

Factors Influencing Sealant Longevity and Restorative Outcomes in Pediatric Patients

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ABSTRACT

Purpose: To identify factors that affect sealant longevity, as well as examine restorative outcomes following sealant loss compared to sealants that remain intact within four years of placement. **Methods:** A retrospective chart review was conducted to analyze sealant treated permanent first molars that had a minimum of four-year follow-up. For study inclusion, patients must have presented for recall and radiographic examination at minimum once per year. Data extracted from the electronic patient record included tooth number, age (5 to 10-years-old), gender, Frankl score, isolation method (rubber dam, cotton roll, DryShield), ASA classification (I or II), appointment type (moderate sedation, nitrous, no pharmacologic adjunct), caries risk, and subsequent restorative codes for each sealant-treated tooth. Analysis was completed using generalized linear models and Chi-square tests; p-values less than 0.05 were considered significant. **Results:** A total of 284 charts met the inclusion criteria. Sealant retention after four years was 37 percent and was influenced by isolation method, with DryShield having fewer than expected failures and cotton roll isolation having more than expected ($P=.04$ and $P=.02$, respectively). No association of sealant failure and caries experience was detected ($P>0.05$). Females had more post-sealant caries experience compared to males (28% versus 14%, $P=.005$). No other factor influenced sealant retention or caries experience. **Conclusions:** Isolation method had a significant effect on sealant retention and should be a consideration for clinicians during sealant placement. Gender had a significant effect on caries experience, which should be taken into account for overall preventative treatment planning.

BACKGROUND

- The caries protective effect of pit and fissure dental sealants has been well documented over the past few decades, particularly in children and adolescents, where pit and fissure caries are prevalent.^{1,4}
- The American Academy of Pediatric Dentistry recommends pit and fissure sealants for caries prevention, particularly in high-risk patients.¹
- Resin-based sealants have demonstrated longer retentive rates compared to other sealant materials, but their hydrophobic properties make them more technique sensitive.^{1,2}
- It is generally agreed that complete sealant retention for resin-based sealants maximizes caries risk reduction.^{2,3,5,6}
- There is ongoing discussion regarding whether sealant loss versus caries experience constitutes sealant failure.⁷
- Limited research has examined the impact of patient behavior on sealant retention or assessed the effectiveness of continuous evacuation isolation methods.
- Few studies have assessed restorative outcomes subsequent to sealant loss at a tooth level, while also considering placement techniques.

We hypothesize that no sealant placement variables influence sealant longevity or subsequent caries experience.

METHODS

- This study was approved by the UTHealth Houston Institutional Review Board.
- Patients aged 5-10 years, seen in the UT Graduate Pediatric Dentistry Clinic between July 2011 and October 2019 and had a sealant placed on a first permanent molar, were included for chart review.
- Inclusion criteria included ASA 1 and 2 patients, who presented for exam and radiographs within 12-month intervals following initial sealant placement, over a 48-month period.
- ASA 3 and 4 patients, as well as teeth noted to have operculum or gingiva over the occlusal surface, molar hypoplasia or enamel hypomineralization were excluded.
- A total of 284 patients met the inclusion criteria and the following data was collected: Age, Gender, Frankl Score, Isolation method (Rubber Dam, Cotton Roll, DryShield), Appointment type (OCS, nitrous, no adjunct), Caries Risk, and Treatment Codes for each tooth, beginning with the initial D1351 code.
- Analysis was conducted using generalized linear models, Chi-square and Fisher's Exact tests; p-values less than 0.05 were considered significant.

RESULTS

- 284 patients were evaluated for sealant retention and restorative outcomes.
- Table 1 provides information related to Sealant Retention.
- Table 2 provides information related to Caries Experience.
- Figure 1 details restorative outcomes and time to initial sealant loss.
- Isolation method influenced sealant retention, with DryShield having overall success rate of 50%, Cotton Roll isolation 31%, and Rubber Dam 41%. ($P=.036$).
- Females had more post-sealant caries experience compared to males (28% versus 14%, $P=.005$).
- High caries risk influenced caries experience ($P=.014$).
- Other Results:
 - Overall sealant retention after four years was 37%.
 - Average time to sealant loss was 24 months.
 - Overall caries experience after sealant placement was 21%.
 - Average time to caries experience was 25 months.
 - No association between sealant retention loss and caries experience was detected ($P>0.05$).
 - No other factor influenced sealant retention or caries experience.
 - The most common treatment code completed following sealant retention loss was D1351(O).
 - The most common treatment code completed following caries diagnosis was D2391(O).

