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Evaluating Dental Surgery Post-operative Pain in Children Following Treatment Under General Anesthesia

Malinda Husson
Virginia Commonwealth University

EVALUATING DENTAL SURGERY POST-OPERATIVE PAIN IN CHILDREN FOLLOWING TREATMENT UNDER GENERAL ANESTHESIA

A thesis submitted in partial fulfillment of the requirements for the degree of Masters of Science in Dentistry at Virginia Commonwealth University.

By

MALINDA MAYNARD HUSSON, D.D.S.,
West Virginia University School of Dentistry, 2002

Director: TEGWYN H. BRICKHOUSE D.D.S., PH.D.
ASSOCIATE PROFESSOR, DEPARTMENT OF PEDIATRIC DENTISTRY

Virginia Commonwealth University
Richmond, Virginia
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Abstract

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Major Director: Tegwyn H. Brickhouse D.D.S., Ph.D
Associate Professor, Department of Pediatric Dentistry

Purpose: The purpose of this pilot study was to determine if there is a difference in post-operative pain experience for children following dental restorations and/or extractions under general anesthesia (GA), with and without local anesthetic (LA). The alternative hypothesis is that children will experience less post-operative discomfort and soft tissue trauma when using intra-ligamental local anesthetic during the intra-operative time period.

Methods: Patients were recruited for this single blind, randomized, prospective cohort study with the following inclusion criteria, children age 2-6 years requiring general anesthesia for dental treatment. Patients were randomized into categories of either receiving a standardized local anesthetic or no local anesthetic for the dental procedure. A Wong-Baker Faces Pain Scale (Figure 1) was utilized to evaluate pre-operative and post-operative pain. Data were compared using a pooled t-test and two way mixed model ANOVA controlling for sex, ethnicity, and intra-op meds given.

Results: Currently, 33 patients have been enrolled in the study. No difference was found in the LA versus the no LA groups, and significantly more pain was reported in the extraction versus non-extraction groups. With the limited sample size, current trends indicate that pain scores do depend on whether or not treatment included the extraction of a tooth.

Conclusion: When adequately powered (n=100), this study could assist clinicians providing dental surgeries under general anesthesia care by providing evidence based criteria for the provision of local anesthetic during general anesthesia to reduce need for intra-operative pain medication to relieve post-operative pain.

INTRODUCTION

A well-documented phenomenon in medicine is the under treatment of pain in children. Under treatment across all age groups has been attributed to misunderstandings about analgesic use, concerns over addiction, and inadequate assessment of pain perception in pediatric patients.[1] Despite attempts at preventing postoperative discomfort, morbidity associated with the extraction of teeth and restorative procedures completed under general anesthesia (GA) remains a common occurrence .[2] Morbidity includes bleeding, postoperative pain and distress, and has been reported as a factor causing fear of dentists which may subsequently lead to aversion of future dental care.[3] Previous studies have reported significant levels of psychological trauma following general anesthesia care in children including the occurrence of nightmares, continued bad memories, and depression lasting up to a month post-operatively.[1]

With the potential adverse effects morbidity incidence can have on promoting routine dental care throughout adulthood, appropriate post-operative pain management strategies for children requiring general anesthesia with dental treatment remains a common concern for dental providers.[4] As a clinician our primary concern should be how we can be manage a child's post-operative pain experience. However, both clinicians and parents often do not give serious consideration to post-operative pain relief for children. The reported use of analgesic agents given to children after routine treatment consisting of restorative dental treatment and/or dental extractions is 17-22%, including only 53-59% of patients reporting pain.[5] The literature indicates that the highest incidence of postoperative pain reported in children is associated with the placement of preformed crowns, followed by root canal therapy and dental extractions. Multiple studies have indicated that tooth extractions included with or without dental procedures may result in postoperative pain.[6-7]

