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The Effects of Silver Diamine Fluoride Treatment on Carious Primary Teeth Prior to General Anesthesia

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The Effects of Silver Diamine Fluoride Treatment on Carious Primary Teeth Prior to General Anesthesia

by

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ABSTRACT

The Effects of Silver Diamine Fluoride Treatment on Carious Primary Teeth Prior to General Anesthesia

By

Pardis Lipkin

This study aims to evaluate the impact of silver diamine fluoride (SDF) application(s) prior to dental treatment under general anesthesia (GA) on treatment types rendered to children under six years old with GA through a retrospective case control study.

Baseline demographics/disease/planned treatment data and dental treatment for qualified patients were collected from electronic dental records. Patients were in divided into a SDF intervention group (N=335, 21.49%,) or non-SDF control group (N=1224, 78.51%) based on their receipt of SDF prior to GA. Statistical analysis was completed for baseline and outcome data using STATA. Student T tests or Mann-Whitney U Test were used appropriately to compare impact of pre-GA SDF application on treatment outcomes between the two groups without adjusting the baseline variable imbalance. Poisson, negative binomial, and linear regression were used in multivariate models to address the baseline variable imbalance on impact of pre-GA SDF application and analyze the effects of baseline and demographic variables on the GA treatment outcomes.

There were significant differences in age, gender, pre-GA dental pain experience, pulp involvement, and planned treatment at baseline between the two groups. In a non-adjusted analysis, the SDF intervention group had significantly more crowns, but significantly fewer unplanned and total pulp therapy and dental extractions under GA (Mann-Whitney U test, $P<0.05$). A multi-variate model confirmed the negative association of pre-GA SDF application with total and unplanned pulp therapy and dental extractions under GA ($p<0.05$), but no association with crowns placed. The model also indicated a positive relationship between invasive dental treatment with patient age, planned treatment needs and GA wait-time. Our study supports SDF application prior to dental treatment under GA as a valuable tool to reduce invasive dental procedures under GA.

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Introduction

Over the last 25 years, caries experience for children in the United States has significantly increased and disproportionately affected low-income communities. The Centers for Disease Control and Prevention (CDC) reported for 2015-2016 an overall caries prevalence of 45.8% and untreated caries prevalence of 13% for youth-aged 2-19 years in the U.S.[1] Furthermore, caries prevalence and household income were inversely associated, with lower-income households facing both the greatest levels of total and untreated dental caries. Barriers to obtaining dental care can include available access to care in the community, transportation, inadequate finances, and low health literacy.[2]

Often children with severe dental needs, medical complexities and/or young children require advanced behavior guidance techniques to complete dental treatments.[3] Methods of treating dental caries with pharmacological managements for pediatric patients, can include anxiolysis with nitrous oxide, mild, moderate or deep sedation, and general anesthesia (GA). Dental treatment with GA is a treatment option for children who cannot cope with complex dental treatment or have special health care needs (SHCN) that require GA to provide dental care in a safe and humane manner.[4] However, solely restoring carious teeth does not prevent recurrence of dental disease. Based on a compilation of studies, Horst reported 38% of patients treated with GA developed at least 1 new caries lesion after 6 months, 45% of patients developed caries after 1 year, and 62% of patients after 2 years.[5] Similarly, in a study by Almeida et al, comparing 42 children with early childhood caries (ECC) treated with GA and 31 caries-free children (control), 79% of children with ECC were found to have detectable caries at their dental recall interval when compared to 29% of the controls.[6] These findings suggest that for children treated with

GA for dental caries the incidence of relapse after treatment is a frequent occurrence, with an increased likelihood of relapse in the long-term (1+ years).[7] Despite rampant dental decay and urgent need for treatment, wait-times for treatment under GA can be long. In a pool of 709 patients at Seattle Children's Hospital, Forsyth et al determined the average wait-time for dental care under GA to be 28 days for children in pain and 71 days for those without pain[6].[8] At the University of California, San Francisco (UCSF) the estimated waiting time prior to general anesthesia is about 2-3 months. Due to lengthy wait-times from consultation to treatment, children awaiting GA are at an increased risk for painful dental episodes, pulpitis, dental abscess, and a need for dental extractions on or before the scheduled treatment date due to continued progression of dental caries.[9]

Silver Diamine Fluoride (SDF) is a topical medicament composed of silver, ammonium, and fluoride ions, that has proven to be a safe and effective treatment for patients with dental caries who are at high-risk of developing caries and in high need of dental care.[10] SDF is applied to teeth with a small brush and the treatment is completed in the dental office. The application is not highly technique sensitive and can be applied for children who have special healthcare needs or challenging behavior, without the need for local anesthesia or advanced behavior guidance techniques such as sedation or GA.[11] SDF has been shown to arrest carious lesions in primary teeth by approximately 80%.[12] Currently approved by the Food and Drug Administration (FDA) as a dental desensitizing agent, the American Dental Association (ADA) supports the off-label use of SDF to arrest caries.[13] Although SDF was only approved for treatment of hypersensitivity by the United States FDA in 2014, it has been used for decades in Japan and other countries to prevent and treat dental caries.[14] While varying concentrations of SDF exist, a systematic review of 1,123 publications by Gao et al found that 38% SDF solution to be most effective for caries treatment in primary teeth, arresting 81% of SDF treated sites, when compared to 10%, 12% and 30% SDF, and placebo. [15] The 38% SDF solution is the only concentration approved by the FDA for desensitization at this time in the U.S. When compared to annual applications, biannual applications of SDF increase rate of caries arrest by 1.69 times. The use of SDF to arrest caries progression, with an aim of limiting pain and infection, can be particularly applicable for children who need dental treatment with GA but cannot receive it quickly due to increased wait-times for treatment with GA.[16]

