Assessing Temperament as a Predictor of Oral 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

2014

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Program Authorized to Offer Degree:
School of Dentistry

University of Washington

Abstract

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Purpose: To investigate whether temperament as measured by the Children's Behavior Questionnaire Short Form (CBQ-SF) is associated with success in oral sedation.

Methods: Child-caregiver dyads were enrolled from patients presenting for midazolam, meperidine, and hydroxyzine, oral sedation. Children between 43 and 96 months of age, ASA I or II, able to take radiographs, whose parents believed he/she would swallow oral medications were enrolled. To assess child temperament, caregivers completed the CBQ-SF. Behavior during sedation was measured at timed intervals and overall sedation results were recorded using the Houpt Behavior Rating Scale. Failure was defined by Houpt overall ratings of fair or worse. The presence of disruptive behavior was also quantified.

Results: The sample population consisted of 61 patient-caregiver dyads with 62% female patients (N=38), an average age of 70 months (SD=13.9), and 51% (N=31) of patients insured by Medicaid. The majority of treatment times were over 60 minutes (53%, N=32). The overall sedation failure rate was 13% (N=8). Presence of disruptive behavior was 28% (N=17). There was not a significant difference in failure rate or presence of disruptive

behavior with respect to age, sex, ASA status, insurance status, reason for sedation, or type of treatment provided. A two sample t-test revealed that children with higher values for impulsivity were significantly more likely to have disruptive behavior (p=.043).

Conclusions: The results of this study suggest that impulsivity may be an important determinant of a child's behavior during sedation, and patient temperament should be considered in case selection for oral sedation.

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ACKNOWLEDGEMENTS

I wish to express sincere appreciation to all of the members of my thesis committee: Drs. Travis Nelson, JoAnna Scott, and Sarat Thikkurissy. Thank you for all your insight, time, and support. Additional thanks to my research assistant, MacKenzie Smith, for all her time spent entering data and to the residents and assistants at the Center for Pediatric Dentistry for their thorough sedation records.

DEDICATION

I dedicate my thesis to:

My husband, Matt, for making me laugh every day.

My mentor, Dr. Nelson, for being the kind of clinician I aspire to be and helping me figure out how to get there.

I. INTRODUCTION

The primary reason for referrals to pediatric dentists is the presence of dental fear and anxiety (DFA) and/or dental behavior management problems (DBMP) in a child who needs dental treatment.[1] Such conditions affect about 9% of children in normal populations of children in Australia, Europe, Canada and the USA.[2] To overcome DFA and DBMP in children, procedural sedation has been employed to protect the developing psyche and allow successful dental treatment.

Moderate sedation (formerly conscious sedation), as defined by the American Academy of Pediatric Dentistry (AAPD) is "a drug-induced depression of consciousness during which patients respond purposefully to verbal commands."[3] Members of the AAPD reported 73% of moderate sedation cases were successful, with success defined as treatment without interruption, but allowing for some patient crying or movement.[4] The true success rate is difficult to assess from the literature due to the variety of drug combinations, dosages, and criteria of determining sedation outcome.[5] Failed sedation appointments represent a waste of resources both for the dentist and family, but more importantly may be the source of future dental fear or anxiety for the patient. Thus it is in the best interest of all parties to maximize moderate sedation success.

A number of factors have been shown to affect sedation success, including gender,[6–8] age,[6,9,10] drug regimen,[11,12] obesity [13], and temperament.[10,14] The operator can also influence the reported sedation outcome through various factors such as provider experience, alteration of the drug regimen, and establishing the criteria by which they select patients for sedation, and determining how they define success.

A wide variety of medications are used for oral sedation in the dental setting. Sedative-hypnotics such as chloral hydrate function primarily to cause sedation (a relaxed, calm, or sleepy condition). Anti-anxiety agents like Midazolam function to decrease anxiety. Narcotics such as meperidine are used to cause analgesia, but can also cause sleepiness.[15] These agents can be used alone, in combination with each other, and/or with nitrous oxide inhalation anesthesia. One of the objectives of nitrous oxide use identified in the AAPD guidelines is potentiating the effects of sedative medications.[16] In very high concentrations it can also produce deep sedation or general anesthesia.[17] Numerous studies have attempted to determine the ideal dose, combination, and route of administration for various sedative agents, however the optimum combination of medications may vary according to operator preferences, patient characteristics, and treatment conditions.[18]

Apart from those studies that have investigated various pharmacologic regimens, there is relatively little research on factors that predict oral sedation success. One factor that may guide successful case selection is patient temperament. Over the past 70 years, temperament research has undergone a fundamental transformation. As this field of research matures it will hopefully offer increasingly accurate methods of temperament assessment that may aid in the selection of pediatric treatment modalities.

Before the 1960's, prevailing theories of children's psychological development proposed that a child is a "tabula rasa", or blank slate, that is imprinted upon by external forces. These external forces were considered the major formative factors in child behavior patterns.[19] In the late 1950's, Stella Chess and Alexander Thomas began studying behavior patterns in infants by following 141 infants over the course of 6 years and interviewing their parents regularly. Based on their results, they hypothesized that children are not "blank slates"; rather they have internal influences that lead to

inherent individual differences in their reactions and motivations. Thomas and Chess defined these innate differences as a child's 'temperament'. They described nine temperament factors that influenced psychological development in all participants .[20–22]

Following the landmark Thomas and Chess study, a growing body of research has elucidated the components of temperament and their behavioral implications. In the 1970's, Buss and Plomin distilled the nine factors that Thomas and Chess used to describe temperament to three factors: Emotionality (degree of emotional distress), Activity (tempo and vigor of a child's energy level), and Sociability (the preference for being with others). This three-factor model, known as the EAS theory, showed an improved ability to predict behavior over the nine factors described by Thomas and Chess.[23]

Contemporary research has shifted focus to the biological basis for temperament. This line of research relies on the assumption that variations in temperament are due to differences in how quickly and to what extent the behavioral neuroregulatory systems are activated and/or suppressed.[19] Rothbart and Derryberry redefined temperament as "individual differences in *reactivity* and *self-regulation* assumed to have a *constitutional* basis." The term *reactivity* refers to the "excitability of the behavioral and physiological systems of a child", while *self-regulation* refers to "neural and behavioral processes that function to modulate this innate reactivity". The *constitutional basis* describes the "relatively constant biological makeup of an individual, which is influenced by heredity, maturation, and experience."[24]