For the majority of children, dental treatment can be completed in a routine dental setting using various behavioral management techniques. However, special behavior management methods including general anesthesia may be required to provide optimal dental care.[8] Dental rehabilitation under general anesthesia is commonly performed in young children because children may be unable to cooperate in a dental clinic setting or because they may require a significant amount of dental work.[4,9] The use of general anesthesia for dental rehabilitation of children, when indicated, is an accepted behavior management technique according to the American Academy of Pediatric Dentistry (AAPD).[9] The group requiring general anesthesia includes children with extreme anxiety, extensive treatment needs, pre-cooperative young age, and/or physical/mental disabilities.[8,10] Pediatric dentists have long sought to provide dental care to their young and disabled patients in a manner which will promote excellence in quality of care and concurrently induce a positive attitude in the patient toward dental treatment.[11]

Literature reviews have found conflicting results describing the immediate recovery period of children who have undergone GA and received local anesthesia for postoperative pain following dental treatment.[2,6,12] While some studies have shown that the prevalence of postoperative pain following general anesthesia with and without local anesthesia to be significantly different, others have found minimal or no difference.[6,7,12]

One potential benefit of the use of local anesthesia with a vasoconstrictor intra-operatively is decreased blood loss during procedures. However, use of these agents has also been associated with a higher incidence of postoperative distress attributed to soft-tissue trauma.[3] A prospective study published in 2000 found that 13% of children aged 2 to 18 experienced soft tissue trauma after unilateral or bilateral mandibular nerve block anesthesia.[13] The incidence of soft tissue trauma was highest in the youngest age groups, with 18% among children less than 4 years, 16% in children aged 4 to 7, 13% in the range 8-11 year old children, and % in children 12 year and older.[13] Use of local anesthesia causes a profound alteration of orofacial sensation particularly affecting the lips, tongue, and cheek.[2] Children may bite their lower lip out of curiosity with the unfamiliar sensation of being numb, inadvertently because no pain is felt, or accidentally during eating or sleeping.[14]

As previously discussed, the occurrence of soft tissue trauma is most commonly found in younger age groups, among children less than 4 years old, who have received a mandibular nerve block.[14] As an alternative to nerve blockade, the use of intra-ligamental injections to achieve local anesthesia is often considered a preferable option because of decreased incidence of postoperative pain and discomfort due to lip and/or cheek biting.[12,15]

Pain is considered a subjective experience, combining the perception of a noxious stimulus with a strong emotional component.[16] A review of recent literature from pediatric surgical disciplines suggest that local analgesia, via infiltration, reduces postoperative pain in children undergoing surgery under GA.[2,12,15-19] Most children requiring general anesthesia for dental treatment, have higher incidences of preoperative anxiety, behavioral difficulties or may have more invasive treatment needs.[8,10] Many of these children do not attend regular dental treatment appointments, and may not have previously experienced the altered sensation associated with a dental local anesthetic injection.

Townsend, et al. found observed that subjects with lip or cheek biting was reported more frequently in the local anesthetic group, than with the control group that did not receive local anesthetic during general anesthesia care.[1] The incidence reported was 4 of 11 (36%) subjects in the LA group reported lip biting, whereas 1 out of 12 (8%) reported biting from the control group. The report of visible damage to the oral structures was not significant with the Fisher exact test ($p<.22$).

In a study by Watts, et al. it was determined that there is a lack of literature on the use of intra-operative local anesthesia as intra-operative analgesia.[17] Furthermore, there are no formal guidelines or recommendations as to the use of local anesthetic during general anesthesia for dental rehabilitation in both the American Society of Anesthesiologists (ASA) and the American Dental Association (ADA).[20,21] The American Academy of Pediatric Dentistry (AAPD) recommend that if local anesthetics are to be used, to decrease the amount due to additive central nervous system effects with general anesthetics.[22] The AAPD guidelines also mention that when general anesthesia is employed, local anesthesia maybe used to reduce the maintenance dosage of the anesthetic drugs.[22]