SDF is becoming increasingly acceptable among pediatric dentists and the parent/guardians of patients as a treatment to treat carious lesions.[17] SDF has the potential to allow for an alternative treatment approach for those who cannot tolerate traditional dental treatment, face barriers to affordability, and lack regular access to care. SDF can also be used to arrest or slow down caries progression in children who are awaiting dental treatment with GA; this may reduce the need for overall or aggressive dental treatments such as pulp therapy and extractions. Currently, there are no known published studies on the short-term effect of SDF application on dental treatment needs for children awaiting GA.

The purpose of this study is to evaluate the effects of SDF application to carious primary teeth in children prior to comprehensive dental treatment under GA. The specific aim of this study is to understand the impact of SDF applications on treatment types rendered under GA.

Methods

This study was reviewed and approved by the University of California, San Francisco (UCSF) Institutional Review Board, San Francisco, CA for use in the UCSF Pediatric Dentistry Clinic (IRB #19-28346)

Study Design

In this case control study, a retrospective chart review of the UCSF Pediatric Dentistry patients was completed using the axiUm electronic health record for children who had treatment rendered under GA between January 2015 and June 2019.

Study Population

Patients aged 6 years and under, from the UCSF Pediatric Dentistry Clinic who were referred for treatment under GA at Benioff Children's Hospital San Francisco who met the following study criteria were included in the study: (1) Children age ≤ 6 years at the time of GA; (2) Healthy or mild systemic disease (ASA I/II); (3) Referred to GA from January 2015 - January 2019; (4) Treated under GA from January 2015 - June 2019. Exclusion criteria included: (1) Severe systemic disease (ASA III/IV) and (2) Known sensitivity to metal. All qualified subjects were divided into two groups in this case control study, based on whether they received SDF prior to their GA appointment or not: (1) SDF intervention group: Children who received SDF application prior to treatment under GA; and (2) Control group: Children who did not receive SDF application prior to treatment under GA.

Data Collection

A list of patients who received dental treatment under GA between January 2015 and June 2019 was generated. Four calibrated investigators reviewed the patients' charts based on the inclusion and exclusion criteria and extracted data for the study. Calibration of the investigators were performed on 20 patient charts after training and 5% of charts were randomly reviewed for data accuracy and cross- and self-calibration.

Patient's demographic data collected included date of birth, gender, and if the child had any special health care needs.

Baseline pre-GA treatment data collected included GA referral date, SDF application status and date of SDF application, reported dental pain, interim therapeutic restorations placement status, pulpal involvement/dental infection presence from dental caries (including obvious fistula or abscess, or periapical radiolucency) and their DMFT/dmft at time of referral to GA.

The planned treatment at GA referral included the aggregate number of crowns, intra-coronal restorations (amalgams and composites), pulp therapy (pulpotomy and pulpectomy) and extractions planned. Data were aggregated for anterior primary teeth, posterior primary teeth, and in total for each patient.

Data collected on GA treatment included the date that treatment was completed, total number of primary teeth extracted or restored due to dental caries, and completed treatment including the aggregate number of crowns, intra-coronal restorations, pulp therapy, and extractions. Planned treatment at GA referral, data were aggregated for anterior primary teeth, posterior primary teeth, and in total for each patient.

A set of data variables of "unplanned treatment" were generated. Unplanned treatment was defined as the sum of treatment type completed in GA, less the sum of treatment type planned at the time of GA consult. These data variables indicate how treatment completed in GA differ or changed from the treatment planned at the time the patient was referred for dental treatment with GA. This is a rough measure of caries progression in aggregate.

Data Analysis

Patient population data analysis was completed including descriptive statistics using STATA.[18] Normality tests were completed for baseline and GA outcome continuous variables and mean, standard error, or median and quartiles were calculated based on the normality tests. Student T tests or Mann-Whitney U Test were used to compare baseline continuous variables based on normality tests results between the two groups.[19] Chi-squared analysis were used to compare dichotomous baseline variables (gender, SHCN, reported dental pain, pulpal involvement, and interim therapeutic restorations).

For outcome data comparison, Student T tests or Mann-Whitney U Test were used appropriately to compare continuous variables based on normality tests results between the two groups without adjusting the baseline variable differences. To address the impact of unbalanced baseline variables, Poisson, negative binomial, and linear regression were used in multivariate models to analyze the effects of baseline and demographic variables on the outcomes of completed and unplanned treatment by treatment type. Poisson regression was applied to the model of the outcome variable with a near normal distribution (number of crowns completed). Negative binomial regression was applied to outcome variables with a high representation of zeros (number of intra-coronal, pulp therapy, and extraction completed). Linear regression was used to analyze unplanned treatment outcomes.

Results

Patient Demographics and Baseline Data

A total of 1,559 children met the inclusion criteria and were included in this study. 21.49% of children received SDF (N=335, intervention group) and 78.51% did not receive SDF (N=1224, control group). Baseline data including patient demographics and planned treatment are shown in Table 1. None of the baseline variables passed the Shapiro Wilk Test for normalcy. The SDF intervention group was significantly more likely to be female and younger at the time of GA treatment, have special healthcare needs, obvious pulpal involvement, and receive interim therapeutic restorations ($P<0.05$) than the control group. There were no statistically significant differences in number of children experiencing dental pain, time between consult and GA treatment, and DMFT/dmft prior to GA treatment between the SDF and the control group ($P>0.05$).