Rothbart et al. developed the Children's Behavior Questionnaire (CBQ) to measure the temperamental characteristics of pre-school and early school-age children. This questionnaire provides a more comprehensive evaluation than other available tools, as it evaluates subjects on 15

different dimensions. (Table 1) These dimensions cluster into three main factors: Extraversion/Surgency, Negative Affectivity, and Effortful Control. Extraversion/Surgency is associated with rapid response initiation (impulsivity), high activity level, risk taking, and comfort with new social situations.[24] Simply put, Extraversion/Surgency refers to the "amount of motor activity, such as pace, quantity and intensity of walking, talking, and thinking."[19] Negative Affectivity is defined as the inclination to experience and express negative emotions. Effortful Control is defined as the child's voluntary and willful control of attention and behavior.[24] Together Extraversion/Surgency and Negative Affectivity measure the reactivity aspect of a child's temperament, whereas Effortful Control measures self-regulation.[19]

Temperament research in the medical and dental field has employed a variety of psychological instruments to determine how variations in temperaments translate to different responses during medical/dental procedures. Schechter et al found that children's distress during immunization was associated with Adaptability and Rhythmicity as assessed by the Behavioral Style Questionnaire (BSQ), a tool based on the theories of Thomas and Chess.[25] Kain et al used an instrument derived from EAS theory to determine that children with lower levels of Activity and Impulsivity were more compliant during induction of anesthesia.[26] Using the CBQ, Salmon and Pereira found that children with higher Effortful Control scores exhibited more coping behaviors during an aversive medical procedure.[27]

The majority of temperament research in dentistry has focused on the Thomas and Chess model.[6,14,28–30] For example, Radis et al used the BSQ to evaluate child behavior during a dental exam. They found that quiet behaviors were associated with Approachability and Adaptability, while higher scores in Intensity and Activity predicted crying.[28] Using another derivative of this model (the Toddler Temperament Scale), Lochary et al found that the

characteristics of Approach/Withdrawal and Adaptability were predictive of behavior during oral sedation for dental treatment.[30] Using the EAS Scale of Child Temperament, Quinonez et al found that Shyness was associated with disruptive behavior in the dental general anesthesia pre-surgical setting.[10] More recently, Isik et al found that psychosomatic behavior problems and inflexible temperament were associated with failure of oral sedation for dental treatment.[14]

Over time the study of temperament has been progressively refined. Currently the CBQ and its counterparts the CBQ-Short Form (CBQ-SF) and CBQ-Very Short Form are the most commonly used temperament assessment tools in psychology research.[31] To date, the CBQ instruments have not been used to evaluate children's behavior during dental treatment or under moderate sedation. The purpose of this research project is to investigate whether temperament as measured by the CBQ Short Form is associated with oral sedation success in the dental setting.

II. METHODS

This study was conducted after receiving approval from the University of Washington Institutional Review Board (#44487). 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 sedation appointment. As part of the informed consent process, caregivers were told that the patient's treatment would in no way be impacted by the decision to participate.

Participants

Sixty-one child-caregiver dyads participated in the study from February 26th, 2013 to December 31st, 2013. The ages of the children receiving treatment ranged from 36-95 months. They were ASA I or II, able to take diagnostic radiographs, had Brodsky grade I or II tonsils, and were scheduled to receive a combination of meperidine, midazolam, hydroxyzine oral sedation at the University of Washington Center for Pediatric Dentistry (CPD). Patient caregivers also had to believe he/she would swallow oral medication. Exclusion criteria were non-English reading caregivers, caregivers under the age of 18, and children who had previously enrolled in the study.

Administration of Temperament Rating Instrument

During the child's sedation 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 (Table 1) as well as the overall dimensions of *Negative Emotion, Effortful control,* and *Surgency/Extraversion*. The CBQ-SF was developed for use in situations in which the full questionnaire, comprised of 195 questions, is not practical. The CBQ-SF has been validated and is nearly as reliable as the standard length CBQ.[32]

Sedation Procedure

Children presenting to the CPD Sedation Clinic were assessed preoperatively and baseline vital signs were recorded. Current height and weight measurements were taken, the patient's heart and lungs were auscultated, and NPO status was verified. Patients were administered 0.3 mg/kg of Midazolam, 1.0 mg/kg of hydroxyzine, and 1.5 mg/kg of Meperidine mixed with $\leq$ 5 mL Humco brand raspberry flavored syrup. Patients waited in the sedation waiting area for a latent period that averaged 53 minutes (SD=9), they were taken to the operatory and placed on a Pedi-wrap protective stabilization device. To facilitate observation of the child's respiration only the lower portion of the

device was applied to the patient. If movement during the procedure became significantly disruptive, the upper portion and/or wrist cuffs were applied. A pre-chordal stethoscope was attached to the patient and connected to an external speaker system. Vital signs (non-invasive blood pressure (NIBP), heart rate, respiratory rate, and oxygen saturation)and behavioral ratings were recorded at 5 minute intervals.

A nasal hood was placed and N_2O/O_2 was initially titrated to 50/50%. If the patient fell asleep during the procedure, the concentration was reduced. After the dental procedure was complete, patients were administered 100% oxygen for a minimum of 5 minutes. Patients had the option of watching internet-streaming video during the sedation procedure. All dental procedures were provided by the pediatric dentistry residents or faculty of the CPD.

Following completion of the sedation procedure patients were given juice for rehydration and normalization of blood sugar and discharged with an accompanying adult to the waiting area. After a waiting period of 10-15 minutes, all patients were assessed for accepted discharge criteria of alertness, orientation, and ability to stand without support.[33] Patients were discharged from the clinic once the criteria were met. A follow up phone call was made the evening after the dental procedure.