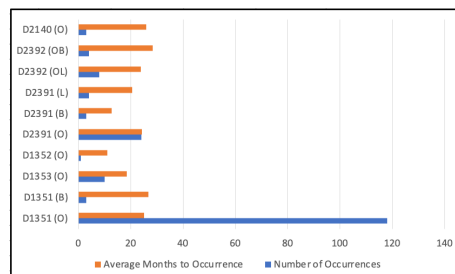


Figure 1. Restorative Outcomes and Time to Initial Sealant Loss

RESULTS

Table 1. Sealant Retention

Variable	Distribution (Number, %)	Failure	Retention	% Retention	p value	Avg Time to Loss (mo)
TOOTH:					p=0.329	
#3	71, 25%	51	20	28%		23.65
#14	72, 25.4%	42	30	42%		22.98
#19	72, 25.4%	45	27	38%		24.31
#30	69, 24.3%	41	28	41%		26.07
AGE (in years):					p=0.687	
5	11, 3.9%	7	4	36%		26.71
6	70, 24.6%	45	25	36%		23.93
7	92, 32.4%	62	30	33%		24.27
8	59, 20.8%	34	25	42%		24.42
9	39, 13.7%	25	14	36%		24.04
10	13, 4.6%	6	7	54%		26.08
GENDER:					p=0.477	
Female	139, 48.9%	91	48	35%		22.98
Male	145, 51.1%	88	57	39%		25.49
ISOLATION METHOD:					p=0.036*	
Rubber Dam	70, 24.6%	41	29	41%		25.15
Cotton Roll	164, 57.8%	113	51	31%		24.7
DryShield	50, 17.6%	25	25	50%		20.48
FRANKL SCORE:					p=0.211	
F1	3, 1.1%	3	0	0%		27
F2	31, 10.9%	20	11	35%		25.2
F3	86, 30.3%	60	26	30%		25.2
F4	164, 57.7%	96	68	41%		23.3
ADVANCED BEHAVIOR TECHNIQUE:					p=0.637	
No Adjunct	171, 60.2%	105	66	39%		23.3
Nitrous	95, 33.5%	61	34	36%		24.8
Moderate Conscious Sedation	18, 6.4%	13	5	28%		28.77
CARIES RISK:					p=0.222	
Low	2, 0.7%	0	2	100%		NA
Moderate	21, 7.4%	14	7	33%		26.36
High	261, 91.9%	165	96	37%		24.03

Table 2. Caries Experience

Variable	Distribution (Number, %)	Caries	No Caries	% Caries	p value	Avg Time to Caries (mo)
TOOTH:					p=0.663	
#3	19	52	27%			26.37
#14	14	58	19%			22.64
#19	14	58	19%			25.29
#30	14	55	20%			25.21
AGE (in years):					p=0.665	
5	3	8	27%			28
6	16	46	24%			24.68
7	24	88	26%			26.79
8	10	49	17%			23.8
9	6	33	15%			23.33
10	2	11	15%			12.5
GENDER:					p=0.005*	
Female	40	99	29%			24.45
Male	21	124	14%			26.05
ISOLATION METHOD:					p=0.790	
Rubber Dam	13	57	19%			26.31
Cotton Roll	37	127	23%			25.35
DryShield	11	39	22%			22.27
FRANKL SCORE:					p=0.117	
F1	1	2	33%			23
F2	7	24	23%			27
F3	25	61	29%			29.72
F4	28	136	17%			20.36
ADVANCED BEHAVIOR TECHNIQUE:					p=0.267	
No Adjunct	32	139	19%			24.31
Nitrous	26	69	27%			25.35
Moderate Conscious Sedation	3	15	17%			29.35
CARIES RISK:					p=0.014*	
Low	0	2	0%			NA
Moderate	0	21	0%			NA
High	61	200	23%			12.5

Table 2. Caries Experience

CONCLUSIONS

- In this study, isolation method significantly influenced sealant retention, with DryShield demonstrating higher success rates compared to both Rubber Dam and Cotton Roll isolation techniques.*
- Gender and caries risk were found to significantly impact caries experience.*
- Clinicians should prioritize optimal isolation when placing resin-based sealants, as well as carefully tailor prevention strategies, weighing the individual risk profile of each patient.*
- Limitations of this study include the retrospective design, reliance on accurate clinical documentation, the relatively small sample size for certain age groups (5, 9, and 10 years old), as well as for patients with moderate and low caries risk, patients receiving moderate conscious sedation, as well as limited numbers of patients with Frankl 1 and 2 behavior ratings.*
- Further research should focus on investigating the influence of isolation methods on sealant retention across various sealant materials.*

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