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Success and Survival of Disced Primary Anterior Teeth

by  
Joanna Meekay

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of the  
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

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## **DEDICATIONS**

I dedicate this paper to Dr. Thomas Tanbonliong and Dr. JungSoo Kim who spent countless hours guiding me and aiding me in this study. Without their support, selflessness and compassion I would not have been able to finish this study as you see it today. I would also like to thank Dr. David Perry, Dr. MyLinh Ngo, Dr. Sharine Thenard and the offices of Alameda Pediatric Dentistry for being so warm and welcoming and allowing me to utilize their patient data.

## **ABSTRACT**

Joanna Meekay: Success and Survival of Disced Primary Anterior Teeth

The purpose of this study was to evaluate the success and survival of anterior primary teeth that have had interproximal discing completed. Two hundred and seventy- five teeth that had discing completed on either the mesial and/or distal surfaces were included in this study (n=275). Data included patient's gender, health status, age at time of treatment, date of initial treatment, depth of caries (into enamel or into dentin), clinical findings post treatment, and all post-operative visits. Descriptive statistics (frequency, mean, standard deviation), independent sample t test, chi-square test, logistic regression and Kaplan-Meier survival analysis were used to analyze the data. The majority of teeth that had discing completed were central incisors (#E,F) and the overall success rate for teeth that had interproximal discing completed was 92%. Difference in survival time of teeth with caries into dentin vs. enamel was not statistically significant. Age at time of completion, depth of caries (into dentin or into enamel) and amount of follow up time were statistically significant factors. These findings indicate that interproximal discing is a viable treatment option of primary maxillary anterior teeth that have caries on the mesial or distal surfaces and future clinical trials are encouraged.

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## Introduction

Caries is the most common chronic disease in childhood affecting roughly 4 million, or 28% of children, from ages two to five years old nationwide (1). The caries rate in children increases with age, by kindergarten 40% of children have caries (2). Caries left untreated may cause pain, discomfort, and infection (3). Additionally, caries in the anterior play a particularly important role aesthetically and can impact the self-esteem of individuals (4,5).

Pediatric dentists face many challenges when treating the dental caries of young patients such as: providing patient comfort and safety, convincing parents to accept optimal treatment plans, and the relative lengthiness of restorative treatments. Restorative treatment is even more difficult on the anterior teeth, where aesthetics is of greater concern (5). Anterior teeth present their own restorative challenges due to their shape, eruption and exfoliation patterns. Primary maxillary incisors have small clinical crowns, thin enamel, and large pulp chambers, which are in close proximity to interproximal surfaces (6). Primary incisors are the first teeth to erupt into the oral cavity—Primary maxillary central incisors, E and #F typically erupt between 6-10 months old, followed by the maxillary lateral incisors, #D and #G, which erupt around 8-12 months old (7). Primary incisors are also some of the first teeth to exfoliate; approximately 7-8 years old (#E , F) and approximately 8-9 years old(#D , G) (7).

In current practices there are both extra coronal and intra coronal restorations that are widely used to treat caries in the anterior teeth: resin composite strip crowns, zirconia crowns, pre-veneered stainless steel crowns, and class III composites (6,8). While extra coronal restorative treatments provide optimal aesthetics, they are expensive, time-intensive, and technique-sensitive. Intra coronal class III composites, are more affordable treatments that also prioritize the unique shape of primary incisors; however, they are not commonly utilized due to

high failure rates caused by the unique shape of primary incisors (6). With the number of restorative options available, there is still very little long term, controlled clinical data which validates or endorses any of the restorative options for repairing carious anterior primary teeth (6). Because of this—and that anterior incisors are the first to exfoliate--many clinicians feel that the time-intensive and technique-sensitive traditional restorative treatments are superfluous; additionally, these restorations require the clinician to achieve patient cooperation, comfort and safety, all of which are more challenging in pediatric patients.