Rating and Monitoring of Behavior

Behavior during the sedation and overall sedation result were measured using the Houpt Behavior Rating Scale (HBRS) (Table 2). [34] The Houpt behavior rating scale was developed in 1985 and is the most commonly used behavior rating scale in recent sedation research.[18] It employs multiple parameters in determining sedation success. Initially the patient is rated at different time periods for sleep, movement, and crying. At completion, the overall sedation outcome is rated at six levels ranging from aborted to excellent.[34]

Behavior ratings were assessed at baseline (BL) and in 5 minute increments once the patient was brought back to the operatory. The procedures performed during treatment were recorded as: placement of monitors and the settling period (M/S), delivery of local anesthesia (LA), placement of rubber dam (RD), operative procedures (O), extractions (E), and completion (C). A successful sedation outcome was defined as a Houpt rating of good, very good, or excellent according to Isik et al. [14] Presence of disruptive behavior was defined as any behavior rating of 1 or 2 throughout the duration of the sedation appointment.[30,35]

Behavior ratings, overall sedation success, and vital signs were recorded by sedation monitors who were blinded to the child's CBQ-SF score. Monitors were either pediatric dental residents, dental assistants, or faculty at the CPD. Monitors were initially calibrated during a formal group training session. Subsequently, as needed, new sedation monitors were calibrated individually by one of the primary investigators.

Data Analysis and Statistics

Following the patient's sedation appointment a review of the chart and sedation record was conducted and the demographic and treatment variables were collected (Table 3). Temperament scores were calculated using the methods included with the CBQ-SF and CBQ-VSF instruments. Patient demographic information and sedation results were assessed with descriptive statistics. Demographic and treatment variables were tested for association with failure and presence of disruptive behavior with Fisher's Exact test when cell counts were less than 5. When cell counts were greater than 5, a Chi-squared test was used. Temperament scales were assessed for association with sedation failure, presence of disruptive behavior, and gender using a Two-Sample T-test with equal variances.

III. RESULTS

Demographic and treatment variables

Sixty-one patient-caregiver dyads were enrolled, with 62.3% female patients (N=38). Patient age ranged from 43 to 95 months with an average age of 70 months (SD=13.9), and 50.8% were insured by Medicaid. The majority of patients were ASA I (80.3%) and required complex dental treatment (62.3%), defined in Table 3. Most patients were scheduled for sedation for multiple reasons (42.6%), as opposed to one of five individual factors (Table 3). Average treatment duration was 55.5 minutes (SD=15.7). No clinically significant deviation from baseline vital signs occurred during sedation procedures. Sedation related side effects reported by caregivers included nausea and vomiting (4.9%) and lethargy (14.7%).

The overall sedation failure rate was 13% (n=8). Presence of disruptive behavior was 28% (n=17) (Table 4). There was not a statistically significant difference in failure rate or presence of disruptive behavior with respect to age, sex, ASA status, insurance status, reason for sedation, or complexity of treatment provided. Duration of treatment that was less than 30 minutes was significantly associated with sedation failure (p=0.034).

Detailed sedation outcomes are recorded in Table 5. Results were polarized. Excellent (n=29) and very good (n=14) ratings accounted for the majority of successful visits, while poor (n=6) and aborted (n=2) ratings comprised the majority of failures. Comparatively few patients were categorized as good (n=9) or fair (n=1). Overall outcome ratings did not differ significantly by age, sex, ASA status, insurance status, reason for sedation, treatment duration, or complexity.

Temperament and Behavior

An overall trend in temperament scores was recognized within successful and failed treatment. For all temperament dimensions within the domains of Effortful Control, the mean scores for the successful treatment group were greater, while values for Negative Affectivity and Extraversion/Surgency were lower. However, there was no statistically significant difference in mean temperament scores for successful and failed treatment. Results of a two sample t-test with equal variance showed that Impulsivity was significantly associated with increases in the presence of disruptive behavior (p=0.043) (Table 6). Temperament scores were also assessed by gender. (Table 7) A two sample t-test with equal variance found that males had significantly greater mean Activity scores than females (p=0.049) and females had significantly greater mean Shyness scores than males (p=0.011). The assumption of equal variances appear to be valid for all T-tests.

Mean Houpt behavioral scores are displayed in Table 8. Average behavioral scores were greater than 3 for all treatment time points, with lowest behavior scores recorded during extractions (mean= 3.36).

IV. DISCUSSION

Overall Sedation Success

The overall success rate as assess using the Houpt Behavioral Rating Scale (HBRS) was 87%. The HBRS was chosen because of its reliability and frequency of use in other sedation research.[36,37] The HBRS confers a behavioral rating based upon alertness, crying, and movement throughout the procedure and allows for a separate rating of overall sedation

success. Because of this separation, a patient that exhibits some negative behavior during any part of the procedure may still have the sedation deemed an overall success.

Factors such as patient age, drug regimen, dosing, latent period, gender, and treatment needs have been shown to affect sedation success.[6–14] Our success rate was substantially higher than the 56% success rate Sheroan et al achieved utilizing the same drug combination.[38] A number of variations in study methodology may account for this discrepancy. All children in the Sheroan study had a history of failed restorative treatment using basic behavior guidance techniques, which may indicate that the children within that sample had more challenging baseline behavior. The medication dosages used were not the same, and a similar but non-identical rating system was used to assess success. The latent period used by Sheroan et al was also shorter, 30 minutes compared to our 53 minute latent period. Therefore, as previously noted, it is extremely difficult to compare success rates between studies even when the same drug combination is used.[5,18]

It is interesting to note that our higher success rate was achieved with lower dosages and a longer latent period. This suggests that dentists may see more gains in overall sedation success by altering patient selection criteria than they will with modifications to sedation drug regimens.

Temperament

The purpose of this study was to determine if any of the temperament dimensions, as measured by the CBQ Short Form, were associated with oral sedation success. The Rothbart questionnaires are the most frequently used temperament tools in developmental research.[31] They are designed to incorporate several key advances in temperament theory that Rothbart

introduced. First, the basis of temperament is differences in biological activity levels. Second, some dimensions (such as Inhibitory Control) appear later and can affect the expression of other dimensions. Other temperament evaluation tools are more restrictive and only evaluate traits that are stable over time. Third, Rothbart's theory focuses on inhibition over reactive processes. Fourth, the effect of environment on a child's temperament is taken into consideration. For these reasons, the CBQ tools are more inclusive than other available temperament assessment tools.[39]

The CBQ-SF evaluates the following dimensions: Attention Control, Inhibition Control, Perceptual Sensitivity, Low Intensity Pleasure, Frustration, Fear, Discomfort, Sadness, Soothability, Activity Level, Shyness, High Intensity Pleasure, Smiling and Laughter, Impulsivity, and Positive Anticipation. Using factor analysis, Rothbart found that these could be condensed into three broad dimensions: Extraversion/Surgency, Negative Affect, and Effortful Control.

