Temperament as a predictor of behavior for conscious sedation in dentistry

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Abstract

Temperament can be defined as the behavioral style of a child or the manner in which a child interacts with the environment. Nine temperament categories have been identified: activity level, biological rhythmicity, initial approach/withdrawal, adaptability, intensity, mood, persistence/attention span, distractibility, and sensory threshold. Temperament categories can be quantified using the Toddler Temperament Scale (TTS), a written questionnaire completed by the caretaker. For this study, 29 healthy children, 14 males and 15 females, ages 18 to 36 months (mean age 30 = 6.2 months) and a mean weight of 13.8 kg = 2.1 kg were sedated with 2 mg/kg hydroxyzine pamoate (p.o.) and 2 mg/kg body weight of meperidine (submucosal). Parents completed the TTS during dental treatment in an adjoining room. The recording of baseline vital statistics, the mirror and explorer examination, and the entire operative procedure were videotaped. The Ohio State University Behavior Rating Scale was used to rate the videotapes of each child's behavior according to the following discrete categories: quiet behavior, crying without struggling, and struggling movement with or without crying. For data analysis, all negative behavior (struggling and for crying) was summed. Using a stepwise linear regression, approach/withdrawal tendency (multiple $R = 0.38$, $r^2 = 0.15$, and $P = 0.0015$) and adaptability (multiple $R = 0.58$, $r^2 = 0.34$, and $P = 0.009$) were found to predict the total percentage of struggling behavior, and approach/withdrawal also approached significance in predicting the percentage of all negative behavior (multiple $R = 0.35$, $r^2 = 0.12$, and $P = 0.055$). The results of this study suggest that approach/withdrawal tendency as measured by the TTS may be an important determinant of a sedated child's behavior during dental treatment. (Pediatr Dent 15:348–52, 1993)

Introduction

The behavior management literature in pediatric dentistry has focused on external environmental influences on the behavior of the child as dental patient. A more comprehensive view may be that the child's development and behavior are affected by a host of factors including individual physiology, temperament, and cognitive traits, as well as family and other environmental influences. Individual behavioral styles of patients undergoing dental treatment are often acknowledged, but have not been investigated previously.

Temperament

Temperament can be regarded as the individual's behavioral style or manner of interaction with the environment. By studying several groups of children in the New York Longitudinal Study (NYLS), Thomas and Chess[1] have identified nine temperament categories that describe the manner in which a child behaves: activity level, biological rhythmicity, initial approach/withdrawal, adaptability, intensity, mood, persistence/attention span, distractibility, and sensory threshold (Table 1). These characteristics apparently exist independently of environmental factors, and many of these characteristics remain fairly stable over time and across situations.[2,3]

Measuring temperament

The Toddler Temperament Scale (TTS), a parental questionnaire developed to identify temperament profiles for the 1- to 3-year-old child, is based on the NYLS findings.[4] The TTS yields scores for the nine temperament categories mentioned above. Similar scores for each temperament category are not equivalent due to different weights applied to the individual questions (refer to the original article for specific score designations).[4] The scores from these temperament categories have been used to group children into constellations of temperament that correspond to assessments of the child's temperamental difficulty (Table 2). Thirty-five per cent of the children from the NYLS sample did not fall into one of the constellations of easy, difficult, or slow to warm up.[5]

Children's temperaments may contribute significantly to how they behave in a given situation.[6,7] Thomas and Chess have suggested the terms *goodness of fit* or *poorness of fit* to describe this interaction. Goodness of fit results when environmental expectations and demands of parents and others on a child are consistent with the temperament of the child.[5] This model of goodness and poorness of fit can provide a framework for analyzing child/environment interaction at home, school, or the dental office. In some cases, it may be possible to alter the demands of the environment to better fit the child's temperament.

Temperament and medical treatment

Wallace examined the influence of temperament on pain management and the administration of analgesics in

Table 1. Toddler Temperament Scale categories

TTS Temperament Category	*Definition*
Activity level	The motor component of the child's functioning; includes proportion of active and inactive periods
Rhythmicity	The predictability or unpredictability of the child's functioning, such as in sleep, hunger, and elimination
Adaptability	Relative ease or difficulty in negotiating an effective response to new situations
Approach or withdrawal	The nature of the initial response to a novel stimulus, such as new food, toy, person, or situation
Threshold of responsiveness	The level of stimulation required to evoke a discernible response
Intensity of reaction	The energy level of response, irrespective of its quality or direction
Attention span and persistence	The length of time an activity is pursued and the capacity to continue despite obstacles
Quality of mood	The amount of pleasant, joyful, and friendly behavior compared to unpleasant and unfriendly behavior
Distractibility	The degree to which extraneous environmental stimuli can interfere with ongoing behavior

3- to 7-year-old children undergoing surgical procedures.[9] She found that among the nine temperament categories, only intensity was a significant predictor of the number of analgesic medications administered. She suggested that children with high intensity levels may receive more pain medication because of their overt reactions to pain, as opposed to less intense children who may not communicate as strenuously. The study design did not address the adequacy of pain management, and the results may simply indicate that less intense children actually experience less pain.

