

Assessing Temperament as a Predictor of Nitrous Oxide Inhalation Sedation Success Using the  
Children's Behavior Questionnaire Short Form

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A thesis  
Submitted in partial fulfillment of the  
Requirements for the degree of

Master of Science in Dentistry

University of Washington

2015

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Program Authorized to Offer Degree:  
School of Dentistry

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**Abstract**

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**Purpose:** To investigate whether child temperament is associated with success in nitrous oxide inhalation sedation in pediatric dentistry.

**Methods:** Child-caregiver dyads were enrolled from patients receiving dental care with nitrous oxide inhalation sedation at a university-based pediatric dental clinic. Children between 36-95 months of age who were ASA I or II were eligible for inclusion. To assess child temperament, caregivers completed the Children's Behavior questionnaire Short Form (CBQ-SF). Behavior was scored based upon specific behavioral notes abstracted from the patient's chart, the Frankl Score, and the ability to complete the previously planned treatment.

This data was abstracted from the chart after the appointment was completed. The Frankl scores were provided by the dentist who performed the treatment.

**Results:** The sample population consisted of 48 patient-caregiver dyads. The overall behavioral failure rate was 15% (N=7/48). Presence of disruptive behavior was 20% (N=9/46). There was

no significant difference in sedation outcome associated with sex, ASA status, insurance status, or complexity of treatment provided. Variation of child behavior was found to be significantly associated with an increase in age. The broad temperament category of effortful control and the subcategory dimensions of attention control, inhibitory control, frustration, sadness, soothability, activity, and impulsivity were significantly associated with sedation outcome. Effortful control, attention control, inhibitory control, pleasure from low intensity activities, frustration, fear, sadness, soothability, activity, and impulsivity were significantly associated with Frankl Behavior Score.

**Conclusions:** The results of this study suggest that the temperament scales of *effortful control, attention control, inhibitory control, frustration, sadness, soothability, activity, and impulsivity* may be important determinants of a child's behavior and overall success during a dental procedure while under the effects of nitrous oxide inhalation sedation.

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## **ACKNOWLEDGEMENTS**

I wish to express sincere appreciation to all the members of my thesis committee. Drs. Travis Nelson, JoAnna Scott, Sarat Thikkurissy, and Katherine Lane. Thank you for all your insight, time, and support. Additional thanks to my research assistants, Julie Vu and Shad Schneider, for all their time spent enrolling patients and entering data and to the residents and assistants at the Center for Pediatric Dentistry for their detailed accounts of patient behavior in their records.

## **DEDICATION**

I dedicate my thesis to:

My mother, Marie, and father, Tom, for believing in my dreams and encouraging me to chase them.

My mentor, Dr. Nelson, for leading by example with his cool, calm, demeanor as a clinician and as teacher.

My mentor, Dr. Joseph Kelly, for taking the time to listen to my struggles and for being a port in my storm.

## I. INTRODUCTION

Successful care of the pediatric dental patient is dependent upon effective management of the child's behavior. To improve cooperation for pediatric dental procedures, nitrous oxide (N<sub>2</sub>O/O<sub>2</sub>) inhalation sedation is commonly employed by dentists. The use of titrated amounts of nitrous oxide and oxygen gases as a behavior guidance adjunct is recognized as a safe and effective technique. When appropriately used, N<sub>2</sub>O/O<sub>2</sub> may reduce anxiety, produce analgesia, and enhance effective communication between a patient and a health care provider. One of the main reasons nitrous oxide is preferred over other pharmacologic agents is due to its superior safety profile, with no recorded fatalities or cases of serious morbidity when used within recommended concentrations. It is simple to administer and easily absorbed by the body, allowing for rapid onset and recovery.<sup>1</sup>

The clinical efficacy of nitrous oxide is sufficient and predictable in the majority of cases, however there are children for whom it fails to provide adequate levels of sedation.<sup>2</sup> This inconsistency in efficacy may result in an aborted, traumatic, or even harmful dental experience for the child. Therefore, a dentist's ability to accurately predict a child's capacity and willingness to cooperate during a dental procedure becomes a major determining factor in the decision to use nitrous oxide as a pharmacologic behavior management adjunct.<sup>3</sup>

