according to a split-mouth design.

Before the application of FSs, the occlusal surfaces were cleaned using a rotating bristle brush at low-speed hand-piece for 30 seconds. Each tooth was isolated using standard cotton rolls, and flexible plastic saliva ejectors were used throughout the procedure. A single operator applied the FSs.

The compositions and manufacturer's instructions of FSs are shown in Table 2.

Group 1 (n = 25): Aegis and Helioseal FSs were randomly applied in a split-mouth design on mandibular second primary molars.

Group 2 (n = 25): Helioseal and Helioseal F FS were randomly applied in a split-mouth design on mandibular second primary molars.

Group 3 (n = 25): Aegis and Helioseal F FS were randomly applied in a split-mouth design on mandibular second primary molars.

After light curing the FSs with an LED curing light (Light Intensity 1,200 mW/cm^2, Bluephase, Ivoclar Vivadent), the explorer was used to check for complete application of FS. The occlusion was checked with articulation paper and modified with a composite finishing bur if necessary, and then FSs were polished with polishing points. All the children and their parents were informed about satisfactory oral hygiene and given diet advice by the researchers.

Follow-up Examination

Criteria for FS scoring are listed in Table 3.

Children were recalled for assessment of FSs at intervals of 1, 3, 6, 12, 18, and 24 months. The evaluators were calibrated by examining sealed teeth before evaluation sessions. Evaluation of the occlusal FSs during visual and tactile examination was performed with a dental mirror and an explorer. Before examination of the FSs, remaining visible debris and plaque were removed with the aid of an explorer, and the sealed tooth surface was dried using a piece of cotton tightly attached to the end of a stick. In case of any disagreement, final evaluations were obtained by examiner consensus. Clinical determination of FS failure was based on the FS obtaining a score of 2 or 3 in marginal integrity or marginal discolorations for occlusal FSs, presence of caries, and totally or partially lost FS revealing a susceptible pit or fissure in retention for occlusal FSs[5,18]. The FSs that were determined to be unsuccessful during any of the control sessions in terms of any criteria were excluded from the study. All data were collected using an evaluation form for each child.

Table 2. Materials used in the study

Materials	Composition	Application procedures	Lot Number
AEGIS Bosworth®Company(USA)	UDMA, mono-and di methacrylates resins TLV-TWA: 15 mg/m³ TWA for ACP N/A for resin	1.Occlusal enamel surface etched with 35% phosphoric acid gel for 40 s, and subsequently washed and dried for 40 s 2.Apply sealant with a disposible brush all etched occlusal surface 3.Light-cure(Bluephase,İvoclar Vivadent, Liechtenstein) for 20s	0608-398
HELIOSEAL İvoclar Vivadent Ets., (Schaan, Liechtenstein)	Bis-GMA, TEGDMA(>99wt%) Additional contents are stabilizers and catalysts(<1 wt%)	1.Occlusal enamel surface etched with 37% phosphoric acid gel for 40 s, and subsequently washed and dried for 40 s 2.Apply sealant with a disposible brush all etched occlusal surface 3.Light-cure(Bluephase,İvoclar Vivadent, Liechtenstein) for 20s	L24213
HELIOSEAL F İvoclar Vivadent Ets., (Schaan, Liechtenstein)	Monomer matrix: Bis-GMA(11.8%), UDMA (23.4%), TEGDMA(23.4%) Fillers: Fluorosilicate glass(20.3%), highly dispersed silicon dioxide(20.2%). Pigments, titanium dioxide, initiators, stabilizers	1.Occlusal enamel surface etched with 37% phosphoric acid gel for 40 s, and subsequently washed and dried for 40 s 2.Apply sealant with a disposible brush all etched occlusal surface 3.Light-cure(Bluephase,İvoclar Vivadent, Liechtenstein) for 20s	H23186

Bluephase, İvoclar Vivadent, Liechtenstein; light intensity: 1200 mw/cm².

Abbreviations: Bis-GMA = bisphenol-aglycidylmethacrylate; N/A = Not available; TEGDMA = triethylene glycol dimethacrylate;

TLV-TWA = Threshold Limit Value-Time-Weighted Average; UDMA = urethane dimethacrylate.

ACP= amorphous calcium phosphate

Statistical Analysis

The SPSS for Windows 11.5 software program was used to analyze the data. Descriptive statistics are expressed as a mean ± standard deviation for the continuous variables and as a percentage for the nominal variables.