As an alternative to traditional restorations, many practitioners treat caries using Silver Diamine Fluoride (SDF), a remineralizing and antimicrobial agent that arrests carious lesions. SDF has been historically used in Japan for over 40 years and has been gaining popularity in the United States (9). Treatment using SDF has shown caries lesion arrest rates upwards of 70%; however, it causes black staining to the cavitated lesion (9). While staining may not be an aesthetic concern in posterior teeth, it is generally more concerning in the anterior region. A study conducted at New York University found that parental acceptance of staining caused by SDF was 70% in the posterior teeth, but only 30% in anterior teeth(10).

In treating anterior caries, some dentists perform interproximal discing—also referred to as interproximal reduction or slenderizing—in order to avoid the challenges associated with traditional restorations and the staining accompanied with the use of SDF. Interproximal discing is the use of a bur to reduce the interproximal surfaces of the tooth; this can be completed into dentin or into enamel. In interproximal discing diseased tooth structure is removed and contacts are opened for better cleanability. The type of bur that is used is at the discretion of the clinician. This procedure is not invasive and does not require local anesthesia, both of which make the procedure easily accessible in most dental offices. Interproximal discing is frequently used in

orthodontics as a way to alleviate crowding (11,12); it is also used in conjunction with many clear aligner systems (13). The majority of studies regarding interproximal discing refer to orthodontic applications, not caries treatment.

In contemporary dental literature interproximal discing is referenced, but only briefly and with an evident scarcity of clinical trials. A paper published by McConville and Tonn from 1967 mentions that “-a review of the literature includes a variety of suggestions for treatment, ranging from relatively simple disking of the lesions to restoring with silver amalgam-(14).” In 2004, a paper published by the European Journal of Pediatric Dentistry mentioned discing in regard to caries treatment: “It is recommended that interproximal caries in these teeth [mandibular anterior incisors] should be treated conservatively by disking the interproximal surfaces to open the contact between the teeth and hence allow for easy flow of the saliva and cleansing of these teeth (15).” However, neither of these papers cited clinical trials. A survey from Sweden looked at the use of interproximal discing in primary molars, however they did not assess its use on primary incisors (16).

In 2013, a multi-office pediatric dental practice in Northern California began treating mesial and distal caries on teeth (#D, E, F, G) using interproximal discing as an alternative to performing traditional restorations or using SDF. This specific practice does not administer local anesthetic prior to discing and utilizes a FG669 taper flat end crosscut carbide fissure bur (Midwest®, Dentsply Sirona, Charlotte, NC, USA). This retrospective descriptive study reviewed patient charts from the aforementioned practice to bolster the current dental literature with clinical data regarding the use of interproximal discing as a treatment for caries in primary teeth. This study has two specific aims: 1. Evaluate the success rate of interproximal discing in

the treatment of caries on anterior primary maxillary teeth. 2. Examine the survival curves of teeth that had discing completed interproximally into dentin versus enamel.