A number of studies have attempted to determine factors associated with positive behavior and successful sedation outcomes during dental treatment.<sup>4,5,6,7,8,9,10</sup> Studies have shown that child temperament, or "behavioral style", may play a large role in determining successful sedation. Early measures of temperament were established by Thomas and Chess,

psychologists who recognized nine different dimensions of temperament.<sup>8,11</sup> Later, Buss and Plomin recognized emotionality, activity, sociability, and impulsivity as important criteria in determining temperament. Their EASI instrument has shown improved ability to predict behavior and has been used extensively in medical and dental research.<sup>12</sup> In the 1980's Rothbart introduced new concepts in temperament assessment by implementing a "psychobiological" approach. This approach recognizes the speed and extent of activation or suppression of neuroregulatory systems as a fundamentally important temperament determinant.<sup>13</sup> Rothbart and colleagues developed the Children's Behavioral Questionnaire (CBQ), which includes 15 temperament dimensions that cluster into 3 main categories.<sup>14</sup> The CBQ's foundation lies in the understanding that temperament is defined as, "constitutionally based individual differences in reactivity and self-regulation, influenced over time by heredity and experience".<sup>15</sup> The CBQ and its derivatives are now recognized as the most frequently used instruments in contemporary pediatric temperament research.<sup>13,16</sup>

In dentistry, research has primarily focused on using temperament to predict patient behavior associated with successful oral sedation in combination with nitrous oxide.<sup>9,17</sup> The majority of studies have evaluated temperament using older temperament instruments such as the EASI, with relatively little research employing contemporary instruments. A recent study by Lane et al. was aimed at predicting moderate sedation outcomes using the Children's Behavioral Questionnaire-Short Form (CBQ-SF).<sup>21</sup> The study showed that children with impulsive behavior were more likely to demonstrate uncooperative behavior during treatment.<sup>21</sup> Nitrous oxide inhalation sedation generally results in minimal sedation. In such cases, temperament and behavioral determinants may be more critical than with more

profound levels of sedation afforded by oral agents.<sup>6</sup> To our knowledge there are no published studies investigating child temperament during dental treatment when employing only nitrous oxide inhalation sedation.

Determining temperament associated with successful nitrous oxide inhalation sedation outcomes has potentially important benefits. It may provide a measure of baseline temperament for children who are capable of tolerating dental treatment with minimal sedation and basic behavior guidance techniques only. By comparing this information with temperament data obtained for children receiving deeper levels of sedation, we may gain insight into characteristics that enable children to successfully receive dental treatment. Additionally, by determining which children fail to receive dental care with nitrous oxide sedation, practitioners may improve case selection for pharmacologic behavior guidance techniques such as oral sedation and general anesthesia and reduce negative patient experiences. The purpose of this study was to determine associations between child temperament determined by the CBQ-SF and nitrous oxide sedation outcomes.

## **II. METHODS**

This study was conducted after receiving approval from the University of Washington Institutional Review Board #47262. Informed consent to participate in the study was obtained from the caregiver of each child-caregiver dyad by one of the investigators on the day of the treatment visit. Once it was determined that the patient met inclusion criteria, caregivers were consented and enrolled in the study. For children aged seven and older, the child's assent was also obtained.

## **Participants:**

Forty-eight child-caregiver dyads participated in the study from June 11<sup>th</sup>, 2014 to January 5<sup>th</sup>, 2015. Children aged 36-95 months were eligible for inclusion, as this was the age range allowed by the CBQ-SF. Other inclusion criteria included children with an American Society of Anesthesiologists (ASA) physical classification I or II, who had never received nitrous oxide inhalation sedation at the University of Washington Center for Pediatric Dentistry (CPD), and who were scheduled to undergo a restorative dental visit requiring administration of local anesthetic and placement of a rubber dam or a dental visit with local anesthetic and extraction. Exclusion criteria were non-English reading caregivers, caregivers under the age of 18, children who had previously used nitrous oxide at the CPD, and children who had previously enrolled in the study.