We found that Impulsivity, as assessed by the CBQ-SF, was significantly associated with the presence of disruptive behavior during oral sedation. Impulsivity is how quickly a child initiates a reaction. Patients that are highly Impulsive in the dental office may grab at instruments that are being introduced in the mouth, be more vocal, or have difficulty remaining in the dental chair. Examples of statements in the CBQ-SF that assess impulsivity are: "usually rushes into an activity without thinking about it," "tends to say the first thing that comes to mind, without stopping to think about it."[32] Patients that exhibit this type of behavior might not be good candidates for sedation.

Effortful Control is a measure of the individual's ability to self-regulate.[39] Effortful Control and Impulsivity are interconnected. A child who has higher Impulsivity scores may not manifest impulsive behavior due to the mitigating effect of higher levels of Effortful Control. Children with higher levels of Effortful Control may be able to have intraoral radiographs taken, even if it is difficult for them. They may also be able to sit in the dental chair, even if they are scared. In short, they will show persistence in the face of dental fear or anxiety. In our patient population we observed a trend of lower scores in the Effortful Control temperament constellation. This suggests that those patients who are capable of limiting their response to aversive stimuli will have more successful treatment visits than those who are not.

The lack of uniformity that makes research comparison difficult in sedation research is also present in temperament research.[21] Dimensions among different temperament instruments may be similar, but cannot be used interchangeably. The broad dimensions that Rothbart identified are most similar to the EASI dimensions. Emotionality is the tendency of a child to become upset, which is similar to Negative Affect. Activity is a reflection of the child's tendency to be "on the go," and Sociability describes how easily the child makes friends. These two categories are mostly contained within the dimension of Extraversion/Surgency. Impulsivity, the level of self-control a child has, is related to Effortful Control. It effectively measures the opposite characteristic, i.e., a *lack* of Effortful Control.

Kain et al found Impulsivity, as assessed with the EASI instrument, was associated with negative outcomes in children undergoing anesthesia induction .[26] Impulsivity was also significantly associated with negative behavior amongst children receiving midazolam pre-medication prior to anesthesia induction using the EASI model.[40] Thus, Impulsivity appears

to be an important determinant of a child's ability to tolerate medical procedures. Although sedation decreases a child's response to aversive stimuli, in children with high levels of Impulsivity the moderate level of sedation induced by oral medications may not be sufficient to attenuate behavioral outbursts. Deep sedation, general anesthesia, and deferred or alternative treatments may be more effective for patients with high levels of Impulsivity.

These findings have significant implications for pediatric oral sedation case selection. Although individual studies have not yet been able to identify an exact temperament constellation that is strongly associated with treatment acceptance, a general theme emerges from the body of research (Table 9). This theme suggests that children with higher levels of self-control, lower levels of activity, and those who are more outgoing tend to have more successful experiences with medical and dental treatment. This study greatly emphasizes the role of child temperament in pediatric procedural sedation case selection, and further establishes the importance of selecting children with lower levels of Impulsivity and greater ability to self-regulate.

Demographic Variables

Age did not affect sedation outcome in the current study. The current evidence regarding the effect of age on sedation behavior is contradictory. Kain et al found that younger children did not respond as well to midazolam sedation prior to anesthesia induction.[9] However, others found no statistical difference in behavior during midazolam sedation for restorative dental treatment among 2, 3, and 4 year olds.[6] This may be due to the fact that subjects were less than 5 years of age. In other studies a significant difference was observed between younger children and those older than five years old.[41,42] The current study population ranged from children aged 36-95 months. For analysis we divided our study population in two

groups at a midpoint of 67 months (5.5 years) and found no significant difference in sedation outcome or presence of disruptive behavior. Although it has been suggested that younger patients may require deeper levels of sedation because of more limited coping skills, our results did not reinforce that concept. This finding may provide further support for the importance of selecting children for oral sedation based upon temperament, rather than a specific age range.

In the current study, a higher proportion of the subjects were female (62.3%). The reason for this is unclear, however it may be a result of a cultural bias. Perhaps caregivers or dental providers were likely to choose sedation for young girls in an effort to spare them from unpleasant dental experiences or because of a belief that females are less capable of tolerating dental treatment. Females had significantly higher scores for Shyness assessed by the CBQ-SF (p=0.011), so perhaps this population was selected for sedation based on observation of shyness at their pre-operative dental visit.

Although there was no statistical difference in sedation outcome or presence of disruptive behavior between sexes, males tended to have more disruptive behavior. In the current study, males scored higher in the activity temperament dimension (p=0.049), which may explain higher levels of disruptive behavior. Patients that are more active may have a difficult time remaining still during dental treatment.

In other research boys have been observed to be more disruptive at separation from their parents for general anesthesia,[10] and tended to exhibit more negative behavior during dental treatment under oral sedation, although this result was also not significant.[6] These results are contrary to the findings of Needleman et al, who found boys had significantly better

outcomes when sedated with a combination of chloral hydrate, hydroxyzine, and nitrous oxide for dental treatment.[7]

In our study there was no association between insurance status and sedation outcome or behavior. In other reports, it has been suggested that children with Medicaid insurance have a tendency to exhibit more negative behavior during treatment than their more affluent peers. [43] This is important, because children of low socioeconomic status often bear the burden of a disproportionately high level of dental disease.[44–46] This population often has greater treatment needs, and therefore may potentially benefit from pharmacologic techniques such as sedation. These findings support selecting children for sedation based upon temperament and treatment needs, not insurance.

Treatment Variables

Shorter treatment duration was associated with sedation failure. This most likely reflects failures that occurred early on in the sedation appointment and may have been cause for aborting treatment. This is in contrast to a successful sedation appointment, where the patient was cooperative, allowing treatment to be completed over a longer period of time. Although it might be expected that longer treatment times would be associated with a greater number of failures due to working beyond the expected duration of sedative medications, this finding was not observed. The average treatment time was 55 minutes, indicating that compliant patients may be expected to cooperate for approximately an hour of operative treatment with this drug combination and dosing.

A systematic review of pediatric dental sedation cited a lack of information on the type of dental treatment being provided as a potential confounder in past sedation research.[18] To

address this issue, treatment complexity was included as a variable in this study. This variable was designed to determine if therapies such as stainless steel crowns (SSCs), pulpotomies, and extractions may empirically create more behavior problems during dental treatment. Although no significant difference in success or presence of disruptive behavior was found with respect to the treatment complexity, average behavior ratings were lowest during extraction time periods. In general, the timing of extractions is dependent on operator preference and the overall treatment plan, however this observation may be reason to consider performing less stimulating procedures earlier in sedation appointments. This practice may promote cooperative behavior during the important initial stages of the appointment and increase the amount of treatment that can be performed in a single visit.