Schechter and his colleagues looked at individual differences in children's responses to pain.[10] They examined the role of temperament and individual pain responses in 5-year-old children receiving a diphtheria-pertussis-tetanus (DPT) immunization. They discovered that factors positively correlated with distressed behavior included more temperament categories in the difficult child constellation of the Behavioral Style Questionnaire, a measure of temperament similar to the TTS but designed for older children.[11] The individual temperament category of adaptability positively correlated with less distressed behavior. The more adaptable the child, the less distressed behavior exhibited upon immunization.

Table 2. Clinically relevant temperament constellations

Temperament of Constellation	*Definition of Constellation*
Difficult	The combination of biological irregularity, withdrawal tendencies to the new, slow adaptability, and frequent negative emotional reactions of high intensity
Easy	The combination of biological regularity, approach tendencies to the new, quick adaptability to change, and predominantly positive mood
Slow to warm up	Characterized by withdrawal tendencies to the new, slow adaptability, frequent negative emotional reactions of low intensity—often labeled "shy"

No studies to date have related a child's temperament to behavior in the dental setting, although the goodness of fit model suggests that some children will be temperamentally more able to meet the demands of dental treatment visits.

The purpose of this study was to determine if any of the nine individual temperament categories or the temperament constellations of the TTS are predictive of a sedated child's behavior as rated on the OSUBRS (Ohio State University Behavior Rating Scale) during a restorative visit.

Methods and materials

Patient sample

The 29 patients selected were from 18 to 36 months old. All children required multiple restorations and had exhibited uncooperative behavior during a single initial visit. Children with previous dental experience were excluded to control for the possibility of learning associated with an unpleasant experience. All were healthy children (ASA Class I) without any known allergies to medications. Informed consent for all procedures for this institutionally approved study was obtained from the parents.

Monitoring, sedation, and dental procedures

Before the appointment, the parents were given written pre- and postoperative instructions, asked to arrive one-half hour prior to the appointment and to have a second adult accompany them. Children were NPO after midnight before the appointment. Compliance with the instructions was ascertained and the medical history was reviewed at the beginning of the appointment. Additionally, informed consent and baseline vital statistics were obtained, the patient was weighed, and the airway was assessed.

All sedations were conducted in accordance with the Guidelines for the *elective use of conscious sedation, deep sedation, and general anesthesia in pediatric patients.*[12]

Following baseline data acquisition, a mirror and ex-

plorer examination of the child's oral cavity was performed. The child was given 2 mg/kg hydroxyzine pamoate (Vistaril®, Pfizer Inc., NY, NY) orally mixed with orange juice (total volume 15cc) under parent and operator supervision via cup or syringe. The parent and child then were escorted to the waiting room where the parent was instructed to observe and hold the child for 30 min.

After the 30-min period, the child was separated from the parent and brought into the operatory. The child was placed in a Papoose Board® (Olympic Medical Group, Seattle, WA), the monitors were reattached, and benzocaine topical anesthetic was applied to the maxillary buccal vestibule contralateral to the side that was to be restored. Two mg/kg body weight of meperidine (Demerol®—Sanofi Winthrop Pharmaceuticals, New York, NY) was injected submucosally into the area above the maxillary buccal vestibule. After 15 min, topical anesthetic was applied a second time and a maximum of 36 mg lidocaine and 0.018 mg epinephrine was administered. Restorative operative dentistry was performed under rubber dam isolation. Tell-show-do and voice control were used for all children by the operator to control behavior during the appointment. Following treatment, the child was returned to the parent, observed for approximately 1 hr, and released into the care of the parent when alert and stable.

Administration and scoring of the TTS

The parent was asked to complete the TTS during dental treatment in an adjoining room. Instructions were given and questions pertaining to the TTS were answered. The parents' responses on the TTS were scored using the standard scoring technique as described by Fullard.[4] Additionally, the scores on the nine temperament categories were grouped into temperament constellations of easy, difficult, and slow to warm up according to Fullard.