## **Administration of Temperament Rating Instrument**

During the child's appointment, caregivers completed the CBQ-SF. The CBQ-SF is a 94 item survey in which caregivers rate their child on a seven-point Likert scale. The CBQ-SF evaluates fifteen dimensions of temperament as well as the overall categories of *Negative Emotion*, *Effortful Control*, and *Surgency/Extraversion* (Appendix A). The CBQ-SF was developed for use in situations in which the full questionnaire, comprised of 195 questions, is not practical. It has been validated and is nearly as reliable as the standard length CBQ.

## **Nitrous Oxide Inhalation and the Dental Procedure**

At the beginning of the dental procedure, an appropriately sized nasal hood was selected and placed, the flow rate was set between 5 to 6L/min, 100% oxygen was utilized for the first 1 to 2 minutes followed by titration of nitrous oxide in 10% intervals up to a maximum total of 50% nitrous oxide and 50% oxygen. Patients had the option of watching internet-streaming video during the dental procedure. All procedures were performed by residents at the CPD. A total of 17 different dentists participated in delivery of patient care. At the end of the appointment, nitrous oxide flow was terminated and 100% oxygen was delivered for 3 to 5 minutes and the patient was determined to have returned to their pretreatment responsiveness prior to discharge.

### **Rating Behavior:**

At the completion of the dental procedure, the treating dentist rated overall behavior displayed during the course of the dental appointment according to the Frankl Behavior Scale (Appendix B). These scores ranged from definitely negative (Frankl -/-), negative (Frankl -), positive (Frankl +), to definitely positive (Frankl +/+). The operators were pediatric dental residents at the CPD and were blinded to the child's CBQ-SF score. A separate overall rating of success or failure was determined based upon specific behavioral notes abstracted from the patient's chart at a later time by the lead investigator, the child's Frankl score, and ability to complete the planned treatment. Following the dental visit, a chart review was conducted and demographic (age, sex, ASA status, insurance type) and treatment complexity (simple or

complex) variables were collected (Appendix C). Temperament scores were calculated using the methods included with the CBQ-SF instrument.

### **Data Analysis and Statistics:**

Demographic and treatment variables were tested for association with sedation success/failure and Frankl Behavior scores using Fisher's Exact test. Temperament scales were assessed for association with sedation success/failure and separately with demographic variables using a Two-Sample T-Test with unequal variances. Frankl behavior is scored in one of 4 categories; +/+, +, -, -/-. Due to a low sample size, there was insufficient data to analyze on all four Frankl categories. To perform statistical analysis, we combined the 4 behavioral categories into 2; positive (+/+ and +) or negative (-, -/-) and tested the temperament scales for association with positive and negative behavior scores using a Two-Sample T-Test with unequal variances.

### **III. RESULTS:**

Forty-eight children between the ages of 36-95 months were enrolled in the study; 58% were male. Out of the 48 children enrolled, 7 (15%) received a failing score for the nitrous oxide sedation procedure. Negative Frankl scores were reported in 9 (19%) children. There was no significant association found between demographic variables (age, sex, ASA Status, and insurance) or complex treatment (defined as stainless steel crowns, pulp therapy, and/or extraction) and sedation outcome. There was a significant association found between age and Frankl score. Older children displayed more behavioral variation. (Table 1)

### **Temperament and Sedation Outcome**

Effortful control (P= 0.015), a broad temperament category, and the subcategories of attention control (P=0.024), inhibitory control (P= 0.005), frustration (P= 0.005), sadness (P= 0.011), soothability (P= 0.015), activity (P= 0.005), and impulsivity (P=0.035) were significantly associated with overall sedation outcome. (Table 2)

### **Temperament and Frankl Scores**

Effortful control (P= 0.001), attention control (P= 0.006), inhibitory control (P= 0.001), frustration (P= 0.012), fear (P= 0.037), soothability (P= 0.001), and impulsivity (P= 0.023) were significantly associated with Frankl scores. (Table 2)

### **Temperament and Demographic Variables Associations**

Perceptual sensitivity was significantly associated with gender (P=0.004). Extraversion/Surgency was significantly associated with ASA status (P=0.030). Soothability was significantly associated with Insurance Type (P=0.025). (Table 3)