## **Materials and Methods**

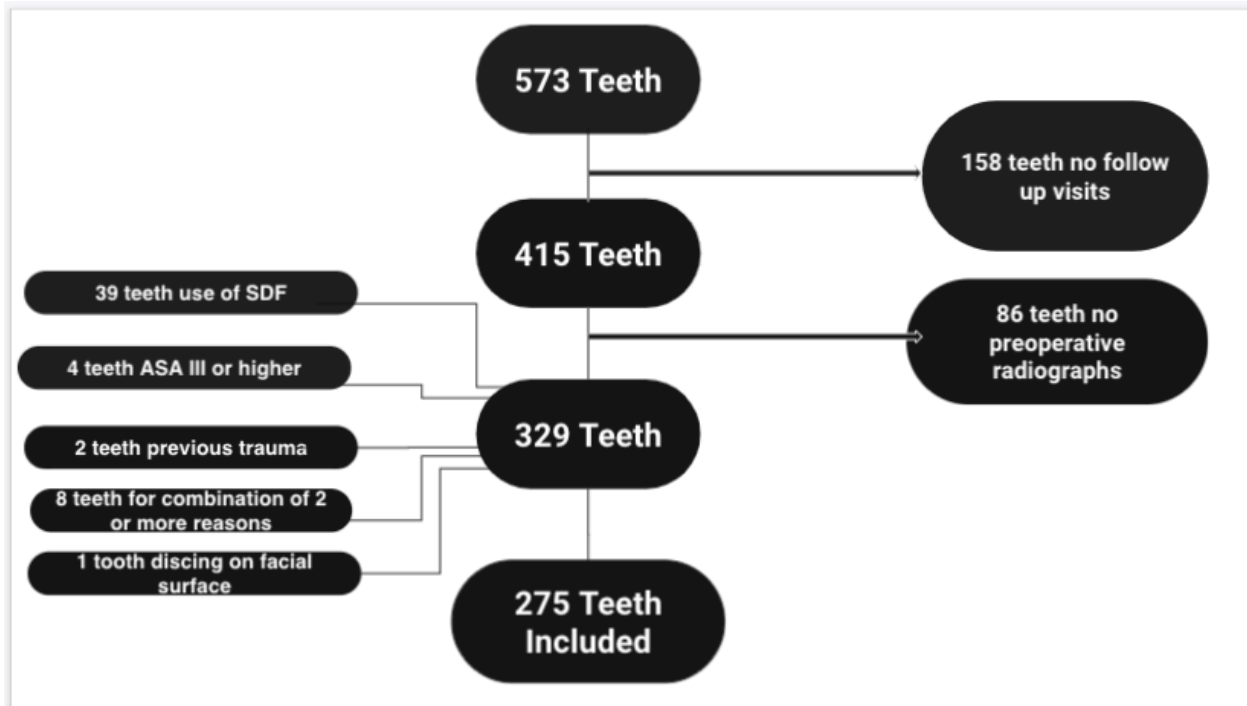
This is a retrospective descriptive study that was approved by the Institutional Review Board of the University of California, San Francisco (UCSF-20-30140) in San Francisco, CA. For this study, a chart review was conducted utilizing patient charts from a multi-office pediatric dental group practice, in Alameda County in Northern California. Charts were selected with specific criteria pertaining to our study: having had at least one surface (mesial or distal) of interproximal discing completed on teeth #D, E, F or G, from January 2013 to January 2018. Each qualifying patient required a discing code (DISCM or DISCD) that is noted in the patient's therapy records.

Patient charts were then reviewed by two calibrated study investigators. The charts were stored in EagleSoft (Patterson Dental, Saint Paul, MN, USA) with completed dental codes, therapy records, odontograms and radiographs which were reviewed at each follow-up visit (periodic oral exams, emergency visits, treatment visits, orthodontic visits). Inclusion criteria was: healthy or well/controlled mild systemic disease patients (ASA I or II), patients who received at least 1 surface of discing (mesial or distal) on teeth (#D, E, F, or G), patients with a preoperative radiograph and patients with at least one follow-up dental examination at the pediatric offices where data was collected. Patient's charts were excluded if they were medically complex (ASA III or greater), involved placement of SDF before or at the time of discing, previous trauma to the tooth being disced, did not contain preoperative radiographs or missing information regarding a follow-up visit after the discing was completed.

The patient's age, gender, and the date of treatment were collected. Preoperative radiographs were evaluated, and depth of caries was recorded into one of two categories: "into dentin" or "into enamel." For this study, successful treatment was considered when no further intervention, except for rediscing is done Failed treatment was recorded if the tooth required further intervention, such as the placement of SDF, intra coronal or extra coronal restorations, abscess formation, or patient discomfort and sensitivity at the discing sites. Data was collected and entered into a secure survey on Qualtrics Software [Qualtrics, Provo, UT]. IBM SPSS 27 [IBM Corp. Armonk, NY: IBM Corp] was used for statistical analyses. Descriptive statistics (frequency, mean, standard deviation), independent sample t test, chi-square test, logistic regression and Kaplan-Meier survival analysis were used to analyze the data.