Behavior-monitoring and rating

A video recorder taped the procedures, capturing the child's entire body in the visual field. The videotape of each visit included the child's behavior during: 1) acquisition of baseline physiologic data with the parent present, 2) a 1-min mirror and explorer examination of the patient's oral cavity, and 3) the operative phase. The operative phase was subdivided into seven procedural segments:

1. Topical application for the meperidine injection
2. Meperidine injection
3. Second application of topical for injection of local anesthetic
4. Injection of local anesthetic
5. Rubber dam placement
6. Tooth preparation and restoration, which took place every other 5 min during this phase
7. Postoperative phase.

The acquisition of baseline physiologic data and the mirror and explorer examination were rated (described below) in their entirety.

The Ohio State University Behavior Rating Scale (OSUBRS) was used to rate the child's behavior recorded on the videotapes. Using the OSUBRS, four types of behavior were scored as follows:

1. Quiet behavior, no movement
2. Crying with no struggling
3. Struggling movement without crying
4. Struggling with crying.

Struggling was defined as rapid and intense head or foot movement or sustained posturing against the restraint.

The OSUBRS was quantified using the Automated Counting System (ACS)® (Version 1.0, JAGTECH, Rockville, MD). The ACS has the rater, while viewing the videotapes, depress a coded key during the time a defined behavioral response occurs. When a new category of behavior is observed, the key symbolizing that behavior is depressed. A computerized analysis of data provides information on the frequency, duration, and mean of each category of behavior during any operationally defined segment of the patient visit.

To establish reliability and permit rater training, four videotapes of patients participating in previous studies and exhibiting all defined behaviors were rated using the OSUBRS. The rater performed training trials using randomized sequences until a level of 85% or greater of the standard rating score for two successive trials was achieved.

The rater was requested to re-rate the test videotapes after completing the rating of the 10th, 20th, and final videotapes used in this study to determine long-term reliability. The rater was blind to the information derived from the TTS until all videotapes had been rated. After behavioral ratings were completed for all tapes, the per cent duration of each of the four types of behavior was calculated.

Results

Demographics

The sample population consisted of 29 healthy children, 14 males and 15 females, whose ages ranged from 18 to 36 months with a mean age of 30 months ± 6.2 months. They had a mean weight of 13.7 kg ± 2.1 kg.

Toddler temperament scores

The mean rating for patient's responses to the TTS were

Table 3. Mean scores and standard deviations of toddler temperament scale categories

TTS Subscale	*Mean Score ± SD*
Activity	3.93 ± .91
Rhythmicity	3.21 .76
Approachability	2.28 .89
Adaptability	3.41 .68
Intensity	3.88 .79
Mood	3.14 .69
Persistence	3.34 .70
Distractibility	4.13 .80
Threshold	4.18 ± .75

scored and each temperament category is listed in Table 3. Additionally, the scores on the nine temperament categories were grouped into the temperament constellations with the following distribution: easy (n = 7, 24%), difficult (n = 7, 24%), and slow to warm up (n = 0, 0%). Fifteen (52%) of the sample did not fit into a constellation.

Intrarater reliability

The intrarater reliability was analyzed using a Cronbach's alpha and a two-factor repeated measures ANOVA. The rater had an alpha = 0.998 when the behavior categories were analyzed across all test/retest sequences.

Behavior

During the operative phase, each child's behavior was rated during specified procedures as described above, which included: topical anesthesia application, meperidine injection, second topical application, local anesthesia injection, tooth preparation, and restoration. The behavior also was rated during the acquisition of baseline physiological data and initial dental examination. The frequency, duration, and mean duration of each behavioral category were recorded. For analysis, the duration of each behavioral category was summed across all procedures. The average percentage of the durations of each behavior over the entire appointment are as follows: quiet (62.4% ± 28.0), crying alone (25.7% ± 23.3), struggling with crying (10.5% ± 11.0), struggling alone (1.5% ± 1.3).

Temperament categories and their relationships to behavior

Two temperament categories, approach/withdrawal and adaptability, were found to predict the percentage of all struggling behavior (with and without crying). Using a multiple regression analysis, approach/withdrawal significantly predicted the percentage of all struggling behavior (multiple R = 0.38, $r^2 = 0.15$, and $P = 0.0015$). When the adaptability category was added to approachability, the predictive ability increased (multiple R = 0.58, $r^2 = 0.34$, and $P = 0.009$). The characteristic of approach/withdrawal approached significance in predicting the percentage of all negative behavior (multiple R = 0.35, $r^2 = 0.12$, and $P = 0.055$). Adaptability was not statistically significant in predicting the percentage of all negative behavior.

Temperament constellations and their relationship to behavior

No measure of behavior during dental treatment was found to be significantly related to any of the temperament constellations of easy, slow to warm up, or difficult. The test showed no difference between the temperament constellations of easy and difficult for the percentage of struggling behavior or the percentage of all negative behavior.