## **IV. DISCUSSION:**

### **Frankl Behavior Score**

One of the most reliable and frequently used behavior rating systems in clinical dentistry and research is the Frankl scale. This scale separates observed behaviors into four categories ranging from definitely negative to definitely positive.<sup>18</sup>

We saw in our study that older children showed more behavioral variation than younger children. The older children had more of the intermediate positive (+) and negative (-) scores than the younger children, who predominately displayed either definitely positive behavior scores (+/+) or definitely negative behavior scores (-/-). These results suggest that as children age, coping skills may enable them to more effectively attenuate negative behaviors. (Table 1)

### **Overall Sedation Success**

The overall nitrous oxide inhalation sedation success rate was determined to be 85.4%. Previous studies of oral midazolam combined with nitrous oxide inhalation sedation for operative pediatric dental procedures (one of the more popular sedation combinations administered for pediatric dentistry) showed overall success rates ranging from 30-85%.<sup>4,17</sup> A study performed by Burnweit et al. reported a 96.7% success rate when nitrous oxide was used for minor non-dental pediatric surgical procedures in children with ages ranging from 1-20 years old. They also reported that 84% of those patients who received local anesthesia via injection did not recall the shot.<sup>20</sup> A study by Lane et al. showed an overall sedation success rate of 87% during operative dental procedures when using a combination of Meperidine, Midazolam, Hydroxyzine administered via oral sedation and nitrous oxide administered via inhalation sedation.<sup>21</sup>

### **Temperament**

The purpose of this study was to determine associations between child temperament and nitrous oxide sedation outcomes. The CBQ-SF is based on temperament within three broad categories: *Effortful Control*, *Negative Affectivity*, and *Extraversion/Surgency*.<sup>15</sup>

*Effortful control* reflects voluntary and willful regulation of attention and behavior. It is defined by the dimensions of *inhibitory control*, *attentional focusing/control*, *perceptual sensitivity*, and *low intensity pleasure*. These variables have in common the requirement that the child use attention to suppress a dominant emotional or behavioral response and perform an alternative response.<sup>15</sup> Previous research has shown that children higher in *effortful control* are more able to disengage their attention from a threat.<sup>19</sup> We found significant associations between the broad category of *effortful control* as well as the sub-categories of *attention control* and *inhibitory control* with both successful overall sedation outcomes and positive Frankl behavior scores. *Attention Control* is defined as, “a tendency to maintain attentional focus upon task-related channels.” *Inhibitory control* is defined as, “the capacity to plan and to suppress inappropriate approach responses under instructions or in novel or uncertain situations”.<sup>15</sup> These results suggest that children who were able to maintain focus on cooperating for the dental procedure and suppress their desire to act out during the procedure were more likely to have successful dental visits.

*Negative affectivity* reflects an individual’s tendency toward negative emotional states. It is defined by the temperament dimensions of *frustration*, *fear*, *discomfort*, *sadness*, and *soothability*.<sup>15</sup> We found significant associations between *frustration*, *sadness*, and *soothability* with both successful overall sedation outcomes and positive behavior scores. *Frustration* is defined as, “the amount of negative affect related to interruption of ongoing tasks or goal blocking.” *Sadness* is defined as, “the amount of negative affect and lowered mood and energy related to exposure to suffering, disappointment, and object loss.” *Soothability* is defined as, “rate of recovery from peak distress, excitement, or general arousal”.<sup>15</sup> Our findings show that

children who are less likely to concede frustration, more likely to persevere through challenges, and are resilient were more likely to have successful sedation outcomes and be given positive behavior scores.

*Extraversion/Surgency* is characterized by high levels of activity and positive emotion, impulsivity, and engagement with an environment.<sup>15</sup> It is defined by the temperament scales of *activity, shyness, high-intensity pleasure, smiling and laughter, impulsivity, and positive anticipation*.<sup>15</sup> Higher *activity* and *impulsivity* scores were significantly associated with both successful overall sedation outcomes and positive behavior scores. *Activity* is defined as, “the level of gross motor activity including rate and extent of locomotion.” *Impulsivity* is defined as, “the speed of response initiation”.<sup>15</sup> Children who were able to remain still during dental treatment and were not reactionary in the dental chair were more likely to have successful sedation outcomes and be given positive behavior scores.