The significant differences between the groups in terms of mean age were performed with One-Way Analysis of Variance (One-Way ANOVA), and a Pearson chi-square test was used for determining gender distribution.

Interexaminer reliability was assessed by examination of the independent samples by the two examiners. In terms of retention, marginal discoloration, marginal adaptation, and caries, the conformity of the evaluations performed by both observers was examined by calculating the kappa coefficient.

The significance of the difference in cumulative survival proportions in terms of retention, marginal discoloration, marginal adaptation, and caries was examined by Kaplan-Meier analysis according to the groups and materials used in this study. The cumulative survival proportions of each group were recorded at 1, 3, 6, 12, 18, and 24 months. The results were accepted as statistically significant for $p < 0.05$.

Table 3. Criteria for fissure sealant evaluation

A. Retention	
0	İntact (Sealant fully intact with no apparent loss of material)
1	Partial loss (Sealant in place with partial loss not involving a susceptible pit or fissure)
2a	Partial loss (Sealant in place with partial loss involving a susceptible pit or fissure)
2b	Total loss
B. Marginal discolouration	
0	No colour change at the tooth/sealant interface
1	Discolouration noted along the margin in one area
2	Discolouration noted along the margin in multiple areas
3	Severe discolouration with evidence of penetration and leakage
C. Marginal İntegrity	
0	Restorative material adjacent to the tooth and not detectable with an explorer
1	Margin detectable with the explorer
2	Crevice along the margin of visible width and depth
3	Crevice formation with exposure of central fissure
D. Caries	
0	No caries of evidence with margin
1	Evidence of caries at the margin of the restoration

*Scores of 0 and 1in retention, marginal discolouration and marginal integrity criteria as well as score of 0 in caries accepted successfull. All other scores were considered the fissure sealant unsuccessful.

RESULTS

A total of 39 girls (52%) and 36 boys (48%) participated in the present study. The mean ages in groups 1, 2, and 3 were 5.00, 4.68, and 4.96 years, respectively. There were no significant differences in age or gender among the groups (Table 1).

The kappa values between the observers in term of retention, marginal discoloration, and marginal adaptation were 0.87, 0.92, and 0.92, respectively.

Cumulative survival percentages of retention, marginal discoloration, marginal adaptation, and caries are shown in Table 4, 5, and 6.

Kaplan-Meier test results applied for each assessment criteria of FSs were as follows;

Retention Rates

There were no significant differences among the groups after 24 months ($p > 0.05$). (Tables 4, 5 and 6).

In Group 1, decreases in retention were determined in both FSs at the 18th and 24th months, but lower retention was determined in Helioseal FS at the end of 24 months (87.8%).

In Group 2, while the decrease started in the retention rates of Helioseal FS at the beginning of the 12th month (96%), the lower retention rate was observed in Helioseal F FS at the end of 24 months (87.8%).

In Group 3, while the retention rate started to decrease for Helioseal F FS at the beginning of the 12th month, the lowest retention rate was observed in Helioseal F FS at the end of 24 months (88%).

Marginal Discoloration

There were significant differences in Group 1 ($p < 0.05$), but the differences were not significant in Group 2 or Group 3 ($p > 0.05$) (Tables 4, 5 and 6).

In Group 1, a decrease was seen in Helioseal FS at the beginning of the 18th month (95.7%), and this decrease reached 82% at the end of 24 months. A 100% success rate was observed in Aegis FS at the end of 24 months.

In Group 2, while the success rate of marginal discoloration decreased in both FSs by the 18th month, the success of Helioseal FS was found lower at the end of 24 months (86.4%).

In Group 3, the success rate for the marginal discoloration started to decrease in Aegis FS at the beginning of the sixth month (95.7%), but the lowest success rate was found in Helioseal F FS at the end of 24 months (81.8%).

Marginal Adaptation

No significant difference was found among the groups in the statistical comparisons conducted ($p > 0.05$) (Tables 4, 5 and 6).

The decrease in the success of the marginal adaptation in Group 1 began for Aegis FS in the 12th month (96%); however, the lowest success rate was determined in Helioseal FS at the end of 24 months (86.5%).

The decrease in the success of the marginal adaptation in Group 2 started in Helioseal FS in the 12th month (95.8%), and this success rate was found at 72.6% for Helioseal FS and 86.5% for Helioseal F FS at the end of 24 months.