## **Results**

The initial sample size consisted of 573 teeth that had been disced on at least one surface. The initial 573 teeth were from 258 different patients. Of the initial 573 teeth evaluated, 298 were excluded for the following reasons: absence of follow-up visits (n=158), no preoperative radiograph (n=86), SDF placed before or during discing (n=39), complex medical history (n=4), previous root fracture (n=2), discing on a surface other than mesial/distal (n=1), and a combination of two or more of the factors above (8) [Figure 1]. Data was collected on the remaining 275 teeth (n= 275), from 125 different patients.



**Figure 1:** Flow chart illustrating the selection process of the teeth.

The average age at the time of treatment was 4.4 years old. 44% of the teeth included were from female patients and 56% were male. 77% (n= 213) of the teeth included were central incisors and the remaining 23% (n= 62) of teeth were lateral incisors. Overall, 60% (n= 166) of the teeth had discing into dentin and 40% (n=109) had discing into enamel. The number of surfaces disced was statistically significant (P-value= .001), 93%(255) of teeth had caries disced on 1 surface only and 7%(20) had caries disced on 2 surfaces. The surfaces disced was also statistically significant (P-value= .001), 83% (n= 227) of teeth had the mesial surface disced, 10% (n= 28) had the distal surface disced, and 7% (n= 20) had both the mesial and distal surfaces disced Overall, 92% (n= 253) of the teeth included in the study had successful outcomes after interproximal discing. The teeth that were disced “into dentin” had a success rate of 89% (n=147) and for the “into enamel” group success rate was 97% (n=106), which is statistically

significant ( P-value = 0.009). Only 6% (n=16) of the teeth included in the study required rediscing. The results of the descriptive statistics and univariate analysis is found in Table 1.

**Table 1.** Descriptive summary and comparisons between caries into dentin and enamel  
\*SD = Standard Deviation

	<b>Total N=275</b>	<b>Caries into Dentin N=166</b>	<b>Caries into Enamel N=109</b>	<b>P-value</b>
Mean Age (years ± SD*)	4.44 ± 0.99	4.35 ± 1.02	4.56 ± 0.93	.083
Gender:				.450
- Female	121 (44%)	70 (42%)	51 (47%)	
- Male	154 (56%)	96 (58%)	58 (53%)	
Tooth Number:				.271
- D	32 (12%)	22 (13%)	10 (9%)	
- E	102 (37%)	58 (35%)	44 (40%)	
- F	111 (40%)	64 (39%)	47 (43%)	
- G	30 (11%)	22 (13%)	8 (7%)	
Tooth Type:				.052
- Central Incisor	213 (77%)	122 (73%)	91 (83%)	
- Lateral Incisor	62 (23%)	44 (27%)	18 (17%)	
Surface(s):				.001
- Mesial	227 (83%)	127 (77%)	100 (92%)	
- Distal	28 (10%)	20 (12%)	8 (7%)	
- Mesial & Distal	20 (7%)	19 (11%)	1 (1%)	
Surfaces:				.001
- 1 Surface (M or D)	255 (93%)	147 (89%)	108 (99%)	
- 2 Surfaces (M and D)	20 (7%)	19 (11%)	1 (1%)	
Need for Rediscing:				.729
- Redisced	16 (6%)	9 (5%)	7 (6%)	
- Not Redisced	259 (94%)	157 (95%)	102 (94%)	
Provider:				.979
- P	90 (33%)	55 (33%)	35 (32%)	
- N	35 (13%)	22 (13%)	13 (12%)	
- T	77 (28%)	46 (28%)	31 (28%)	
- Other	73 (26%)	43 (26%)	30 (28%)	
Outcome:				.009
- Success	253 (92%)	147 (89%)	106 (97%)	
- Failure	22 (8%)	19 (11%)	3 (3%)	
Mean Follow-up Time (years ± SD*)	2.41 ± 1.26	2.41 ± 1.31	2.42 ± 1.18	.971

Table 2 describes the factors that increased the likelihood of successful treatment (n= 253 teeth). The most significant factors were age at time of discing, length of follow-up, and whether