Discussion

The purpose of the study was to determine if any of the nine temperament categories or the temperament constellations associated with a difficult, easy, or slow-to-warm-up temperament are predictive of a sedated child's behavior. A multiple regression analysis using the nine category scores of the TTS as predictor variables for behavior indicated that approachability and adaptability are significant predictors of uncooperative behavior during sedation. When examining the general TTS constellations of easy, difficult, and slow to warm up, no significant differences were found between the temperament constellations regarding behavior during a dental sedation visit.

Behavior rating scale

The OSUBRS was designed to measure the disruptive behavior of patients in a restraining device and was modeled after the NCBRS described by Chambers in 1981.[13] The scale generated data in a form amenable to use with parametric statistics. The scale was operationally defined and extremely reliable as evidenced by the high rater test/retest reliability. The rating scale included four categories of behavior: quiet, crying alone, struggling alone, and struggling and crying together. Struggling alone accounted for only 1.5% of total behavior, and was combined with the struggling and crying behavior for data analysis. The sum of the two struggling categories is a measure of the per cent of physically disruptive behavior exhibited by the child, and is a clinically relevant measure of the success of a sedation. The percentage of struggling behavior also was added to the percentage of crying behavior for data analysis as an indicator of the total of all negative behavior. Behavior variability in the group was extremely large, as evidenced by the large standard deviations of the mean.

Temperament categories

Approach/withdrawal behavior refers to the initial reaction of a child to the presentation of unfamiliar stimuli such as a new food, toy, or person. A child who is very approachable will speak first to a stranger without shyness, whereas a withdrawn child will not speak when spoken to by a stranger, withdraws physically, looks frightened, and may cry. The subjects' scores on the temperament category of approach/withdrawal significantly predicted the total percentage of struggling behavior during the dental appointment. This association was negative, indicating that children who scored as less approachable or more withdrawn on the TTS exhibited more physically disruptive and negative behavior during dental treatment. This finding indicates that a more withdrawn child is less likely to cooperate for dental treatment under sedation than a more approachable child.

Adaptability is a measure of the ease or difficulty with which another person can alter the child's behavior. A very adaptable child will respond promptly to a directive from a parent even against the child's own inclinations, whereas a poorly adapting child does not modify activity despite frequent attempts at intervention. The temperament category score of adaptability, when added to the regression analysis with the category of approach, was more predictive of the percentage of physically disruptive

behavior during the appointment than approach alone. This was a positive numerical relationship indicating that the more adaptable the child, the higher the percentage of disruptive behavior. This suggests that an adaptable child who is ordinarily receptive to behavior modification may actually be less cooperative during a dental visit than a less adaptable child. The direction of this finding is the opposite of what might be expected and it is unclear as to what this means. However, adaptability alone was not predictive of per cent negative behavior or per cent disruptive behavior. The results of this study, in which adaptability was inversely related to the per cent disruptive behavior during the dental appointment are opposite to the findings of Schechter et al.[10] in which adaptability was correlated inversely with high distress scales during immunization.

The remaining seven categories, activity, intensity, persistence, distractibility, threshold, rhythmicity, and mood, do not appear to be important determinants of uncooperative behavior during sedation. In contrast to approach/withdrawal and adaptability, which measure sociability, these traits measure characteristics that are not socially predicated.

Temperament constellations

No final conclusions regarding temperament constellations can be drawn because of the low and inequitable distribution of patients within some categories. Larger constellation samples or analysis of larger number of extremes within constellations may have provided more information.

The ToddlerTemperament Scale and dental treatment

The study design did not allow us to examine the effects of temperament on behavior both with and without sedation. It is not clear whether the findings are applicable to behavior under sedation only or if they apply to dental visits in general. Future studies are needed to examine the role of temperament in the behavior of unsedated dental patients and the relationship of temperament to the effectiveness of behavior management modalities.

It would be helpful to know if the dental environment can be altered to fit the needs of withdrawing children. Perhaps these children could be targeted for an opportunity to become more familiar with the dental environment before they are asked to undergo treatment. For children with temperaments that do not provide a good fit with the dental environment, general anesthesia may provide a more effective and compassionate alternative.

This is a pilot study; due to the large number of independent variables examined and the low sample size, further studies are needed to confirm these results.

Conclusions

The results of this study suggest that approach/withdrawal tendency as measured by the TTS may be an important determinant of the behavior of a child sedated with meperidine during a dental visit. Data from future studies relating behavior during dental treatment and temperament categories may suggest more effective behavior management strategies to improve the "goodness of fit" between the patient and the environment.

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