We found that many factors affect treatment success. An experienced practitioner knows this intuitively, but identifying specific predictive factors has clinic utility. In this study, perhaps the most significant finding relates to the temperament category of Effortful Control. Over the course of a dental procedure, children who are able to successfully receive care must inhibit negative reactions. This corresponds to the innate ability to focus on a task and persist although it is difficult. In future research this category could possibly be excerpted from the CBQ and used clinically to help predict successful treatment outcomes.

#### **Demographic and Treatment Variables:**

Forty-eight patient-caregiver dyads were enrolled, with 58.3% male patients (N=28). Patient age ranged from 36-95 months of age, with 56.3% being between the age of 67-95

months (N=27). Seventy-three percent (N=35) were insured by Medicaid while the remaining patients were privately insured. There were no patients that paid out of pocket for their treatment. Three out of four patients participating in the study were ASA I (N=36) and 70.8% (N=34) required only simple dental treatment (intracoronaral restorations) (N=34).

#### **Study Limitations:**

A major limitation of this study was the number of providers involved in patient care. The study was conducted at a university-based dental clinic where seventeen different dental residents performed treatments with nitrous oxide inhalation. The number of providers introduced variability from the standpoint of provider skill and nitrous oxide administration technique. The low number of patients enrolled in this pilot study limits the interpretation of the results. In future studies larger sample sizes may enable researchers to draw more definitive conclusions regarding specific dimensions of temperament and child cooperation.

#### **V. CONCLUSIONS**

1. Sedation success rate was not significantly associated with differences in age, sex, ASA status, insurance status, or treatment complexity.
2. Frankl behavior scores for older children (67-95 months of age) had wider variation than those of younger children (36 to >67 months of age).
3. The CBQ-SF temperament scales of *attention control*, *inhibitory control*, *frustration*, *sadness*, *soothability*, *activity*, and *impulsivity* were all associated with successful sedation outcomes and positive Frankl Behavior Scores.

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Table 1. Demographic Variables Associations with Overall Sedation Outcome and Frankl Scores

	Overall Sedation Outcome			Frankl Scores				P – Value	Total N=48
	Success N=41	Failure N=7	P – Value	+/+ (N=35)	+ (N=4)	- (N=4)	-/- (N=5)		
<b>Age (months):</b>			>0.999					0.047*	
<b>36-&lt;67</b>	18 (85.7%)	3 (14.3%)		18 (85.7%)	0 (0.0%)	0 (0.0%)	3 (14.3%)		21
<b>67-96</b>	23 (85.2%)	4 (14.8%)		17 (62.9%)	4 (14.8%)	4 (14.8%)	2 (7.4%)		27
<b>Sex:</b>			0.683					0.654	
<b>Male</b>	23 (82.1%)	5 (17.9%)		19 (67.9%)	3 (10.7%)	2 (7.1%)	4 (14.3%)		28
<b>Female</b>	18 (90.0%)	2 (10.0%)		16 (80.0%)	1 (5.0%)	2 (10.0%)	1 (5.0%)		20
<b>ASA Status:</b>			>0.999					0.914	
<b>I</b>	31 (86.1%)	5 (13.9%)		26 (72.2%)	3 (8.3%)	4 (11.1%)	3(8.3%)		36
<b>II</b>	10 (90.9%)	1 (9.1%)		9 (81.8%)	1 (9.1%)	0 (0.0%)	1 (9.1%)		11
<b>Insurance Status:</b>			>0.999					0.777	
<b>DSHS</b>	30 (85.7%)	5 (14.3%)		24 (68.6%)	4 (16.7%)	3 (8.6%)	4 (16.7%)		35
<b>Private</b>	11 (84.6%)	2 (15.4%)		11 (84.6%)	0 (0.0%)	1 (7.7%)	1 (7.7%)		13
<b>Treatment Complex:</b>			0.400					0.779	
<b>Yes</b>	11 (78.6%)	3 (21.4%)		9 (64.3%)	2 (14.3%)	1 (7.1%)	1 (7.1%)		14
<b>No</b>	30 (88.2%)	4 (11.8%)		26 (76.5%)	2 (5.9%)	3 (8.8%)	3 (8.8%)		34