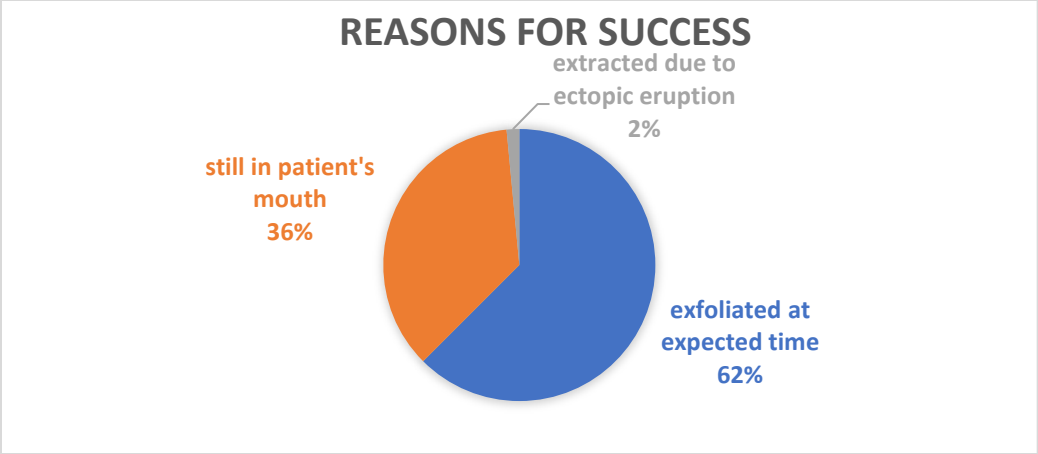
caries was into dentin or enamel. Older age at the time of treatment had significantly higher odds of success than younger patients (OR= 5.28, 95% CI=2.40-11.59, p <0.001). Increase in the follow-up time after discing increased the odds of the treatment success (OR=4.53, 95% CI = 2.47-8.31, p< 0.001). Caries “into dentin” had significantly lower chance of success compared to caries “into enamel” (OR=0.20, 95% CI=0.05-0.85, p=0.029).

**Table 2:** Factors that affect the discing success

	Odds Ratio	95% Confidence Interval	P-value
Age (years)	5.28	(2.40, 11.59)	< .001
Central Incisor Lateral Incisors	1 (reference) 0.97	(0.25, 3.77)	.966
Caries into Enamel Caries into Dentin	1 (reference) 0.20	(0.05, 0.85)	.029
Caries into 1 surface (mesial or distal) Caries into 2 surfaces (mesial and distal)	1 (reference) 1.15	(0.19, 6.83)	.881
Follow-up time (years)	4.53	(2.47, 8.31)	< .001

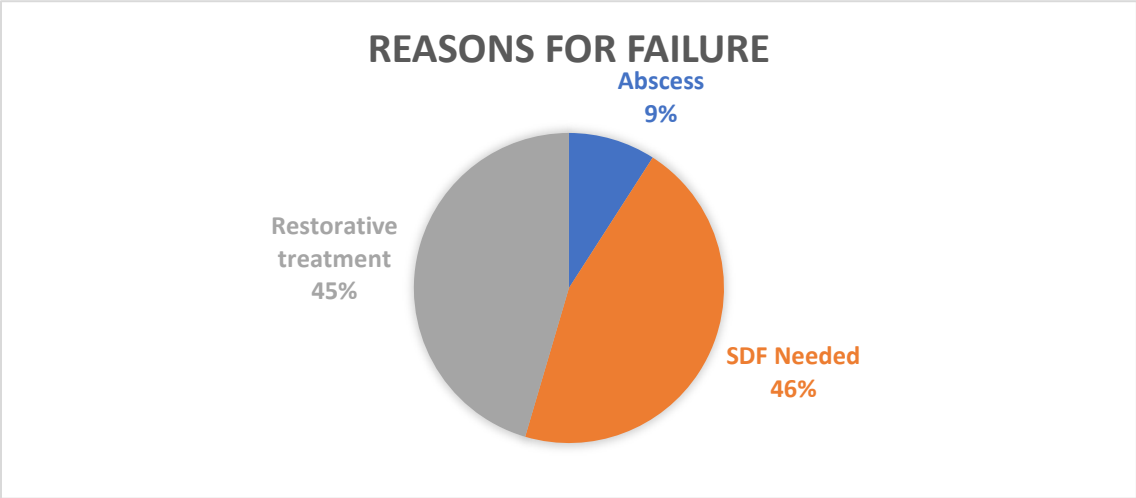
When assessing 92% (n=253) of teeth that were categorized as having a successful outcome, 62.5% (n=158 teeth) lasted until the expected exfoliation, 36% (n=91 teeth) had not exfoliated prior to the final follow-up date having no recurrent decay, and 6% (n=4) were extracted due to ectopic eruption. These results are described below in Figure 1.