Study Limitations

One of the major limitations of this study was the variety of providers assessing patients for sedation, performing the dental treatment, and evaluating patient behavior during the sedation procedures. Individual operators can have a profound effect on the outcome of moderate sedation procedures, as the patient is often quite interactive and receptive to communicative behavioral techniques. Operators during the sedation appointments were pediatric dental residents that had varying levels of skill at managing disruptive behaviors. This effect may have been attenuated somewhat, due to the fact that the supervising dentist was the same in all cases.

Evaluators were initially calibrated, however behavioral rating is inherently subjective, and with numerous evaluators varying impressions of behavioral severity can be anticipated. This may have decreased the reliability of some observations.

We observed 8 sedation failures in 61 subjects. The low number of failed sedations in this study significantly limited the ability to detect meaningful temperament differences. In future research, larger patient numbers would likely enable statistical analysis with greater power and further elucidate characteristics that are associated with sedation success and failure. Since no correction for multiple testing was made, there is the possibility that a finding was found to be significant, when in reality it is not.

The relatively low rate of sedation failure in this study may be partly attributed to the pre-operative screening process. To meet inclusion criteria, patients were required to cooperate for radiographs. Taking diagnostic radiographs requires persistence and the ability to focus on a reasonably challenging task. This process may have eliminated from inclusion many patients with lower ability to maintain Effortful Control. Treatment for these patients was instead deferred, or they were treated under general anesthesia. Future research should evaluate temperament differences in patients that receive care under general anesthesia, oral sedation, nitrous oxide inhalation sedation, or local anesthesia only. Such data would prove valuable in selecting treatment modalities that are most likely to result in safe and effective care while preserving the psyche of the developing child.

V. CONCLUSIONS

1. Sedation success rate was not significantly associated with differences in age, sex, ASA status, insurance status, reason for sedation, or treatment complexity.
2. The CBQ-SF temperament scale of impulsivity was associated with the presence of disruptive behavior as assessed by the Houpt Behavior Scale ($p=0.043$).

3. Treatment duration less than 30 minutes was significantly associated with sedation failure ($p=0.034$), likely because treatment was terminated earlier due to poor behavior during failed sedation appointments.

Appendix A. Sedation Referral

Preoperative Sedation Checklist

Patient Name:_____ **Sex: M/F** **Age:** _____ **Date** _____

Primary Reason for Sedation: History of Failure with Basic Behavior Guidance Excessive Fear/Anxiety
Young Age Extent of Tx Necessary To Protect Psyche Distance Traveled

Medical History/Review of Systems:

Allergies_____

Current Medications/Drug Interactions_____

_____

Relevant Diseases_____

Cardiac_____

Pulmonary/Respiratory_____

Airway:

Brodsky: **I II** III IV

Mallampati: I II III IV

Contraindications:

Obesity	**Severe Macroglossia**
Snoring	**Limited Oral Opening**
Micrognathia	**Hx. Of Premature birth**

Hx. Recurrent respiratory infections
Hx. Frequent nose bleeds

Past History of Sedation/General Anesthesia_____

ASA Classification: I II

For ASA II patients: Is a medical consultation indicated Yes No

Selection Criteria (must answer YES to all questions)

Able to obtain radiographs (except in cases of limited treatment/extraction) Yes No

Parents/Clinician believe child will swallow medications Yes No

Patient Age >2yrs Yes No

Treatment will be accomplished in 2 or fewer sedation appointments Yes No

_____

Is this patient a candidate for in-office sedation? Yes No

Attending Signature_____

Resident Signature _____

Brodsky Classification

Mallampati Classification

Version 2.0

Appendix B. Sedation Record

Sedation Record

Patient Name:_____ **MR#**_____ **Sex:** M/F **Age:** _____ **Date** _____

Informed Consent Signed: Yes No

NPO Since: _____ **Weight:** _____**kg** **Normal Weight for age:**_____**kg** **Height**_____

Review of Systems:

Cardiac_____ Pulmonary_____ **Brodsky:** **I** **II** III IV **Mallampati:** I II III IV

Change in Medical Hx? Yes No _____
Recent Respiratory Illness? Yes No _____

Local Anesthesia Max: _____kg X _____mg/kg = _____ mg ÷ _____ mg/carpule = _____carpules = _____ ml

Naloxone: ____kg X 0.1mg/kg =____mg ÷ 0.4mg/ml = ____ml (repeat PRN q/2-3 min) Max = 2.0 mg/dose (5ml)

Flumazenil: ____kg X 0.01mg/kg =____mg ÷ 0.1mg/ml = ____ml (repeat PRN q/min) Max = 0.2mg/dose (2ml), 1mg total

Medications:

Midazolam: _____ kg x _____mg/kg = _____ mg ÷ 2 mg/ml = _____ ml waste = _____ ml

Meperidine: _____ kg x _____mg/kg = _____ mg ÷ 10 mg/ml = _____ ml waste = _____ ml

Hydroxyzine: _____ kg x _____mg/kg = _____ mg ÷ 2mg/ml = _____ ml waste = _____ ml

Diazepam: _____ kg x _____mg/kg = _____ mg ÷ 1mg/ml = _____ ml waste = _____ ml

_____ _____ kg x _____mg/kg = _____ mg ÷ _____mg/ml = _____ ml waste = _____ ml

Time of Administration:_____

Local Anesthesia Administered: _____ ml of _____

Time																	
Pulse																	
O_2 Sat																	
Resp																	
BP																	
N_2O %																	
Flow Rate																	
Treatment																	
Alertness																	
Movement																	
Crying																	

Sedation Results: *Excellent* *Very Good* *Good* *Fair* *Poor* *Aborted* Over Sedated

Discharge Time:_____Awake, Verbal, Ambulatory with Assistance **With (Caregiver's Name)** _____