In order to properly manage postoperative pain in children, clinicians must be able to anticipate the occurrence of pain.[8,17,23] Without adequate assessment of these postoperative occurrences in children undergoing GA, it is difficult to plan appropriate interventions. Effective pain management for children is dependent upon the ability of care providers to reliably observe and assess the presence and intensity of postoperative pain.[16-19] A better understanding of the techniques of evaluating and preventing pain in children can help reduce the children's emotional and physical distress.[8] By evaluating the types of procedures and the pain associated with these procedures, clinicians should be able to anticipate painful episodes. Utilizing assessment tools including the Wong Baker Face Pain Scale (figure 1), procedures that are associated with higher levels of postoperative pain, can be appropriately identified and analgesic interventions can be employed.[8,16-19]

The aim of this pilot study was to determine if there is a difference in the postoperative pain of children following dental restorations or the combination of extractions and dental restorations under general anesthesia with and without local anesthesia. The alternative hypothesis is that by using local anesthetic as an intra-ligamental (periodontal ligament) injection during the intra-operative time period of the general anesthetic, children will experience less post-operative discomfort. If the alternative hypothesis is found to be correct than this study could assist clinicians providing dental surgeries under general anesthesia care by reducing the post-operative anxieties and pain associated with dental treatment under general anesthesia care.[7]

METHOD AND MATERIALS

All patients included in this single blind, randomized, prospective cohort pilot study were seen on an outpatient basis at Virginia Commonwealth University Ambulatory Care Center. The VCU Institutional Review Board (IRB) for Humans Subjects Protection approved this study. Informed consent was obtained from the parent during the pre-surgical consultation at the Ambulatory Care Center. All patients were previously identified as requiring general anesthesia for their dental care due to their pre-cooperative/uncooperative behavior.

The inclusion criteria for this study were as follows: any child with primary dentition 2-6 years of old predetermined to require general anesthesia care for dental treatment and/or extractions, ASA 1 and 2 patients, English speaking.

Pre-study formal calibration occurred for the PACU nurses and for the pediatric dental residents prior to their participation in this study. All instructions, informed consent, and IRB paperwork were reviewed prior to allowing practitioners and nurses to participate.

There were two groups with a total of n=33 patients, with the following n=16 patients were randomized in the group to receive local anesthesia and n=17 were in the no local anesthetic control group. The groups were set up as follows: first group of children receiving dental restorations for primary teeth, and second group of children receiving the combination of dental restorations and dental extractions of primary teeth. Each of these groups were then treated either with or without local anesthesia using intra-ligamental lidocaine, as previously randomized using the SAS randomization technique prior to starting the study. Each number from 1-100 was assigned a random value of local anesthesia or no local anesthesia. Each child participating received one of the pre-numbered and randomized packets. The children not receiving local anesthetic served as the control group for this study.

After receiving informed consent, the child, parent and the resident in the preoperative assessment area evaluated and rated the patient's preoperative pain utilizing the Wong-Baker Faces Pain Scale[24], prior to the start of anesthesia care. The Wong-Baker Faces pain scale consists of six cartoon faces with varying expressions ranging from very happy to very sad.[1] The six different faces with associated numbers are on an ordinal continuous value scale ranging from 0 (no pain) to 10 (worst pain imaginable). Three preoperative baseline pain scores were recorded at the pre-operative assessment time.

The study used a standardized anesthetic regimen, as deemed appropriate by the consulting pediatric anesthesiologist. The anesthesia protocol included, pre-operative oral midazolam at 0.5 milligrams (mg) per kilogram (kg) up to 20 mg total, mask induction with sevoflurane/oxygen/nitrous oxide, induction medications such as Fentanyl (narcotic) 0.5-1.0 micrograms per kilogram and propofol at 2 mg/kg. We requested no additional pain medications (narcotics) be administered throughout the intra-operative time period unless found to be medically necessary by the anesthesia team (interventions were recorded).