Table 4. Cumulative success rates for the evaluation criterias in Group 1

Criteria	Aegis	Helioseal	Log-Rank	p-value
Retention			1,033	0,309
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%100,0	%96,0		
18.Month	%95,8	%92,0		
24.Month	%95,8	%87,8		
Marginal Discoloration			4,439	*0,035
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%100,0	%100,0		
18.Month	%100,0	%95,7		
24.Month	%100,0	%82,0		
Marginal İntegrity			1,129	0,288
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%96,0	%100,0		
18.Month	%96,0	%95,7		
24.Month	%96,0	%86,5		
Caries			3,239	0,072
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%100,0	%100,0		
18.Month	%100,0	%95,7		
24.Month	%100,0	%86,5		

The decrease in the success of the marginal adaptation in Group 3 started in Aegis FS in the 18th month (95.8%), but the lowest success rate was determined in Helioseal F at the end of 24 months (86.4%).

Caries

There were no statistically significant differences among the groups at the end of 24 months ($p > 0.05$) (Tables 3, 4 and 5).

Caries formation was seen in Helioseal FS only in Group 1 and Group 2. At the end of 24 months, Helioseal FS showed success at the rate of 86.5% in Group 1 and 95.5% in Group 2, but there were no significant differences ($p > 0.05$).

Table 5. Cumulative success rates for the evaluation criterias in Group 2

Criteria	Helioseal	Helioseal F	Log-Rank	p-value
Retention			0,124	0,725
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%96,0	%100,0		
18.Month	%91,8	%92,0		
24.Month	%91,8	%87,8		
Marginal Discolor-ation			0,010	0,919
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%100,0	%100,0		
18.Month	%86,4	%95,7		
24.Month	%86,4	%86,5		
Marginal İntegrity			1,451	0,228
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%95,8	%100,0		
18.Month	%87,1	%95,7		
24.Month	%72,6	%86,5		
Caries			1,045	0,307
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%100,0	%100,0		
18.Month	%95,5	%100,0		
24.Month	%95,5	%100,0		

Table 6. Cumulative success rates for the evaluation criterias in Group 3

Criteria	Helioseal F	Aegis	Log-Rank	p-value
Retention			0,991	0,320
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%96,0	%100,0		
18.Month	%92,0	%100,0		
24.Month	%88,0	%95,7		
Marginal Discoloration			0,723	0,395
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%96,0		
12.Month	%100,0	%96,0		
18.Month	%100,0	%96,0		
24.Month	%81,8	%91,6		
Marginal İntegrity			0,221	0,638
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%100,0	%100,0		
18.Month	%100,0	%95,8		
24.Month	%86,4	%91,5		
Caries			-	-
1.Month	%100,0	%100,0		
3.Month	%100,0	%100,0		
6.Month	%100,0	%100,0		
12.Month	%100,0	%100,0		
18.Month	%100,0	%100,0		
24.Month	%100,0	%100,0		

DISCUSSION

Studies have emphasized that the success of fissure sealants, one of the most important tools in preventive dentistry, is directly associated with the material's ability to remain on the tooth surface[3-6]. The sealant's retention on tooth surfaces prevents food accumulation in the pits and fissures, therefore preventing the formation of caries. Previous studies have revealed that there is a strong relationship between the retention of FSs and the prevention of caries formation[4,5,18]. Although retention is one of the most important criteria in the evaluation of the success of FSs, marginal adaptation, marginal discoloration, and caries formation are other important factors that affect the clinical success of FSs. In present research, all criteria (retention, marginal adaptation, marginal discoloration, and caries formation) were assessed over a period of 24 months.

In vivo studies that compared the clinical effectiveness of FSs used the method of split-mouth technique, and we used split-mouth technique in this study to minimize the effects of individual patient factors[5,18,19].

Studies comparing the clinical effectiveness of FSs observed that generally the method of testing the same mouth environment (split-mouth) is used[5,18,19]. In the present study, we tried to minimize the effects of individual factors of the patient on the result by applying the FSs to two symmetrical primary teeth within the same mouth environment. In the literature review, it was seen that the evaluation of the clinical success of the FSs was generally performed on the first permanent molar tooth, and the number of studies performed on primary molar teeth was limited[20-24]. Thus, in the present study, FSs were applied to the primary molar teeth, and their clinical success was evaluated.

Poulsen *et al* [20] compared the efficiency of the FSs on the mandibular and maxillary second primary molar teeth on the retention values of isolation via a rubber dam or cotton roll. At the end of six months, the full retention rates of the FSs were found to be higher on the side where teeth were isolated via a rubber dam. However, the differences in retention rates between two techniques were not statistically significant. It was stated from this research that good saliva isolation could be performed with a cotton roll, like with a rubber dam. In this study; the cotton roll was used for saliva isolation and the negative effect of saliva, which would cause clinical failure of FSs, was eliminated.