Post-Op Call: Date:_____ Time:_____ By:_____ Spoke to:_____

Continues on reverse

Version 2.0

Post Op Disposition			
	Y	N	
Sleep			Did not sleep
			Slept in car on way home
			Napped at home <30 min
			Napped at home 30 min-1 hr
			Napped at home 1-2 hr
			Napped at home >2 hr
			Difficult to Awake
Nausea			Reports unpleasant sensation from stomach area
Vomiting			Has vomited since leaving dental office
Tissue Trauma			Has bit or scratched lip causing visible injury
Pain			No Pain
			Mild Pain
			Moderate Pain
			Severe Pain
			Controlled with:
Appetite			Average appetite
			Lack of appetite
			Unusually large appetite
Activity			Lethargic after returning home
			Played after returning home

Version 2.0

Appendix C. Behavior Coding Sheet

Behavior (Houpt Scale)

Record during:

- Baseline
- Parental separation
- Placement of monitors
- Local anesthetic administration
- Rubber dam application
- Every 5 minutes during treatment
- Completion

Alertness

1. Fully awake, alert
2. Drowsy, disoriented
3. Asleep

Crying

1. Hysterical crying
2. Continuous or strong crying
3. Intermittent or mild crying
4. No crying

Movement

1. Violent, interrupting treatment
2. Continuous, making treatment difficult
3. Controllable, not interfering with treatment
4. No movement

Sedation Results

Excellent: No crying or movement

Very Good: Some limited crying & movement

Good: Difficult but all treatment was performed

Fair: Treatment interrupted but eventually completed

Poor: Treatment interrupted, only partial treatment was completed

Aborted: No treatment rendered

Treatment

(B) Baseline

(M) Placement of Monitors/Settling

(LA) Local anesthetic administration

(RD) Rubber dam application

(O) Operative

(E) Extraction

(C) Completion

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Appendix D. Tables

Table 1. Temperament Scale Definitions: Children's Behavioral Questionnaire (CBQ)[19,32]

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

Table 2. Houpt scale for overall sedation result and behavior[34]

Overall Sedation Result	
Excellent	No crying or movement.
Very Good	Some limited crying or movement.
Good	Difficult, but all treatment was performed.
Fair	Treatment interrupted, but eventually completed.
Poor	Treatment interrupted, only partial treatment was completed.
Aborted	No treatment rendered.
Behavior Ratings	
Alertness	
1	Fully awake, alert
2	Drowsy, disoriented
3	Asleep
Crying	
1	Hysterical crying
2	Continuous or strong crying
3	Intermittent or mild crying
4	No crying
Movement	
1	Violent, interrupting movement
2	Continuous, making treatment difficult
3	Controllable, not interfering with treatment
4	No movement

Table 3. Demographic and treatment variables collected from patient chart audit

Demographic Variables
Age
Sex
ASA Status
Insurance Status
Height
Weight
Treatment Variables
Reason for Sedation
History of failure with basic behavior guidance
Excessive fear/anxiety AND/OR young age
To protect the developing psyche
Extent of treatment
Logistic concerns (ie: distance travelled)
Multiple reasons
Treatment complexity
Complex (SSC, pulp therapy, extraction)
Simple (fluoride, sealants, intracoronal restorations)
Vital Signs
Behavior Ratings
Overall Sedation Result
Post-operative complications

Table 4. Description of study participants by oral sedation success rate

Demographic Variables	Total N (%)	Sedation Result* Success N(%)	Failure N(%)	P value§	Presence of Disruptive Behavior† No N(%)	Yes N(%)	P value
Age (months)				0.715			0.301‖
36 – <67 months	28 (45.9)	25 (89.3)	3 (10.7)		22 (78.6)	6 (21.4)	
67 – 96 months	33 (54.1)	28 (84.8)	5 (15.2)		22 (66.7)	11 (33.3)	
Sex				0.461			0.127‖
Male	23 (37.7)	19 (82.6)	4 (17.4)		14 (60.9)	9 (39.1)	
Female	38 (62.3)	34 (89.5)	4 (10.5)		30 (79.0)	8 (21.0)	
ASA status				1.000			1.000§
I	49 (80.3)	42 (85.7)	7 (14.3)		35 (71.4)	14 (28.6)	
II	12 (19.7)	11 (91.7)	1 (8.3)		9 (75.0)	3 (25.0)	
Insurance status				0.746			0.390§
DSHS	31 (50.8)	26 (83.9)	5 (16.1)		23 (74.2)	8 (25.8)	
Private	29 (47.6)	26 (89.7)	3 (10.3)		21 (72.4)	8 (27.6)	
None	1 (1.6)	1 (100.0)	0 (0.0)		0 (0.0)	1 (100.0)	
Treatment Variables							
Reason for sedation				0.731			0.423§
History of failure	1 (1.6)	1 (100.0)	0 (0.0)		1 (100.0)	0 (0.0)	
Dental fear/anxiety OR young age	18 (29.5)	14 (77.8)	4 (22.2)		11 (61.1)	7 (38.9)	
Amount of treatment	10 (16.4)	9 (90.0)	1 (10.0)		8 (80.0)	2 (20.0)	
Protection of the developing psyche	6 (9.9)	6 (100.0)	0 (0.0)		6 (100.0)	0 (0.0)	
Multiple reasons	26 (42.6)	23 (88.5)	3 (11.5)		18 (69.2)	8 (30.8)	
Treatment duration				0.034¶			0.174§
>30 minutes	4 (6.5)	3 (75.0)	1 (25.0)		2 (50.0)	2 (50.0)	
≥30 minutes to <60 minutes	25 (41.0)	19 (76.0)	6 (24.0)		16 (64.0)	9 (36.0)	
≥60 minutes	32 (52.5)	31 (96.9)	1 (3.1)		26 (81.2)	6 (18.8)	
Treatment complexity				0.698			0.809‖
Simple	23 (37.7)	21 (91.3)	2 (8.7)		17 (73.9)	6 (26.1)	
Complex	38 (62.3)	32 (84.2)	6 (15.8)		27 (71.0)	11 (29.0)	

*Success determined by treatment completed is defined as patients who had a fair overall sedation result or better.

†Defined as any behavior ratings of 3 or 4 for crying and movement throughout the procedure.

‡At $\alpha = 0.05$, p value <0.05.

§P value obtained Fisher's exact test.

‖P value obtained using Chi Squared test.