Additionally, as seen in Table 1, those in the SDF intervention group had significantly more planned crowns and pulp treatment but fewer planned intra-coronal restorations than the control group. Specifically, the SDF treatment group had more planned posterior crowns and anterior pulp therapy treatments at time of their GA consult. Number of anterior teeth planned for extraction was compared between children greater than and less than or equal to 60 months of age, to account for treatment differences in teeth nearing expected exfoliation between the two groups. There was no significant difference found in mean number of anterior teeth planned for extraction between these two age groups (P=0.29).

Outcome Data

Outcome of mean number of dental treatments completed in general anesthesia for the study population by SDF intervention group and control group are shown in Table 2. The SDF intervention group had significantly more crowns (control mean= 8.10 ± 0.10, SDF mean= 9.0 ± 0.00, p=0.00) completed but significantly less pulp therapy (control mean= 1.30± 0.00, SDF mean= 0.90±0.10, p=0.01) and extractions completed (control mean= 2.00± 0.10, SDF mean= 1.30±0.10, p<0.01) than the control group. Specifically, the SDF intervention group had significantly more anterior crowns (control mean= 2.50± 0.10, SDF mean= 3.10±0.20, p<0.01) and posterior crowns (control mean= 5.40± 0.10, SDF mean= 5.80±0.10, p=0.02) completed, but fewer anterior pulp therapies (control mean= 0.20± 0.00, SDF mean= 0.20±0.00, p=0.68), anterior extractions (control mean= 1.00± 0.00, SDF mean= 0.70±0.10, p<0.01) and posterior extractions (control mean= 0.70± 0.00, SDF mean= 0.50±0.00, p<0.01). Box plots comparing completed crowns, pulp therapy, intra-coronal restorations, and extractions comparing the SDF and control group are shown in Figure 1.

For unplanned treatment (treatment completed at GA but was not planned at referral or planned differently) by treatment type, the SDF intervention group had significantly more intra-coronal, unplanned fillings completed (control mean= 0.25± 0.08, SDF mean= 0.67±0.11, p= 0.02) while the control group had significantly more unplanned extractions (control mean= 1.10± 0.07, SDF mean= 0.00±0.65, p <0.01) and pulp therapy (control mean= 0.85± 0.06, SDF mean= 0.34±0.10, p<0.01). Box plots comparing completed crowns, pulp therapy, intra-coronal restorations, and extractions comparing the SDF and control group are shown in Figure 2.

To address the impact of unbalanced baseline demographic, disease and treatment plan bias of the two groups, regression models were used to analyze the use of SDF on completed crowns, intra-coronal restorations, pulp therapy, and extractions. Results are shown in Table 3.

Pre-application of SDF did not show significant impact in the Poisson regression model for completed crowns at GA (p=0.22). In the model, number of completed crowns was positively associated with the patient's DMFT/dmft before GA (p<0.01) and number of planned crowns (p<0.01). The number of crowns completed was negatively associated with the patient's age in months (p<0.01) and the number of extractions planned (p=0.01).

For the negative binomial regression model of completed intra-coronal restorations SDF did not have a statistically significant impact (p=0.10). The number of intra-coronal restorations completed was positively associated with more intra-coronal restorations planned (p<0.01). The patients age at GA (p<0.01) and the number of extractions planned (p=0.04) had a negative association with completed intra-coronal restorations.

The negative binomial regression model for completed pulp therapy showed a statistically significant negative association between SDF and completed pulp therapy (p<0.01). The model also showed decreased completed pulp therapy associated with having SHCN (p=0.01), and number of fillings planned (p=0.04). The number of teeth requiring pulp therapy increased in the model with the number of pulp therapies planned ($p<0.01$) and the time between the consult and GA date ($p<0.01$).

The application of SDF had a statistically significant negative association with completed total extractions ($p=0.01$). In addition, the model also showed positive association of extractions completed with SHCN ($p<0.01$), age at time of GA ($p<0.01$), dental pain ($p=0.04$), planned total extractions ($p<0.01$), and time between consult and GA date ($p=0.00$).

As shown in Table 4, a linear regression was modeled for unplanned crowns. This model demonstrated a positive association between unplanned crowns with DMFT/dmft before GA ($p<0.01$) and negative associations with age at GA ($p<0.01$), number of crowns planned ($p<0.01$), and number of extractions planned ($p=0.01$).

In the linear model of unplanned fillings there was a statistical significant negatively association between unplanned fillings and age at GA ($p<0.01$) and number of fillings planned ($p<0.01$).

Unplanned pulp therapy was associated with SDF treatment ($p<0.01$). With the model demonstrating that SDF placement would predict reduced unplanned pulp therapy. Having SHCN ($p=0.03$) and number of planned pulp therapies ($p<0.01$) were also negatively associated with unplanned pulp therapy. The linear regression demonstrated positive correlation of increased number of unplanned pulp therapy with wait-time from consult to GA ($p<0.01$)

Unplanned extractions were negatively associated with SDF placement ($p=0.01$). In the linear regression model SDF treatment was shown to predict reduced unplanned extractions. Unplanned extractions were positively associated with SHCN ($p<0.01$), age at GA treatment ($p<0.01$), dental pain ($p=0.04$), planned pulp therapy ($p=0.01$), and time from consult to GA treatment ($p<0.01$).