Subjects were randomly assigned to either receive LA or no LA. The pediatric dental resident opened the pre-randomized sealed envelope with the corresponding number and value of LA or no LA. Subjects assigned to the LA group received a standardized LA protocol as follows: 2% plain Lidocaine administered in the first quadrant to be treated, after placement of the throat pack, and prior to the start of the procedure. Operators used intra-ligamental injections of the 2 % Lidocaine plain with a 3mL syringe and a 30 gauge short needle. The local anesthetic was administered in two locations for each single rooted tooth (buccal and lingual), and four locations for each multi-rooted tooth treated (mesial buccal, distal buccal, mesial lingual and distal lingual). The operators did not exceed doses of 4.4mg/kg total of 2 % plain lidocaine. The total amount and time of administration of the local anesthesia was recorded in the anesthesia record and post-operative report. Treatment in each quadrant was completed in the following order: Extractions, composite resins, stainless steel crowns. Treatment was completed by quadrants, and additional local anesthetic was administered prior to each quadrant. Intra-operative pain medication interventions were recorded.

Following completion of the dental treatment and general anesthesia care, the patients were escorted to the Post Anesthesia Care Unit (PACU). The PACU nurses, patients, and their parents were blinded as to whether or not the child had received a local anesthetic. Three pain scores were obtained as follows, patients, PACU nurse and the parent subjectively graded the child’s pain intensity in the immediate postoperative time period, using the visual Wong-Baker pain scale[24], (Figure 1). Additional pain medications administered in the PACU were recorded after the reporting of the pain scores.

The patients were called at home, 6-8 hours following their procedure. Their pain was evaluated by the parents at this time, utilizing the Wong-Baker Faces Pain Scale. The research assistant, whom was blinded as to whether or not the patient received LA, recorded the pain measurement for future review. Pain medications administered at home were recorded.

A total of eight pain scores were recorded for each patient. Three preoperative (patient, parent, and pediatric dental resident obtaining consent), three in the immediate postoperative time period (patient, PACU nurse, and parent), and two (patient and parent) 6-8 hours postoperative (obtained by a research assistant).

Outcome variables were self reported patient post-operative pain scores, and the control variables included pre-operative pain score, treatment type, and the need for intra-operative interventions. The pilot study was powered following a similar study by Coulthard, et al. assuming within the cell SD=2.13, with n=25 per cell, the power of finding a one standard deviation difference in pain between the local anesthetic group vs. no local anesthetic group with a power =99%, then ½ standard deviation with a n=25, has a 90% power.[12]

Data obtained were compared using a pooled t-test and ANOVA experimental design. Final analysis completed used an ANCOVA controlling for pre-operative reported pain scores, treatment completed, and the need for intra-operative medications. Primary independent variable comparison was made between the local anesthetic and no local anesthetic experimental groups. All computations were completed using the SAS software (Cary NC, USA).

RESULTS

The data collected was analyzed using the SAS computer software program. Descriptive statistics of the cohort data set was compared and is represented as the demographics of the sample in Table 1. No difference was noted between the demographics of the groups. Medications administered in the PACU, at home and interventions intra-operatively were all demonstrated in table 1. Similar findings were found between all groups without statistical significance.

Table 2 shows the reported average pain scores by intervention. Similar findings were reported between the groups. Table 3 showing the descriptive statistics stratified by extractions. Table 4 showed the reported average pain scores with and without Local Anesthesia, stratified by extractions. Table 5 reports the difference in pain score means. Table 6 reports the ANOVA comparison of the groups, comparing the patient's pre-operative and post-operative pain. Table 7 reports the ANCOVA results from the patient post-operative pain reported controlling for the co-variables (intra-operative pain medications administered, pre-operative pain scores, age at time of surgery, extractions, local anesthetic administered, and extraction plus local anesthesia). Table 8 reports the ANCOVA results, for post-operative pain with local versus no local groups.

Preliminary analysis was completed after we designated the “no local” groups as our reference groups and compared the “local” group pain scores to the “no local” group pain scores, and stratified the results for the two extraction groups.

Pain scores were found to depend significantly on whether or not treatment included the extraction of a tooth. (Table 4) Therefore, the effect of local anesthesia was determined by first stratifying groups according to treatment including no extraction or at least one extraction. Among the patients whose treatment included at least one extraction, no significant difference in pain scores were found between the patients that received local as compared to patient that did not receive local anesthesia (p=0.106). This is also true of the patients that did not experience an extraction as part of their treatment (p=0.316).