¶ indicates a statistically significant result

Table 5. Overall outcome of oral sedation

Demographic Variables	Excellent N(%)	Very Good N(%)	Good N(%)	Fair N(%)	Poor N(%)	Aborted N(%)
Total	29 (47.5)	14 (23.0)	9 (14.8)	1 (1.6)	6 (9.8)	2 (3.3)
Age (months)						
36 – <67 months	14 (50.0)	7 (25.0)	4 (14.3)	0 (0.0)	3 (10.7)	0 (0.0)
67 – 96 months	15 (45.4)	7 (21.2)	5 (15.2)	1 (3.0)	3 (9.1)	2 (6.1)
Sex						
Male	6 (26.1)	7 (30.4)	6 (26.1)	0 (0.0)	3 (13.0)	1 (4.4)
Female	23 (60.5)	7 (18.5)	3 (7.9)	1 (2.6)	3 (7.9)	1 (2.6)
ASA status						
I	25 (51.0)	9 (18.4)	7 (14.3)	1 (2.0)	5 (10.2)	2 (4.1)
II	4 (33.3)	5 (41.7)	2 (16.7)	0 (0.0)	1 (8.3)	0 (0.0)
Insurance status						
DSHS	16 (51.6)	7 (22.6)	3 (9.7)	0 (0.0)	3 (9.7)	2 (6.4)
Private	13 (44.8)	7 (24.2)	6 (20.7)	0 (0.0)	3 (10.3)	0 (0.0)
None	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)
Treatment Variables						
Reason for sedation						
History of treatment failure	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Dental fear/anxiety or age	9 (50.0)	3 (16.6)	1 (5.6)	1 (5.6)	3 (16.6)	1 (5.6)
Amount of treatment	6 (60.0)	1 (10.0)	2 (20.0)	0 (0.0)	1 (10.0)	0 (0.0)
Protection of the psyche	2 (33.3)	3 (50.0)	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)
Multiple reasons	11 (42.3)	7 (26.9)	5 (19.2)	0 (0.0)	2 (7.7)	1 (3.9)
Treatment duration						
>30 minutes	2 (50.0)	0 (0.0)	0 (0.0)	1 (25.0)	0 (0.0)	1 (25.0)
≥30 minutes to <60 minutes	9 (36.0)	5 (20.0)	5 (20.0)	0 (0.0)	5 (20.0)	1 (4.00)
≥60 minutes	18 (56.3)	9 (28.1)	4 (12.5)	0 (0.0)	1 (3.1)	0 (0.0)
Treatment complexity						
Simple	12 (52.2)	5 (21.7)	3 (13.0)	1 (4.4)	0 (0.0)	2 (8.7)
Complex	17 (44.7)	9 (23.7)	6 (15.8)	0 (0.0)	6 (15.8)	0 (0.0)

Table 6. Temperament scores of study participants by oral sedation success rate

Temperament Scales	Overall Mean (SD)	Overall Sedation Outcome			Presence of Disruptive Behavior		
		Success Mean (SD)	Failure Mean (SD)	P value*	No Mean (SD)	Yes Mean (SD)	P value*
Effortful Control	5.31 (0.82)	5.33 (0.83)	5.16 (0.80)	0.591	5.36 (0.77)	5.19 (0.96)	0.469
Attention Control	4.66 (1.00)	4.70 (1.03)	4.40 (0.79)	0.423	4.73 (1.00)	4.49 (1.02)	0.396
Inhibitory Control	4.88 (1.02)	4.95 (0.99)	4.42 (1.14)	0.167	5.03 (0.91)	4.49 (1.20)	0.061
Perceptual Sensitivity	5.46 (0.95)	5.53 (0.92)	5.02 (1.14)	0.161	5.52 (0.97)	5.32 (0.92)	0.477
Low-Intensity Pleasure	5.79 (0.69)	5.80 (0.71)	5.74 (0.58)	0.822	5.83 (0.71)	5.69 (0.65)	0.481
Negative Affectivity	4.25 (0.65)	4.24 (0.66)	4.31 (0.60)	0.786	4.25 (0.69)	4.26 (0.53)	0.937
Frustration	4.31 (1.19)	4.26 (1.15)	4.69 (1.48)	0.348	4.16 (1.05)	4.72 (1.47)	0.102
Fear	3.84 (1.10)	3.78 (1.03)	4.25 (1.53)	0.260	3.75 (1.09)	4.06 (1.15)	0.337
Discomfort	3.95 (1.22)	3.95 (1.21)	3.96 (1.42)	0.991	4.02 (1.18)	3.78 (1.35)	0.485
Sadness	4.17 (0.86)	4.17 (0.87)	4.20 (0.80)	0.934	4.19 (0.80)	4.12 (1.02)	0.779
Soothability	4.95 (0.84)	4.99 (0.85)	4.67 (0.73)	0.309	4.94 (0.83)	4.97 (0.88)	0.923
Extraversion/Surgency	4.17 (0.45)	4.14 (0.44)	4.34 (0.55)	0.239	4.11 (0.43)	4.32 (0.49)	0.112
Activity	4.96 (0.91)	4.91 (0.89)	5.28 (1.04)	0.291	4.88 (0.88)	5.16 (1.00)	0.293
Shyness	3.54 (1.30)	3.54 (1.22)	3.60 (1.88)	0.779	3.54 (1.22)	3.28 (1.56)	0.322
High-Intensity Pleasure	5.01 (1.10)	4.92 (1.07)	5.57 (1.22)	0.122	4.88 (1.05)	5.33 (1.18)	0.155
Smiling & Laughter	6.06 (0.64)	6.02 (0.67)	6.34 (0.28)	0.185	6.00 (0.69)	6.22 (0.45)	0.226
Impulsivity	4.56 (1.06)	4.48 (0.98)	5.10 (1.43)	0.120	4.39 (0.93)	5.00 (1.25)	0.043
Positive Anticipation	5.37 (0.74)	5.34 (0.75)	5.60 (0.70)	0.344	5.28 (0.68)	5.62 (0.84)	0.107

*P values obtained using two-sample t-test with equal variances.

Table 7. Temperament scores of study participants by gender.