Discussion

The aim of this study was to assess the impact of SDF application on dental treatment rendered to children under GA. Our findings indicated that pre-GA application of SDF for children under 6 years old had a negative correlation with invasive dental treatment needs (i.e. pulp therapy and extractions) under GA. While there are no other studies examining the impact of use of SDF before GA for direct comparison of findings, the findings of this study align with previous studies demonstrating that SDF can arrest dental caries and has many applications in pediatric dentistry.[20, 21] SDF has been shown to reduce restorative treatment in children, in a study population not treated with GA.[22] SDF treatment has also been recommended for when treatment of a primary tooth cannot be imminently completed.

The use of pre-GA application of SDF has the potential to reduce both the treatment time and cost under GA related to pulpal therapy and dental extractions. It may also reduce the likelihood of emergency events such as dental pain and dental infection during wait-times to improve oral function. Furthermore, it may help to address recent research findings on increasing barriers of provider's access to operating rooms. Obtaining operating room access is becoming more and more challenging to pediatric dentists. Thus intermediate care, such as SDF, could be applied to slow the progression and/or arrest dental caries, to later reduce need for and cost of invasive dental procedures.[23] The financial aspects of GA also often limit and delay the ability for children to receive dental care in a timely manner, thus our results are not only applicable to pediatric dentists who have reduced or eliminated OR time, but also to patients and families who must delay dental treatment with GA for financial or third party payer barriers.[24] At the UCSF Division of Pediatric Dentistry, where this study was completed, the insurance pre-authorization process can contribute to delays in the completion of comprehensive dental care. Thus, our study results suggest that UCSF providers have the potential to arrest caries and reduce invasive dental treatments in GA by applying SDF while waiting for insurance pre-authorization.

Long wait-time is a major barrier for dental treatment under GA. Our study data showed that the average wait-time from referral to actual GA treatment was over 100 days with an average of 131 day and median of 104 days. There was also a positive correlation between wait-time and completion of invasive procedures (pulpal therapy and extractions). This finding is consistent with other published studies that have shown wait-times for dental treatment with GA range between 28 days for children in pain to 71 days for children without pain, and even up to multiple years in length.[25] One of the major challenges of long wait-times for GA is the continued progression of dental caries that can result in dental emergencies (such as dental pain and infection) and increased need for dental treatment needs when care is ultimately rendered. A study assessing the effects of temporary restorations, antibiotics, or no treatment while awaiting treatment with GA, demonstrated that wait-time length can alter the treatment types patients receive and effect the number of teeth they have extracted.[26] Our study results support the use of SDF as an additional intervention that should be implemented, as it may help slow or arrest caries progression and prevent associated dental pain and infection while children are waiting for treatment under GA.

While SDF has clear benefits to children who are waiting for GA, only about one in five children in this study received SDF prior to their GA appointment. Comparable research on SDF can explain why not all children received SDF. One factor that may have influenced the placement of SDF is the esthetics. One of the barriers to SDF placement is the negative esthetics of SDF turning carious tooth structure black or dark brown. While studies have shown parental acceptance of SDF esthetics, the appearance of the treatment can contribute to why not all children in this study received SDF.[27] Additionally, cost of SDF treatment may hinder patient and parent acceptance of its use. During the study period, and up to January 2022, the California Medi-Cal dental program did not include SDF as a covered benefit.[28] Thus, many of the families in this study would have had out of pocket costs for SDF treatment. The cost of SDF may also explain the limited use of SDF in this study population. There are still many states in the U.S. that do not cover SDF application for children.[29] This study demonstrates that SDF can ultimately reduce the number of invasive dental treatments need and can be used to advocate to increased insurance coverage for SDF nationwide.

Furthermore, as SDF is a relatively new treatment in pediatric dentistry in the U.S., provider comfort with the treatment may have hindered its use as interim care while waiting for GA.[30] Recent studies have shown, that in the last decade use of SDF has increased.[31] As this study supports the use of SDF for children waiting for dental care with GA, this added evidence should further encourage providers to consider SDF use, even when they ultimately plan to treat patients under GA.

This study also aligns with the American Academy of Pediatric Dentistry's support of establishing a dental home by age 1.[32],[33] Our study found that age at which children had dental treatment with GA was positively associated with an increased number of total dental treatment needs, pulpal therapy and dental extractions later completed under GA. Thus, establishing a dental home by age 1, not only allows for early prevention but also enables less invasive treatment, such as SDF, to be completed before disease progression has occurred and more teeth are lost to extraction. This reinforces that SDF can be used as an effective tool for caries control at young age. Even pre-cooperative children who cannot cooperate for restorative dental care are still able to benefit from the application of SDF.[34] This finding aligns with prior studies demonstrating reduced treatment and treatment costs for children who obtain dental care at an earlier age.[35]

One limitation of this study was its retrospective and observational nature. We were unable to randomize assignment of patients to application to SDF and control group, thus there were sample-size, baseline population demographic, disease status, and planned treatment imbalances between the two groups. To address this limitation, we identified known confounding factors and used multi-variate statistical models to control for all the measured differences between the two groups (e.g. age, special healthcare needs, pulpal involvement, etc.). These analyses helped us to recognize that more crowns placed in the SDF intervention group may have been related to an excessive number of crowns planned at baseline. Despite this, the impact of SDF placement remained significant on the treatment outcomes including reducing the number of pulp therapy and extractions predicted. However, it is possible that there is presence of additional unmeasured variables confounding the results that we could not account for in our analyses. Additionally, all data that was collected in the study was gathered by multiple clinicians, which could result in bias and confounding of the study results. Further prospective randomized studies examining the effect of SDF on dental treatment are still needed and will provide valuable scientific basis for pediatric dentistry practice.