In the second case, we designated the “no extraction” group as our reference and compared the “extraction” group pain scores to the “no extraction” pain scores within each of the two intervention groups. Patients were randomly assigned to either receive local anesthesia or not receive local anesthesia. Since pain scores were found to depend significantly on whether or not treatment included an extracted tooth, our analysis compared the pain scores of patients that had an extraction with those that did not have an extraction within the two independent variable groups (Local Anesthesia vs. No Local Anesthesia Administered). Patients that had at least one extraction reported significantly higher pain scores than those with no extractions in the group that did not receive local anesthesia (p=0.002). Among those patients that received local anesthesia, there was no significant difference between the pain scores of these patients having an extraction as compared with patients that did not have an extraction (p=0.160).

The same results were found for the data analyzed comparing the parent post-operative pain scores, and the PACU nurse post-operative scores. Parents reported higher pain scores that those with no extractions, in the group that did not receive local anesthesia. Among those patients that received local anesthesia, there was no significant difference between the pain scores reported by the parent for the patients having an extraction as compared with the scores reported for those patients that did not have an extraction.

PACU nurse post-operative scores reported were analyzed, with the same findings as the patient and parent. The PACU nurses reported higher pain scores than those with no extractions, in the group that did not receive local anesthesia. Among those patients that received local anesthesia, there was not a significant difference between the pain scores reported by the PACU nurses for the patients having an extraction as compared with the scores reported for those patients that did not have an extraction. The preliminary description of the pain scores indicates differences between the extraction groups and some differences between the anesthesia groups.

In Table 6, the ANOVA results controlled for gender, race/ethnicity, intra-operative pain medication, treatment, local anesthesia administered (yes or no), and age (years). The ANOVA compared the groups correlated with continuous characteristics. Patient pre-operative and post-operative pain correlated, r=0.26, p-value=0.218. The treatment group was found to be statistically significant in the patient reported post-operative pain group, p=.030.

Table 7 reports patient post-operative pain and shows the ANCOVA results from the data. The use of intra-operative pain medications, and the pre-operative pain measure appeared unrelated. Older patients reported nominally more pain, and the effect of local anesthesia is not consistent across the extraction groups.

Table 8 and figure 2 reported the post-operative pain scores reported and whether or not there was a difference in the pain scores with a 95% confidence interval. Patients that had extractions included in their treatment, regardless of local anesthesia experienced the most pain.

DISCUSSION

Results of this pilot study have not yet demonstrated statistically significant differences between pain scores in the intervention groups (local anesthetic versus no local anesthetic). However, when comparing extraction groups, this data indicates statistically higher pain scores with the patients receiving treatment including extractions.

Due to the small sample size, missing numbers and data could cause an impact on the results. Some variables that we would like to consider were the difficulty and inability to reach patient's parents at home, resulting in missing data in the at home pain scores for parents and patients, and medications administered at home. Other problems with obtaining data were inconsistencies with incorrectly following treatment protocol, for example one dentist incorrectly did not use local anesthesia for a patient that was randomized to receive local anesthesia. The patient was kept in the group randomized as receiving local anesthesia, to stay true to the randomized coding.

As a pilot study, the primary purpose is not to determine statistical significance but rather to estimate the size of the anesthesia differences so that these may be used in a power analyses to design a full-fledged experiment that will establish the differences between the anesthesia groups.

For a future study with this two-group design (local anesthetic administration and restorative treatment plus extraction groups) and these covariates (pre-operative pain scores, age, intra-operative pain medication interventions), in order to have 80% power to detect a difference due to local anesthetic administration in the extraction (yes) group at Alpha= 0.025, would require about 84 subjects (total). However, we would need to recruit more than that, because the power calculation assumes there would be complete data on 84 subjects. This pilot study lost about 10% (30 completed data out of n=33), so we would want to recruit approximately 92 subjects to account for this.

CONCLUSION

Many studies have focused on parameters evaluating children's post-operative discomfort.[1] However, at this time, only a limited amount of studies have looked into the administration of local anesthetic with general anesthesia care. Our research allows for the conclusion that a better understanding of the techniques of evaluating and preventing pain in children may help reduce emotional and physical distress that children sometimes experience in the post-operative time period.