\*Indicates statistically significant P- value

Table 2. Temperament Scales Associations with Overall Sedation Outcome and Frankl Scores

Temperament Scales	Overall Sedation Outcome				Frankl Scores				
	Overall N=46	Success N=39	Failure N=7		+/+ N=33	+ N=4	- N=4	-/ N=5	
	Mean (SD)	Mean (SD)	Mean (SD)	P- Value	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	P-Value
<b>Effortful Control:</b>	5.35 (0.80)	5.55 (0.57)	4.25 (1.04)	0.015*	5.56 (0.61)	5.65 (0.26)	4.86 (0.93)	4.13 (1.00)	0.001*
<b>Attention Control</b>	4.87 (1.26)	5.09 (1.13)	3.62 (1.31)	0.024*	5.24 (0.97)	4.53 (2.06)	3.67 (0.41)	3.63 (1.57)	0.006*
<b>Inhibitory Control</b>	4.98 (1.07)	5.24 (0.85)	3.55 (1.09)	0.005*	5.30 (0.78)	5.61 (0.67)	3.60 (1.00)	3.57 (1.13)	0.001*
<b>Perceptual Sensitivity</b>	5.44 (1.03)	5.56 (1.00)	4.80 (1.02)	0.104	5.62 (1.06)	5.24 (0.41)	4.90 (1.45)	4.85 (0.39)	0.273
<b>Low-Intensity</b>	5.89 (0.54)	5.94 (0.53)	5.66 (0.56)	0.255	6.00 (0.50)	5.88 (0.44)	5.28 (0.57)	5.70 (0.55)	0.061
<b>Negative Affectivity:</b>	4.15 (0.75)	4.10 (0.79)	4.38 (0.42)	0.201	4.08 (0.77)	4.10 (1.20)	4.42 (0.58)	4.38 (0.22)	0.742
<b>Frustration</b>	3.96 (1.22)	3.76 (1.19)	5.07 (0.71)	0.005*	3.72 (1.14)	3.35 (1.43)	4.83 (0.78)	5.29 (0.73)	0.012*
<b>Fear</b>	3.61 (1.22)	3.52 (1.21)	4.08 (1.26)	0.307	3.38 (1.14)	4.46 (1.74)	3.22 (1.10)	4.78 (0.31)	0.037*
<b>Discomfort</b>	4.02 (1.19)	4.01 (1.25)	4.10 (0.93)	0.837	4.04 (1.34)	3.50 (0.36)	4.66 (0.45)	3.78 (0.87)	0.563
<b>Sadness</b>	4.10 (0.97)	3.95 (0.92)	4.99 (0.78)	0.011*	3.88 (0.90)	4.25 (1.35)	4.88 (0.87)	4.83 (0.72)	0.061*
<b>Soothability</b>	4.76 (1.16)	4.99 (1.03)	3.54 (1.15)	0.015*	5.10 (0.93)	5.05 (0.82)	2.84 (0.97)	3.93 (1.14)	0.001*
<b>Extraversion/Surgency:</b>	4.30 (0.48)	4.26 (0.49)	4.50 (0.35)	0.158	4.22 (0.51)	4.45 (0.35)	4.50 (0.13)	4.52 (0.42)	0.374
<b>Activity</b>	4.77 (0.99)	4.59 (0.93)	5.74 (0.69)	0.005*	4.62 (0.92)	4.33 (1.05)	5.43 (1.26)	5.55 (0.74)	0.087
<b>Shyness</b>	3.63 (1.42)	3.60 (1.34)	3.78 (1.98)	0.827	3.65 (1.41)	3.19 (1.02)	2.71 (1.36)	4.63 (1.61)	0.214
<b>High-Intensity</b>	5.17 (0.81)	5.10 (0.84)	5.52 (0.59)	0.133	5.13 (0.82)	4.63 (0.40)	5.73 (1.06)	5.38 (0.62)	0.259
<b>Smiling and Laughter</b>	5.85 (0.90)	5.88 (0.90)	5.64 (0.94)	0.552	5.93 (0.91)	5.66 (0.88)	5.61 (1.23)	5.63 (0.81)	0.809
<b>Impulsivity</b>	4.48 (0.95)	4.33 (0.88)	5.32 (0.96)	0.035*	4.25 (0.86)	4.71 (0.93)	5.63 (1.18)	4.92 (0.73)	0.023*
<b>Positive Anticipation</b>	5.22 (0.74)	5.17 (0.77)	5.50 (0.44)	0.133	5.13 (0.76)	5.27 (0.55)	5.75 (1.04)	5.37 (0.31)	0.434