This study aimed to assess the effect of SDF from time of consult and examination to treatment rendered under GA. However, another limitation of this study is a lack of identified caries lesion surface involvement and/or tooth level data at baseline and progression over time. Thus, the planned and completed treatment for a single tooth could not be measured over time. The unplanned treatment variables—the sum of treatments completed in a patient less the number of treatments planned was used as a rough measure of caries progression; this represented a change in the treatment plan during the time from consult to treatment. If the number of crowns completed exceeded the number of crowns planned, the unplanned treatment was considered a rough measure of caries progression. A limitation of this measure is that not all children in this study would have cooperated for radiographs, thus many of the treatment plans for patients were based solely on clinical visual examination at baseline referral. This likely hindered accurate pulpal diagnosis at baseline and created confounders for the study results.

This study was completed at a large academic medical center that included care provided by dental students, post graduate dental residents, and pediatric dental faculty. Furthermore, over

90% of children treated in the UCSF Pediatric Dentistry Clinic are insured through the California Medi-Cal dental program. Thus, the results of this study may not be generalizable to other clinical settings and/or non-similar patient populations. Additional, prospective randomized controlled studies are needed to examine the intermediate and long-term outcome of pre-GA SDF application on primary teeth for children treatment under general anesthesia.

Conclusion

Children under six years of age who received SDF treatment prior to GA had more teeth treated with crowns, fewer teeth receive pulp therapy, and fewer teeth extracted in a non-adjusted comparison. Multi-variate models demonstrated that SDF application prior to GA had significant positive correlations to unplanned dental extractions or pulp therapy under GA. Additionally, age, treatment plan at time of referral, and GA wait-time also had a significant correlation to GA treatment needs. General and pediatric dentists should consider application of SDF at referral or prior to GA for patients requiring dental treatment under GA to potentially reduce the later need for invasive dental treatments.

Table 1. Patient demographic and baseline disease and treatment status data

	Control Group				SDF Group				All				P Value (Chi-Squared/Mann U)
Sample Size (N=)	**1224 (79%)**				**335 (21%)**				**1559**				
Female (%)	41%				50%				43%				**<0.0001**
Patients with Special Health Care Needs (Yes %)	29%				22%				28%				**0.01**
Dental Pain Before GA (Yes %)	17%				19%				18%				0.57
Had Teeth with Obvious Pulpal Involvement (Yes %)	36%				41%				36%				**0.03**
Interim Therapeutic Restorations Placed (Yes %)	2%				8%				3%				**<0.0001**
	Mean	**±**	**SE**	**Median**	**Mean**	**±**	**SE**	**Median**	**Mean**	**±**	**SE**	**Median**	
Time to General Anesthesia (days)	131.2	±	3.1	104.0	131.0	±	6.6	104.0	131.1	±	2.8	104.0	0.79
Age at General Anesthesia (months)	55.7	±	0.4	55.0	51.3	±	0.8	50.0	54.8	±	0.4	54.0	**<0.0001**
DMFT/dmft at baseline	10.9	±	0.1	11.0	11.2	±	0.2	12.0	11.0	±	0.1	11.0	0.06
Planned Treatment at Referral (# of Teeth)													
Planned Anterior Crowns	1.20	±	0.10	0.00	1.30	±	0.20	0.00	1.20	±	0.10	0.00	0.34
Planned Posterior Crowns	4.60	±	0.10	5.00	5.10	±	0.20	6.00	4.70	±	0.10	5.00	**0.00**
Planned Total Crowns	7.20	±	0.10	7.00	8.40	±	0.20	8.00	7.40	±	0.10	8.00	**<0.01**
Planned Anterior Fillings	0.70	±	0.00	0.00	0.70	±	0.10	0.00	0.70	±	0.00	0.00	0.64
Planned Posterior Fillings	1.10	±	0.10	0.00	0.60	±	0.10	0.00	1.00	±	0.10	0.00	**<0.01**
Planned Total Fillings	1.80	±	0.10	0.00	1.20	±	0.10	0.00	1.70	±	0.10	0.00	**<0.01**
Planned Anterior Pulp Therapy	0.08	±	0.02	0.00	0.20	±	0.05	0.00	0.10	±	0.02	0.00	**0.01**
Planned Posterior Pulp Therapy	0.36	±	0.03	0.00	0.40	±	0.06	0.00	0.37	±	0.03	0.00	**0.02**
Planned Total Pulp	0.43	±	0.04	0.00	0.60	±	0.08	0.00	0.47	±	0.04	0.00	**<0.01**
Planned Anterior Extraction	0.60	±	0.00	0.00	0.50	±	0.10	0.00	0.60	±	0.00	0.00	0.29
Planned Posterior Extraction	0.30	±	0.00	0.00	0.20	±	0.00	0.00	0.30	±	0.00	0.00	0.07
Planned Total Extraction	1.00	±	0.10	0.00	0.80	±	0.10	0.00	0.90	±	0.60	0.00	0.72