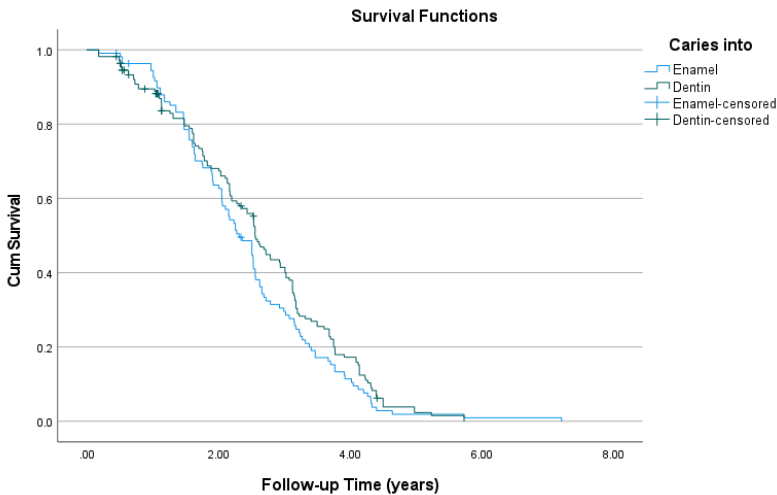
**Figure 2:** Descriptive statistics for successful outcomes

When assessing the 22 teeth that were categorized as having an outcome of failure, all of the teeth exhibited a continuation of the caries process. 9.1% (n=2) developed an abscess, 45.5% (n=10) required SDF placement, and another 45.5% (n=10), required further restorative treatment. These is illustrated in Figure 2.



**Figure 3:** Descriptive statistics for failure outcomes

Kaplan-Meier mean survival curves were created for teeth that were disced into dentin vs disced into enamel, illustrated in Figure 3. Estimated time until failure of disced teeth to enamel was 2.31 and 2.55 years for teeth with caries into dentin ( $P=.154$ ). Difference in survival time of teeth with caries into dentin vs. enamel was not statistically significant.



**Figure 4.** Kaplan-Meier survival curves for teeth disced with caries into enamel vs. dentin

### Discussion

This purpose of this study is to evaluate the success rate of treating caries in anterior primary teeth using interproximal discing and examine the survival curves of interproximal discing “into dentin” versus “into enamel.” The various factors associated with the success and failure of this treatment modality is also explored. This study was unique because it followed up on primary maxillary anterior teeth that had interproximal caries that were treated with interproximal discing. This has not been published in the literature.

The result of this retrospective descriptive study demonstrates that interproximal discing of primary maxillary incisors has a 92% success rate. Major factors correlated with success include patient age at the time of treatment, depth of caries (into dentin or enamel), and the

length of follow-up time. Success increased with age. Patients who are older are also closer to the age of natural exfoliation of the primary maxillary incisors, creating a shorter window of time for a failure to occur. Caries into enamel also showed a higher odds ratio (OR =1 enamel) for success rate when compared to caries into dentin (OR=0.2); looking at each individual category caries into enamel” had a 97% success rate, while caries into dentin had an 89% success rate. We hypothesize that caries into enamel was more successful since the caries process was not as severe at the time of discing, and therefore easier to control. The overall 92% success rate after interproximal discing may be attributed to increased cleanability at these sites allowing for more direct contact of saliva at the previously diseased areas. Saliva’s beneficial properties are well documented, the leaching of calcium, phosphate and fluoride ions from the saliva and onto the tooth’s pellicle contribute to the remineralization process (17).