In summary,

- With our limited sample size, currently there is not a statistical significant difference between the local anesthetic and the no local anesthetic groups.
- Future studies could utilize different local anesthesia techniques, including inferior alveolar blocks and infiltrations.
- With an increase in sample size the data has the potential to indicate the need for additional studies and to determine the benefit of LA during GA care.
- Preliminary data concludes that patient post-operative pain after GA does not depend on the use of local anesthetic.
- Current trends of our data set indicate that pain scores depend significantly whether or not treatment included the extraction of a tooth.

After completion of this study it is our hope that we will be able to help determine the best method of treating children's post-operative pain after general anesthesia, the best method of administering local anesthetic, what procedures cause the most significant post-operative pain, and help decrease the amount of complications with self inflicted soft tissue trauma children experience with local anesthetic traditional administration.

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Appendices

Tables and Figures

Table 1: Descriptive Statistics of Cohort Data Set

		Local Anesthesia *(n=16)*		**No Local Anesthesia** *(n=17)*	
		n	%	n	%
Gender	*Male*	8	47.06	9	52.94
	Female	8	50.00	8	50.00
Ethnicity	*Caucasian*	5	45.45	6	54.55
	African-American	6	42.86	8	57.14
	Hispanic	3	75.00	1	25.00
Treatment	*Restorative*	7	46.67	8	53.33
	Restorative & Extraction	9	50.00	9	50.00
Meds administered in PACU	*No*	9	50.00	9	50.00
	Yes	5	38.46	8	61.54
Meds administered at home	*No*	4	44.44	5	55.56
	Yes	8	44.44	10	55.56
Med interventions intra-operatively	*No*	11	57.89	8	42.11
	Yes	5	35.71	9	64.29
Average Age	*Mean*	3.95		4.12	
	SD	1.19		1.10	

Table 2: Reported Average Pain Scores By Intervention

		Local Anesthesia			**No Local Anesthesia**		
		n	Mean	SD	n	Mean	SD
Patient	*Pre-operative*	15	1.93	2.84	15	2.00	2.62
	Post-operative	13	2.54	3.33	14	4.29	4.70
	Home	11	1.09	1.38	15	2.13	3.07
Parent	*Pre-operative*	16	1.63	2.87	15	1.20	2.11
	Post-operative	15	3.73	4.15	17	4.12	3.41
	Home	12	1.00	1.35	15	1.60	1.68
Nurse	*Post-operative*	14	2.29	3.41	17	3.00	3.54
Resident	*Pre-operative*	16	0.44	1.75	15	0.53	1.41

Table 3: Descriptive statistics of cohort data sets, stratified for extraction

		Local Anesthesia				No Local Anesthesia			
		Extraction (n=9)		Non-Extraction (n=7)		Extraction (n=9)		Non-Extraction (n=8)	
		n	%	n	%	n	%	n	%
Gender	*Male*	5	41.7	3	60.0	7	58.3	2	40.0
	Female	4	66.7	4	40.0	2	33.3	6	60.0
Ethnicity	*Caucasian*	3	50.0	2	40.0	3	50.0	3	60.0
	African-American	3	37.5	3	50.0	5	62.5	3	50.0
	Hispanic	1	100.0	2	66.7	0	0.0	1	33.3
Treatment	*Restorative*	9	50.0	7	46.7	9	50.0	8	53.3
Meds administered in PACU	*No*	4	57.1	5	45.5	3	42.8	6	54.6
	Yes	3	33.3	2	50.0	6	66.7	2	50.0
Meds administered at HOME	*No*	2	100.0	2	28.6	0	0.0	5	71.4
	Yes	4	33.3	4	66.7	8	66.7	2	33.3
Med interventions intra-operatively	*No*	6	66.7	5	50.0	3	33.3	5	50.0
	Yes	3	33.3	2	40.0	3	33.3	3	60.0

Table 4: Reported average pain scores with and without Local Anesthesia, stratified by extractions.