Table 2. Completed Dental treatment under General Anesthesia (Outcome data)

Completed Treatment Under General Anesthesia (#s of Teeth)	Mean	±	SE	Median	Mean	±	SE	Median	Mean	±	SE	Median	P Value (Mann U)
	Control Group				SDF Group				All				
Total teeth extracted or restored due to caries	12.38	±	0.11	12.00	12.90	±	0.20	13.00	12.50	±	0.09	12.00	**0.01**
Completed Anterior Crowns	2.46	±	0.08	2.00	3.09	±	0.15	3.00	2.60	±	0.08	2.00	**<0.01**
Completed Posterior Crowns	5.40	±	0.10	6.00	5.80	±	0.10	6.00	5.50	±	0.10	6.00	**0.02**
Completed Total Crowns	8.09	±	0.13	8.00	8.96	±	0.04	8.80	8.28	±	0.11	8.00	**<0.01**
Completed Anterior Fillings	1.07	±	0.04	0.00	1.13	±	0.09	0.00	1.08	±	0.04	0.00	0.68
Completed Posterior Fillings	0.98	±	0.05	0.00	0.76	±	0.09	0.00	0.94	±	0.05	0.00	0.06
Completed Total Fillings	2.05	±	0.07	1.00	1.89	±	0.13	1.00	2.02	±	0.06	1.00	0.45
Completed Anterior Pulp	0.23	±	0.02	0.00	0.17	±	0.03	0.00	0.21	±	0.02	0.00	0.68
Completed Posterior Pulp Therapy	1.05	±	0.04	1.00	0.77	±	0.06	0.00	0.99	±	0.03	0.00	**<0.01**
Completed Total Pulp Therapy	1.28	±	0.05	1.00	0.94	±	0.07	0.00	1.21	±	0.04	1.00	**0.01**
Completed Anterior Extraction	1.00	±	0.04	0.00	0.68	±	0.07	0.00	0.94	±	0.04	0.00	**<0.01**
Completed Posterior Extraction	0.73	±	0.04	0.00	0.47	±	0.05	0.00	0.67	±	0.03	0.00	**<0.01**
Completed Total Extraction	1.99	±	0.07	1.00	1.30	±	0.11	0.00	1.84	±	0.06	1.00	**<0.01**

Unplanned Treatment

	Mean	±	SE	Median	Mean	±	SE	Median	Mean	±	SE	Median	P Value
	Control Group				SDF Group				All				
Crowns Unplanned	0.51	±	0.12	0.00	0.59	±	2.59	0.00	0.53	±	0.11	0.00	0.78
Fillings Unplanned	0.25	±	0.08	0.00	0.67	±	0.11	0.00	0.34	±	0.07	0.00	**0.02**
Pulp Unplanned	0.85	±	0.06	0.00	0.34	±	0.10	0.00	0.74	±	0.05	0.00	**<0.01**
Extraction Unplanned	1.10	±	0.07	0.00	0.65	±	0.10	0.00	1.00	±	0.06	0.00	**<0.01**

Table 3. Regression Model for outcomes of completed crowns, fillings, pulp therapy, and extractions

Outcome Variable	Crowns Completed			Intra-Coronal Restorations Completed			Pulp Therapy Completed			Extractions Completed		
	Poisson Regression Model			Negative Binomial Regression			Negative Binomial Regression			Negative Binomial Regression		
Parameter	**Coefficient**	**S.E.**	**P Value**	**Coefficient**	**S.E.**	**P Value**	**Coefficient**	**S.E.**	**P Value**	**Coefficient**	**S.E.**	**P Value**
SDF	0.03	0.26	0.22	0.16	0.10	0.10	-0.40	0.11	**<0.01**	-0.25	0.09	**0.01**
Gender	0.03	0.02	0.12	-0.07	0.08	0.37	0.00	0.08	0.97	-0.13	0.07	0.06
SHCN	-0.40	0.02	0.10	0.00	0.89	0.98	-0.23	0.09	**0.01**	0.23	0.08	**<0.01**
Age at GA	0.00	0.00	**<0.01**	-0.01	0.00	**<0.01**	-0.01	0.00	0.09	0.01	0.00	**<0.01**
Pain	-0.05	0.03	0.07	-0.11	0.11	0.30	0.12	0.11	0.28	0.18	0.09	**0.04**
DMFT Pre-GA	0.03	0.01	**<0.01**	-0.03	0.03	0.28	0.05	0.02	0.06	0.04	0.02	**0.05**
Protective Restorations	-0.01	0.06	0.91	0.15	0.22	0.50	0.54	0.24	0.82	-0.40	0.23	0.08
Crowns Planned	0.04	0.01	**<0.01**	-0.01	0.25	0.68	0.03	0.02	0.25	0.01	0.02	0.57
Intra-Coronal Restorations Planned	0.00	0.01	0.64	0.15	0.03	**<0.01**	-0.06	0.03	**0.04**	-0.04	0.02	0.08
Extractions Planned	-0.02	0.01	**0.01**	-0.07	0.03	**0.04**	-0.02	0.03	0.44	0.23	0.03	**<0.01**
Pulp Planned	0.00	0.01	0.60	-0.04	0.03	0.15	0.10	0.03	**<0.01**	0.04	0.02	**0.06**
Time to GA	0.00	0.00	0.20	0.00	0.00	0.53	0.00	0.00	**<0.01**	0.00	0.00	**<0.01**
Constant/Intercept	1.67	0.06	<0.01	1.43	0.20	<0.01	-0.24	0.21	0.26	-1.12	0.18	<0.01

Table 4. Linear regression model for outcome of unplanned crowns, intra-coronal restorations, pulp therapy, and extractions.