The results of the study also showed that increased follow-up time also increased the likelihood of a successful outcome. Controlling caries requires adequate follow-up, monitoring, increasing patient oral hygiene (18); this is consistent with the study’s finding that patients who had greater follow-up time had a higher likelihood of receiving successful treatment. There is existing literature of the reported benefits of increased frequency and number of dental visits with fewer instances of active decay (19). We can also infer patients who had longer follow up had an increase in oral hygiene and were more closely monitored and educated for all other etiological factors of caries as this is standard practice at the offices included in this study.

Interproximal discing is widely used in other countries, such as Sweden. In a survey of 108 public dental service clinics in Sweden, 96% of the clinics performed discing, also referred to as “grinding.” Two-thirds of dentists used discing on primary molars as an alternative to conventional therapy, and the use of anesthesia for discing was significantly lower than that of

conventional therapy. While the Swedish study does not specifically assess the use of discing in primary maxillary anterior teeth, it does show that the use of discing, is currently used as an alternative treatment option for caries internationally (16).

Although there are no randomized clinical trials or retrospective studies in the literature looking at the success rate of treating caries in primary maxillary anterior teeth using interproximal discing, similar outcomes were observed when comparing the success rate found in our study to other treatment modalities. For extra coronal restorations such as zirconia crowns, Seminario et al. found that in the anterior these crowns had a 93% probability of survival at the 12-month mark, which decreased to 76% by the 36-month mark (20). In our study, the average follow-up time was 28 months, and we found success of treatment with interproximal discing to be 92%. When comparing discing to anterior resin strip crowns, Ram et al. found that after 24 months resin strip crowns had an 80% success rate, which is lower than the 92% success rate found in our study for interproximal discing over a similar period of time, 28 months (21).

While this study shows a promising outlook on the use of interproximal discing as a modality for treating anterior caries, it had limitations. Since this was a retrospective descriptive study, many clinical factors could not be standardized or controlled such as home oral hygiene regimens, provider, actual depth of discing, follow up intervals and amount of fluoride used. The outcomes were also based on the details of the records, radiographs and any other pertinent information in the patient's electronic dental records. These notes varied from provider to provider and it is possible certain clinical findings could have been omitted. For some of the patient's, post-operative radiographs were not taken at consistent intervals, thus it is difficult to interpret any radiographic changes associated with the discing that may have taken place. Many

patients were also excluded from the study due to a lack of follow-up, limiting our study's sample size. A larger sample size may yield a different outcome.

One hundred fifty-eight teeth were excluded from this study for lack of follow up. The multi-office pediatric dental practice in this study sees many patients for restorative treatment only and then these patients return to the original referring office, thus these patients have no follow up visits. If these teeth could have been included in the study, the N value would have increased to 431, possibly affecting our results.

Despite these limitations, the results of this study showed a 92% success rate for interproximal discing in the treatment of caries. Based on the results discing is a treatment option for interproximal caries on primary anterior teeth that should be strongly be considered. In this study, prescription toothpaste use and yearly in-office fluoride applications were not recorded, these may have also contributed to the success of interproximal discing. Future clinical trials on this technique are encouraged.

## **Conclusions**

- 1. Discing, as a treatment modality for anterior teeth with interproximal caries has a 92% success rate in our study.**
- 2. The mean survival rates of failure for teeth with caries into enamel or dentin are not statistically significant.**
- 3. Increase in patient age at time of discing, caries into enamel, and longer follow-up time were statistically significant factors associated with a successful outcome.**

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