	Local Anesthesia						**No Local Anesthesia**					
	Extraction (n=9)			**Non-Extraction** (n=7)			**Extraction** (n=9)			**Non-Extraction** (n=8)		
	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Patient												
Pre-operative	9	1.2	1.7	6	3.0	4.0	7	3.4	3.0	8	0.8	1.5
Post-operative	6	3.5	3.8	7	1.7	2.9	8	6.3	4.3	6	1.7	4.1
Home	5	1.2	1.1	6	1.0	1.7	8	3.0	3.6	7	1.1	2.3
Parent												
Pre-operative	9	0.8	1.7	7	2.7	3.8	7	1.4	2.5	8	1.0	1.9
Post-operative	8	4.1	4.8	7	3.3	3.6	9	6.0	3.5	8	2.0	1.8
Home	6	0.7	1.0	6	1.3	1.6	8	2.0	1.8	7	1.1	1.6
Nurse												
Post-operative	8	2.8	3.7	6	1.7	3.2	9	5.2	3.4	8	0.5	1.4
Resident												
Pre-operative	9	0.0	0.0	7	1.0	2.7	7	1.1	2.0	8	0.0	0.0

Table 5: Difference in Patient Pain Score Means, with 95% Confidence Limits

	Local Anesthesia				**No Local Anesthesia**			
	Extractions		***No Extractions***		***Extractions***		***No Extractions***	
Patient								
Difference between means	3.41		-2.77		-1.42		-5.62	
95% CI	-0.10	6.92	-5.96	0.42	-5.11	2.27	2.19	9.04

Table 6: ANOVA comparison of groups, comparing the patient's pre-operative and post-operative pain.

			Patient Pre-Op Pain				Patient Post-Op Pain			
Characteristic	n	%	n	Mean	SE	p-value	n	Mean	SE	p-value
Gender						0.464				0.808
Male	17	52	15	2.330	0.699		15	3.267	1.083	
Female	16	48	15	1.600	0.699		12	3.667	1.211	
Race/Ethnicity						0.488				0.982
Caucasian	11	38	10	2.100	0.867		9	3.222	1.441	
African American	14	48	13	2.000	0.760		11	3.455	1.303	
Hispanic	4	14	3	0.000	1.583		4	3.000	2.161	
Intra-operative pain medication						0.960				0.241
No	19	52	19	1.947	0.627		18	2.778	0.796	
Yes	14	48	11	2.000	2.000		9	4.778	1.975	
Treatment						0.638				0.030
Restorative	15	45	14	1.714	0.727		13	1.692	1.058	
Restorative & Extraction	18	55	16	2.188	0.680		14	5.071	1.019	
Local anesthesia						0.947				0.279
No	17	52	15	2.000	0.705		14	2.538	1.137	
Yes	16	48	15	1.933	0.705		13	4.286	1.096	
Age (years)						0.853				0.157
	33	100	30	1.967	r = 0.04		27	3.444	r = 0.28	

p-values: ANOVA, comparing groups. Correlations with continuous characteristic.
Note: Patient pre-op pain and post-op pain correlated, r = 0.26, p-value = 0.218.

Table 7: ANCOVA results from patient post-operative pain report controlling for the source.

Source	df	F	p-value
Intra-op pain meds	1	0.836	0.370
Pre-op pain	1	0.073	0.789
Age at surgery	1	2.753	0.111
Extraction	1	8.900	0.007
Local anesthesia	1	0.288	0.597
Extract*Local	1	3.882	0.061
Error	23		

N = 30, R^2 = 43%

Table 8: ANCOVA results, for post-operative pain with local versus no local groups

	Post-op Pain				
Local	LS Mean	SE	95% CI		p-value
	No extraction				
Yes	2.723	1.153	0.338	5.108	
No	0.824	1.031	-1.309	2.957	
difference	1.899	1.643	-6.445	2.647	0.660
	Extraction				
Yes	3.236	1.036	1.092	5.380	
No	6.225	1.066	4.020	8.431	
difference	-2.990	1.564	-7.317	-1.337	0.251