	Crowns Unplanned			Fillings Unplanned			Pulp Therapy Unplanned			Extractions Unplanned		
Parameter	**Coefficient**	**S.E.**	**P Value**	**Coefficient**	**S.E.**	**P Value**	**Coefficient**	**S.E.**	**P Value**	**Coefficient**	**S.E.**	**P Value**
SDF	0.27	0.22	0.23	0.20	0.17	0.24	-0.52	0.13	**<0.01**	-0.36	0.13	**0.01**
Gender	0.29	0.18	0.11	-0.07	0.14	0.63	0.02	0.10	0.09	-0.23	0.11	**0.04**
SHCN	-0.31	0.20	0.12	0.06	0.15	0.71	-0.25	0.11	**0.03**	0.49	0.12	**<0.01**
Age at GA	-0.04	0.01	**<0.01**	-0.02	0.00	**<0.01**	0.00	0.00	0.17	0.02	0.00	**<0.01**
Pain	-0.39	0.24	0.10	-0.31	0.18	0.09	0.17	0.14	0.21	0.29	0.14	**0.04**
DMFT Pre-GA	0.23	0.05	**<0.01**	-0.04	0.04	0.27	0.05	0.03	0.11	0.06	0.03	0.06
Protective Restorations	-0.21	0.51	0.68	0.14	0.93	0.73	-0.09	0.29	0.77	-0.55	0.31	0.08
Crowns Planned	-0.60	0.05	**<0.01**	-0.02	0.04	0.64	0.04	0.03	0.13	0.04	0.03	0.22
Intra-Coronal Restorations Planned	0.05	0.06	0.45	-0.66	0.05	**<0.01**	-0.06	0.03	0.10	-0.04	0.04	0.28
Extractions Planned	-0.18	0.07	**0.01**	-0.07	0.05	0.21	-0.03	0.04	0.48	-0.24	0.04	**<0.01**
Pulp Planned	-0.06	0.06	0.35	-0.05	0.07	0.31	-0.86	0.03	**<0.01**	0.10	0.04	**0.01**
Time to GA	0.00	0.00	0.20	0.00	0.00	0.87	0.00	0.00	**<0.01**	0.00	0.00	**<0.01**
Constant/Intercept	4.56	0.46	<0.01	3.32	0.35	<0.01	0.65	0.26	0.01	-1.15	0.27	<0.01