Temperament Scales	Gender		
	Male Mean (SD)	Female Mean (SD)	P value*
Effortful Control	5.20 (1.02)	5.37 (0.69)	0.436
Attention Control	4.42 (1.06)	4.81 (0.95)	0.150
Inhibitory Control	4.68 (1.23)	5.00 (0.86)	0.228
Perceptual Sensitivity	5.36 (1.10)	5.52 (0.87)	0.527
Low-Intensity Pleasure	5.74 (0.78)	5.83 (0.64)	0.621
Negative Affectivity	4.19 (0.67)	4.29 (0.64)	0.584
Frustration	4.20 (1.17)	4.38 (1.22)	0.579
Fear	3.85 (1.22)	3.84 (1.04)	0.968
Discomfort	3.67 (1.18)	4.12 (1.23)	0.166
Sadness	4.12 (0.94)	4.20 (0.81)	0.710
Soothability	4.94 (0.94)	4.96 (0.78)	0.940
Extraversion/Surgency	4.21 (0.40)	4.14 (0.49)	0.545
Activity	5.25 (0.87)	4.78 (0.91)	0.049†
Shyness	3.01 (1.31)	3.87 (1.20)	0.011†
High-Intensity Pleasure	5.22 (1.12)	4.88 (1.08)	0.251
Smiling & Laughter	5.96 (0.65)	6.12 (0.63)	0.331
Impulsivity	4.90 (1.06)	4.35 (1.02)	0.050
Positive Anticipation	5.30 (0.61)	5.42 (0.81)	0.541

*P values obtained using two-sample t-test with equal variances.
†Indicates a statistically significant result.

Table 8. Mean Houpt Behavioral Scores at selected oral sedation treatment points.

Demographic Variables	BL Mean (SD)	M/S Mean (SD)	LA Mean (SD)	RD Mean (SD)	O Mean (SD)	E Mean (SD)	C Mean (SD)
Average	3.98 (0.11)	3.89 (0.28)	3.66 (0.50)	3.68 (0.51)	3.73 (0.46)	3.36 (0.92)	3.67 (0.63)
Age (months)							
36 - < 67 months	3.98 (0.09)	3.95 (0.16)	3.65 (0.52)	3.80 (0.35)	3.76 (0.38)	3.8 (0.45)	3.72 (0.54)
67 - 96 months	3.97 (0.12)	3.83 (0.35)	3.67 (0.49)	3.57 (0.61)	3.70 (0.53)	3 (1.10)	3.63 (0.71)
Sex							
Male	3.98 (0.10)	3.89 (0.34)	3.59 (0.45)	3.60 (0.45)	3.57 (0.62)	3.50 (0.58)	3.64 (0.64)
Female	3.97 (0.11)	3.89 (0.24)	3.70 (0.52)	3.72 (0.55)	3.82 (0.31)	3.29 (1.11)	3.67 (0.63)
ASA status							
I	3.97 (0.12)	3.89 (0.30)	3.62 (0.54)	3.65 (0.54)	3.76 (0.39)	3.33 (1.00)	3.71 (0.62)
II	4.00 (0.00)	3.89 (0.20)	3.81 (0.26)	3.78 (0.41)	3.61 (0.69)	3.5 (0.71)	3.5 (0.68)
Insurance status							
DSHS	3.98 (0.09)	3.87 (0.32)	3.67 (0.40)	3.63 (0.54)	3.79 (0.38)	3.75 (0.50)	3.76 (0.52)
Private	3.98 (0.09)	3.92 (0.23)	3.67 (0.58)	3.73 (0.49)	3.70 (0.05)	3.14 (1.07)	3.58 (0.75)
None	3.5 (-)	3.5 (-)	3 (-)	4.00 (-)	2.5 (-)	-	3.5 (-)
Treatment Variables							
Reason for sedation							
History of failure	4.00 (-)	4.00 (-)	4.00 (-)	4.00 (-)	4.00 (-)	-	4.00 (-)
Dental fear/anxiety OR young age	3.94 (0.16)	3.77 (0.42)	3.51 (0.56)	3.54 (0.60)	3.53 (0.69)	2.67 (1.53)	3.47 (0.86)
Amount of treatment	4.00 (0.00)	4.00 (0.00)	3.84 (0.32)	3.84 (0.35)	3.73 (0.53)	3.67 (0.58)	3.63 (0.74)
Protection of the developing psyche	4.00 (0.00)	3.88 (0.31)	3.88 (0.21)	3.80 (0.27)	3.89 (0.15)	-	3.9 (0.22)
Multiple reasons	3.98 (0.10)	3.93 (0.17)	3.63 (0.54)	3.67 (0.55)	3.80 (0.23)	3.6 (0.55)	3.76 (0.46)
Treatment duration							
>30 minutes	3.88 (0.25)	3.88 (0.25)	3.38 (0.48)	4.00 (0.00)	3.17 (0.76)	-	3.5 (0.50)
≥30 minutes to <60 minutes	3.98 (0.10)	3.82 (0.37)	3.53 (0.61)	3.52 (0.65)	3.62 (0.60)	2.5 (2.12)	3.43 (0.82)
≥60 minutes	3.98 (0.09)	3.94 (0.18)	3.80 (0.34)	3.79 (0.32)	3.86 (0.22)	3.56 (0.53)	3.92 (0.23)
Treatment complexity							
Simple	3.98 (0.10)	3.90 (0.22)	3.69 (0.39)	3.68 (0.56)	3.80 (0.32)	3.5 (0.71)	3.76 (0.44)
Complex	3.97 (0.11)	3.89 (0.28)	3.66 (0.50)	3.68 (0.51)	3.73 (0.46)	3.36 (0.92)	3.67 (0.63)

Table 9. Summary of dental temperament research

Author	Treatment rendered	Outcome measure	Significant dimension	Temperament instrument
Schechter et al (1991)	Immunization	↑High distress behaviors	↓Adaptability	BSQ
Kain et al (2006)	Anesthesia induction	↑Anxiety ↓Compliance	↑Activity level ↑Impulsivity	EASI
Salmon and Pereira (2002)	Cystourethrogram	↓Coping behaviors	↓Effortful control	CBQ
Quinonez et al (1997)	Anesthesia induction	↑Disruptive behaviors	↑Shyness	EASI
Radis et al (1994)	Dental exam	↓Quiet behavior ↑Crying	↓Approach/Withdrawal	BSQ
Lochary et al (1993)	Oral sedation	↑Struggling	↓Approach/Withdrawal	TTS (BSQ variant)
Isik et al (2010)	Oral sedation	↓Success	↑Inflexibility	STSC (Thomas and Chess variant)
Jensen and Stjernqvist (2002)	Oral Sedation	↓Treatment acceptance	↑Shyness	EASI