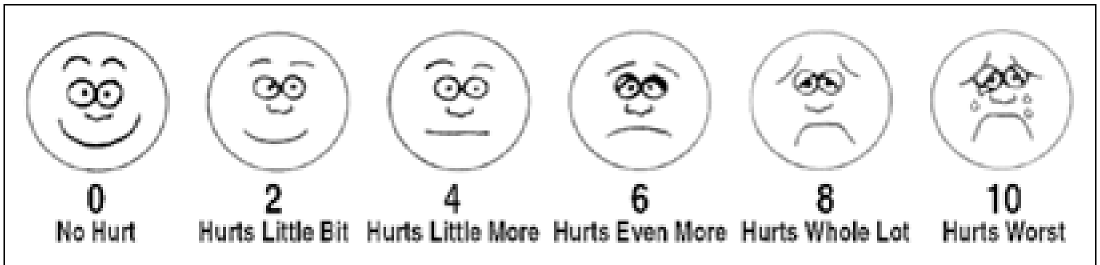

Figure 1. Wong Baker Faces Pain Scale. Utilized to assess pain scores in children.[24]

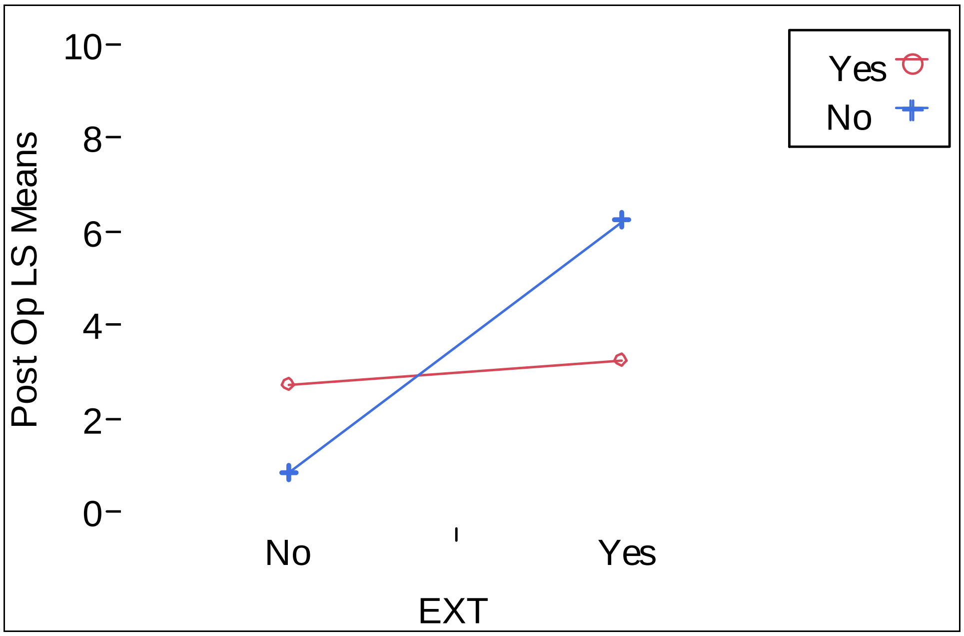

Figure 2: Post-operative pain mean scores, blue + yes local anesthesia was used, red 0 no local anesthesia was not used, compared with extractions versus no extractions during general anesthesia treatment.

VITA

Malinda Maynard Husson was born on July 8, 1976 in Huntington, WV. She attended Marshall University in Huntington, WV and graduated cum laude in 1998. She then was accepted to West Virginia University School of Dentistry, and graduated with the degree of Doctor of Dental Surgery in May 2002. Malinda continued her studies by completing a General Practice Residency at the Veterans Affairs Medical Center in Washington, DC in July 2003. She later practiced as a general dentist for one year in Harrisonburg, VA. Then completed a two year dental anesthesiology residency at The Mount Sinai School of Medicine from 2004-2006. After completion of her residency, she worked as a Dentist Anesthesiologist for three in Alexandria, Virginia prior to completing a two year pediatric dental residency at Virginia Commonwealth University School of Dentistry.