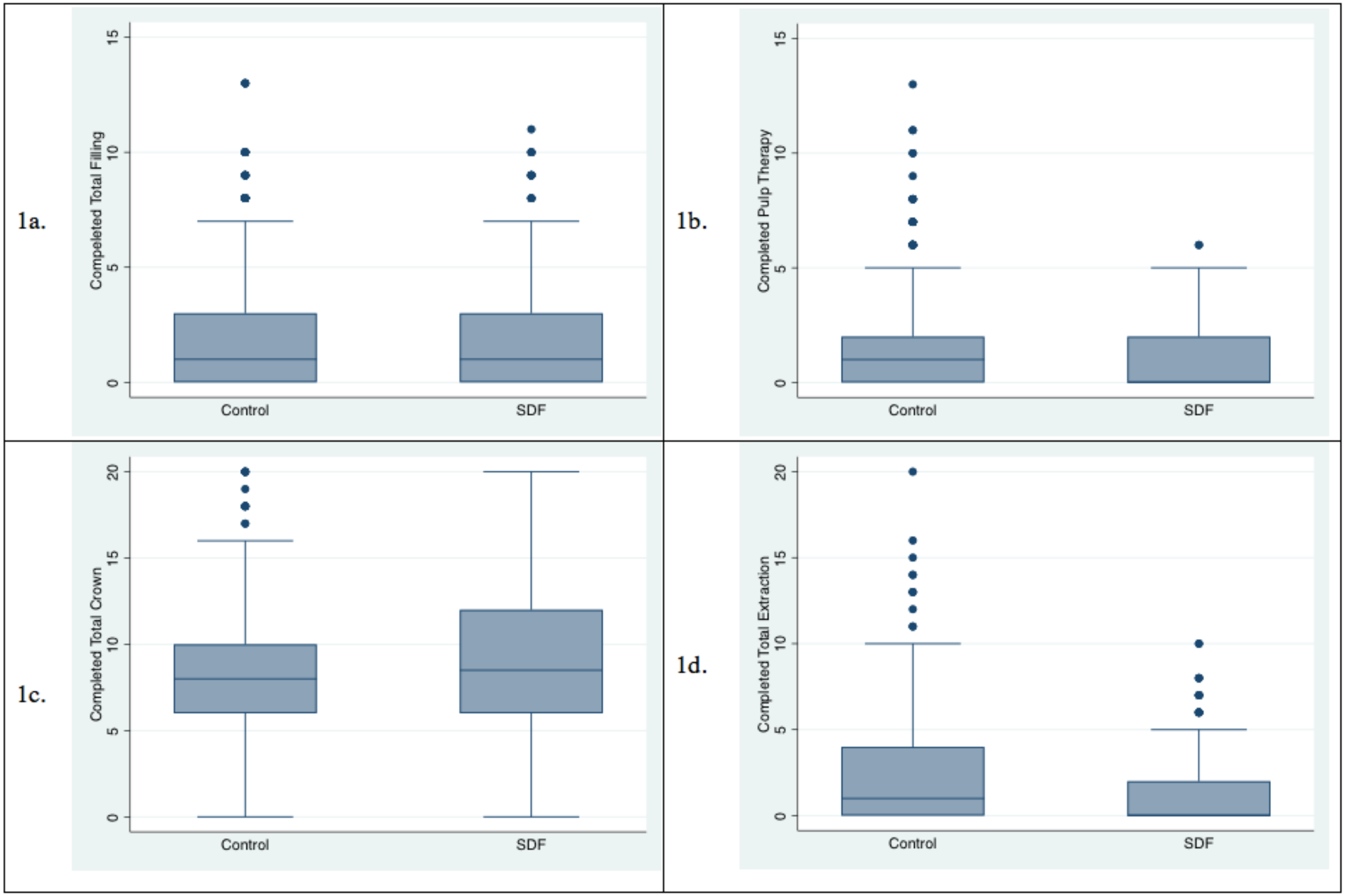

Figure 1: Box Plots-- Completed Total Fillings (1a), Pulp Therapy (1b), Crowns (1c), and Extractions (1d)

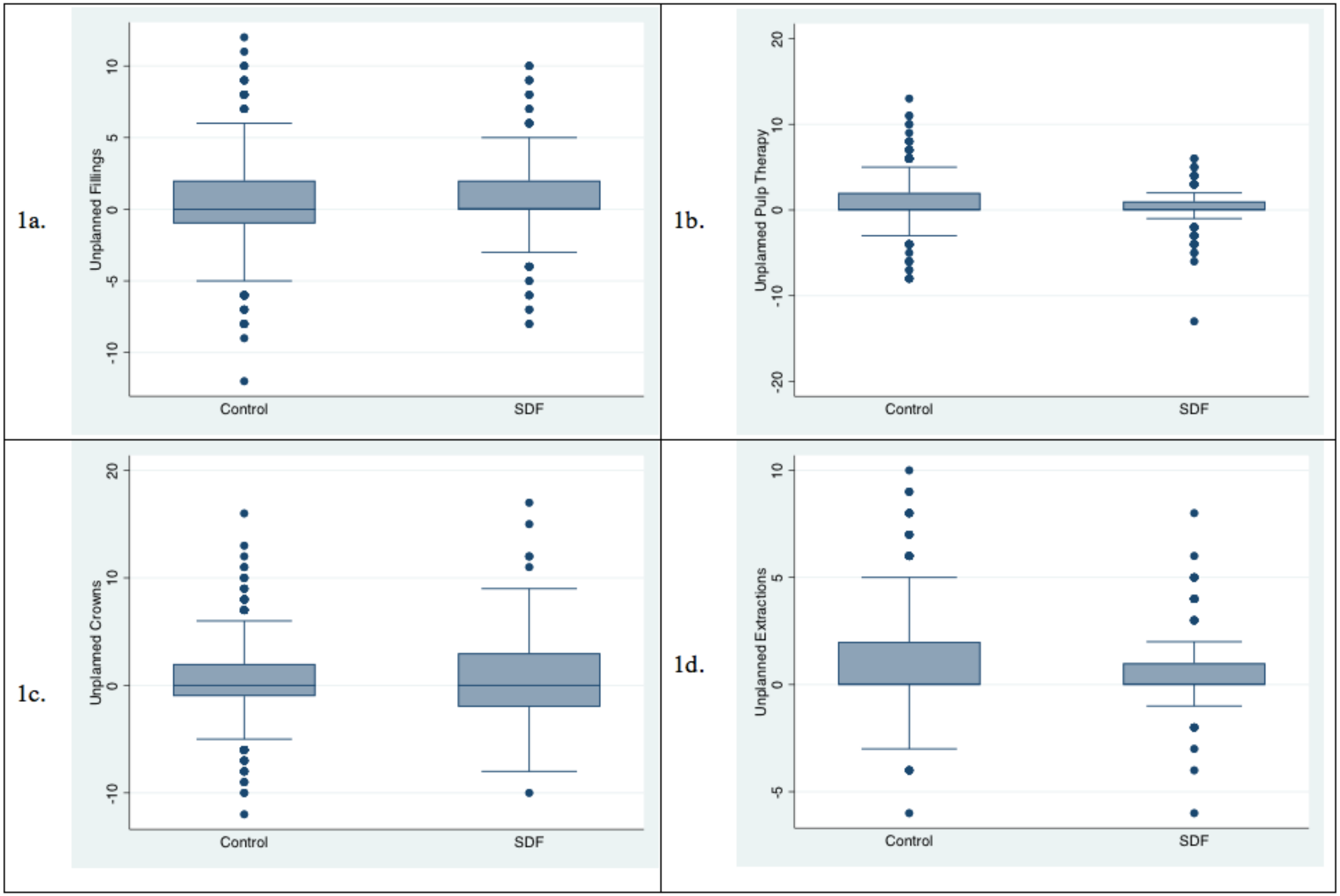

Figure 2: Box Plot: Total Unplanned Fillings (1a), Pulp Therapy (1b), Crowns (1c), and Extractions (1d)

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