Yıldız *et al* [25] compared the clinical success of a fluoride-containing and filled FS (Helioseal F) with a non-fluoride and unfilled FS (Concise). After 24 months, the retention rate of the Helioseal F was found lower (77%) than that of the Concise FS (82%). Although there were no statistical differences between the present study and Yıldız *et al* [25], the different retention rates may be associated with applying different types of the FSs. In the present study, when the retention-rate results (Helioseal F and Helioseal FSs) were evaluated after 24 months, it could be asserted that the retention was found to be Aegis > Helioseal > Helioseal F.

In contrast to this study's results, Carlsson *et al* [26] evaluated the 2-year clinical success of Helioseal F FS and concluded 77% full retention, 22% partial retention, and 1% total loss of Helioseal F. Vrbic[21] compared the retention rates of the Helioseal F FS on primary molar teeth after a 3-year follow-up and observed that the full retention rates were 98% in the first year, 97% in the second year, and 95% in the third year. In this study's results, success rates were 96–100% at the end of the first year and 87.8–88% at the end of the second year for Helioseal F FS. Koch *et al* [27] investigated the retention and marginal integrity of Helioseal F and an unfilled FS (Delton) for 12 months. Although they found no significant difference in retention criteria, there was a significant difference in the marginal adaptation. Helioseal F FS showed lower success for marginal adaptation. These results were associated with the wetting ability and the inorganic filler rate of the FS. Although the retention results of Koch *et al* and this study's results were similar, the results for marginal adaptation were different. This difference may be associated with the fact that the follow-up period, the teeth selected for study, and the evaluation criteria for the success rates of FSs were different for this study. In this study, the follow up period was 24 months, the selected teeth were primary molars, and the evaluation criteria were based on the success rates of the FSs.

Cogo *et al*[22] evaluated the retention and marginal integrity of the flowable composite resin (Tetric EvoFlow) and Concise FS on the primary molar teeth and reported no difference at the end of 24 months of clinical follow-up. Boksman [29] evaluated the retention and effect on caries rates of two fluoride-containing FSs (UltraSeal XT and FluoroShield) and found that the total retention rate was 96.3% for UltraSeal XT and 91.4% for FluoroShield, with no carious lesions observed during the two-year follow-up.

When the success rates of the FSs were evaluated in terms of marginal discoloration and marginal adaptation, Aegis > Helioseal F > Helioseal results were obtained. The difference in Group 1 was significant in terms of marginal discoloration. Patient behavior, saliva control, and enamel alterations might cause lower success and different results. In addition, some authors[3,6,23,26] have stated that the rate and type of inorganic filler may be factors affecting the retention of FS.

Silva [13] revealed that amorphous calcium phosphate (Aegis) and fluoride (Flourshield) containing FSs promote remineralization of artificially induced caries lesions on enamel surfaces. Coudhary *et al* [30] demonstrated that Aegis FS and fluoride containing FS (Teethmate F1) have remineralization potential because of ACP molecules and fluoroapatite formation; in addition, these results were supported by scanning electron microscopy.

Alsaffar [31] evaluated the effect of FSs (Delton, Aegis, UltraSeal XP plus, and Clinpro (fluoride-containing), Fuji Triage (glass ionomer sealant)) in protecting adjacent enamel from acid demineralization. They concluded that resin-based FSs containing fluoride or ACP could provide a more preventive effect on demineralization of adjacent enamel than conventional non-fluoride FS.

In the present study; caries formation was observed only in the Helioseal FS group a in 24-month period. The abovementioned studies reported that ACP and fluoride-containing FSs stimulate remineralization on the enamel surface. Nonexistence of caries formation in the Aegis and Helioseal F FS groups may be associated with above mentioned reason.

CONCLUSIONS

In this clinical research, the data determined that multiple factors (retention, marginal integrity, marginal adaptation, and caries) may affect FS success. The kind (filled or unfilled), inorganic filler, and organic structure of FS are considered to be important factors in the success rate. The prevention of caries formation in children in early stages by extending the application of the fluoride or FSs containing amorphous calcium phosphate on primary teeth is one of the important results of this study. In primary dentition, FSs may be an effective method for prevention of caries and incipient lesions on primary molar teeth.

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