\*Indicates statistically significant P-value

Table 3. Temperament Scales Associations with Demographic Variables

Temperament Scales	Gender		P-Value	ASA Stats		P-Value	Insurance		
	Male N=27	Female N=19		I N=34	II N=11		DSHS N=33	Private N=13	P-Value
	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
<b>Effortful Control</b>	5.20 (0.89)	5.57 (0.60)	0.109	5.40 (0.71)	5.23 (1.09)	0.630	5.33 (0.87)	5.41 (0.62)	0.716
<b>Attention Control</b>	4.67 (1.46)	5.14 (0.88)	0.188	4.95 (1.17)	4.76 (1.55)	0.717	4.71 (1.39)	5.27 (0.75)	0.084
<b>Inhibitory Control</b>	4.91 (1.11)	5.07 (1.04)	0.614	5.01 (1.08)	4.98 (1.10)	0.935	4.90 (1.13)	5.17 (0.93)	0.414
<b>Perceptual Sensitivity</b>	5.10 (1.05)	5.93 (0.79)	0.004*	5.40 (1.08)	5.65 (0.89)	0.436	5.47 (1.02)	5.36 (1.09)	0.746
<b>Low-Intensity</b>	5.86 (0.52)	5.94 (0.57)	0.637	5.90 (0.55)	5.90 (0.54)	0.990	5.89 (0.58)	5.89 (0.45)	0.963
<b>Negative Affectivity</b>	4.12 (0.76)	4.18 (0.74)	0.747	4.22 (0.82)	3.88 (0.42)	0.080	4.13 (0.69)	4.17 (0.91)	0.901
<b>Frustration</b>	3.97 (1.31)	3.94 (1.13)	0.921	4.02 (1.26)	3.69 (1.16)	0.439	3.92 (1.21)	4.04 (1.29)	0.777
<b>Fear</b>	3.66 (1.28)	3.54 (1.17)	0.737	3.64 (1.31)	3.41 (0.77)	0.499	3.75 (1.10)	3.25 (1.48)	0.288
<b>Discomfort</b>	4.13 (0.23)	3.86 (1.21)	0.459	4.10 (1.20)	3.76 (1.24)	0.446	4.11 (1.05)	3.78 (1.52)	0.486
<b>Sadness</b>	4.13 (1.04)	4.08 (0.89)	0.860	4.14 (0.97)	3.83 (0.84)	0.312	4.07 (0.85)	4.19 (1.25)	0.757
<b>Soothability</b>	4.79 (1.11)	4.73 (1.26)	0.868	4.86 (1.18)	4.62 (1.07)	0.526	4.54 (1.18)	5.32 (0.93)	0.025*
<b>Extraversion/ Surgency</b>	4.26 (0.48)	4.35 (0.48)	0.628	4.21 (0.48)	4.50 (0.33)	0.030*	4.33 (0.44)	4.21 (0.57)	0.482
<b>Activity</b>	4.83 (0.98)	4.67 (1.02)	0.587	4.66 (1.03)	4.97 (0.80)	0.322	4.75 (1.05)	4.80 (0.85)	0.865
<b>Shyness</b>	3.90 (1.51)	3.25 (1.24)	0.113	3.50 (1.43)	3.85 (1.39)	0.483	3.71 (1.37)	3.42 (1.61)	0.572
<b>High-Intensity Pleasure</b>	5.12 (0.75)	5.23 (0.92)	0.681	5.15 (0.85)	5.18 (0.74)	0.907	5.16 (0.79)	5.17 (0.90)	0.958
<b>Smiling and Laughter</b>	5.75 (1.04)	5.98 (0.68)	0.358	5.81 (0.92)	6.10 (0.75)	0.294	5.83 (0.81)	5.89 (1.13)	0.836
<b>Impulsivity</b>	4.49 (0.90)	4.48 (1.03)	0.991	4.50 (1.00)	4.43 (0.86)	0.826	4.44 (0.92)	4.60 (1.06)	0.628
<b>Positive Anticipation</b>	5.26 (0.69)	5.17 (0.81)	0.697	5.19 (0.69)	5.30 (0.95)	0.741	5.27 (0.69)	5.10 (0.87)	0.535

\*Indicates statistically significant P- value

*Appendix A: Description of Temperament Categories*

<b>Scale</b>	<b>Definition</b>
<b>Effortful Control</b>	Voluntary and willful control of attention and behavior
<b>Attention Control</b>	Tendency to maintain attentional focus upon task-related channels
<b>Inhibitory Control</b>	The capacity to plan and to suppress inappropriate approach response under instructions or in novel or uncertain situations
<b>Perceptual Sensitivity</b>	Detection of slight, low-intensity stimuli from the external environment
<b>Low Intensity Pleasure</b>	Amount of pleasure or enjoyment related to situations involving low stimulus intensity, rate, complexity, novelty, and incongruity
<b>Negative Affectivity</b>	Inclination to experience negative affect related to interruption of ongoing tasks or goal blocking
<b>Frustration</b>	Amount of negative affect related to interruption of ongoing tasks or goal blocking
<b>Fear</b>	Amount of negative affect, including unease, worry or nervousness related to anticipated pain or distress and/or potentially threatening situations
<b>Discomfort</b>	Amount of negative affect related to sensory qualities of stimulation, including intensity, rate or complexity of light, movement, sound, texture
<b>Sadness</b>	Amount of negative affect and lowered mood and energy related to exposure to suffering, disappointment and object loss
<b>Soothability</b>	Rate of recovery from peak distress, excitement, or general arousal
<b>Extraversion/Surgency</b>	Amount of motor activity, such as pace, quantity and intensity of walking, talking, and thinking
<b>Activity level</b>	Level of gross motor activity including rate and extent of locomotion
<b>Shyness</b>	Slow or inhibited approach in situations involving novelty or uncertainty
<b>High Intensity Pleasure</b>	Amount of pleasure or enjoyment related to situations involving high stimulus intensity, rate, complexity, novelty, and incongruity
<b>Smiling and Laughter</b>	Amount of positive affect in response to changes in stimulus intensity, rate, complexity, and incongruity
<b>Impulsivity</b>	Speed of response to initiation
<b>Positive Anticipation</b>	Amount of excitement and positive anticipation for expected pleasurable activities

Appendix B: Frankl Behavior Scores

<b>Frankl Behavior Score</b>	<b>Description</b>
<b>( -/- ) Definitely Negative</b>	Refusal of treatment, forceful crying, fearfulness, or any other overt evidence of extreme negativism.
<b>( - ) Negative</b>	Reluctance to accept treatment, uncooperative, some evidence of negative attitude but not pronounced (sullen, withdrawn)
<b>( + ) Positive</b>	Acceptance of treatment; cautious behavior at times; willingness to comply with the dentist, at times with reservation, but patient follows the dentist's directions cooperatively.
<b>( +/+ ) Definitely Positive</b>	Definitely positive. Good rapport with the dentist, interest in the dental procedures, laughter and enjoyment.

Appendix C: *Demographic and treatment variables collected from patient chart audit*

<b>Demographic Variables</b>	
<b>Age</b>	
<b>Sex</b>	
<b>ASA Status</b>	
<b>Insurance Status</b>	
<b>Treatment Complexity</b>	
	Complex (SSC, pulp therapy, extraction)
	Simple (fluoride, sealants, intracoronary restorations)