Scientific Article

Temperament and trait anxiety as predictors of child behavior prior to general anesthesia for dental surgery

Rocio Quinonez, BA, BScDent, DMD **Robert G. Santos BA, MA**
Ron Boyar, DMD, MSc **Howard Cross, DMD, MSc**

Abstract

Children's individual styles of interaction with the environment (temperament) influence stable tendencies towards distress (trait anxiety) and context-specific manifestations of distress (state anxiety). Measures of temperament and trait anxiety were examined as predictors of state anxiety (i.e., disruptive behaviors) in the presurgical setting. During a 2-month period, 51 nonpremedicated, healthy children (M = 3 years of age) were consecutively studied as they presented to a hospital setting for dental treatment under general anesthesia (GA). Using correlation and backward multiple regression analyses, one temperament category (shyness), but not trait anxiety (the revised CMAS), predicted disruptive behaviors (the revised MBPRS) during preseparation (r^2 = .16, P = .0038) and separation (r^2 = .09, P = .0281) from parents. Shyness, age, and gender best predicted disruptive behaviors during preseparation (multiple R^2 = .31, P =.0005). Temperament (a) predicts children's distress in the presurgical setting, and (b) appears to be moderated by age, gender, and interpersonal factors. Awareness of temperamental influences can help predict children's behavior and aid in the presurgical care of children.(Pediatr Dent 19:427–31, 1997)

Negative behaviors are often displayed by children undergoing GA without premedication (i.e., without pharmacological intervention).[1] These behaviors are often suggestive of anxietry and distress. If unattended, such anxiety may lead to lifelong fears, and ultimately result in avoidance of future treatment and interference with care delivery.[1-4]

The use of conscious sedation has improved the quality of care of children undergoing all dental procedures, including those undergoing GA. However, because of inadequate training and associated risks, many practitioners are reluctant to premedicate. Risks include progressive loss of consciousness, airway patency and ventilatory response, and other unpredictable systemic sequellae.[1,5] With or without premedication, it is important for practitioners to understand the antecedents of anxiety for two reasons: to identify children for whom the presurgical experience may be potentially damaging (and may therefore benefit from presurgical sedation) and to aid in the development of techniques to prevent and ameliorate anxiety.

Anxiety and temperament

Traditionally, theories of anxiety reflected the enduring debate between nature (genetic influences) and nurture (environmental influences).[6,7] Anxiety was viewed as either a trait (a genetically based variable that is stable across different environments) or a state (a context-dependent that is variable in different environments). A more useful view recognizes anxiety as the product of a complex interplay of both genetic and environment influences over the life span. At the center of this interactional, developmental view is the concept of *temperament*.

Temperament refers to infants' and childrens' individual styles of interaction with the environment. Temperament appears heritable and stable across time, but modifiable by later environmental influences.[8] Early temperamental vulnerabilities appear to be precursors of trait anxiety,[9] and influence negative behaviors elicited by different contexts, or state anxiety.[10] Finally, early temperament predicts the appearance of multiple, specific phobias several years later.[11]

To date, few dental-related studies have examined the role of temperament as a predictor of negative behavior. Lochary et al.,[12] using the Toddler Temperament Scale (TTS), found that approachability predicted struggling behavior in children who required conscious sedation. Radis et al.,[13] using the Behavior Style Questionnaire (BSQ), found similar results for initial dental examination: approachability and adaptability predicted quiet behaviors in 3 year olds, whereas intensity and activity predicted crying behavior in 5 year olds. The rating scales (TTS, BSQ) used in these studies were based on the early nine-factor temperament model of Thomas and Chess.[14] Later analyses and evidence have shown that the nine-factor model has no emperical basis,[15] and the three-factor EAS model is a better predictor of later personality and behavior.[15] The three fac-

Table 1. Definitions of EAS Temperament Survey categories

EAS Subscale	*Definition (features of high scorers)*
Emotionality	Distress-proneness (e.g., crying, tantrums)
Activity	Behavioral arousal (e.g., high rates of speaking and moving)
Sociability	Preference for being with others versus being alone (e.g., sharing, attention-seeking)
Shyness	Derivative of Sociability: A tendency to be tense and inhibited with strangers or causal acquaintances

tors are emotionality, activity, and sociability. A fourth component, shyness, is considered a derivative of sociability (Table 1). The EAS Temperament Survey for Children: Parent Rating (EAS), a 20-item instrument wherein parents rate their children on a five-point scale (1 = not characteristic, 5 = very characteristic), provides a measure of the EAS factors. Scores for emotionality, activity, sociability, and shyness are each indexed by five items. The scale shows good test–retest reliability (M = .70) and internal consistency (M = .83) for children 1 to 9 years of age, and there is considerable evidence for the heritability and stability of the EAS factor structure.[15] To our knowledge, our present study is the first to use the EAS model in a dental-related setting.

The "goodness of fit" concept describes the relationship between a child's temperament and a specific setting.[14] This concept implies that certain temperament profiles are more harmonious with the dental situation than other profiles. Poor goodness of fit results in a child who becomes easily upset, displays irregular biological functioning, shows intense and often negative reactions to environmental changes, and tests the patience of both parents and practitioners.

Lochary et al.[12] suggested that GA may be a more effective, compassionate option for children showing poor goodness of fit between temperament and dental setting (e.g., behavioral problems). Routinely, practitioners consider hospitalization with GA administration for two groups: children with behavioral problems and children too young for dental chair treatment. Consequently, pediatric clinicians must consider the potentially negative impact of the hospital and GA experience, both before and after surgery, arising from poor goodness of fit.

The purpose of the present study was to investigate whether the temperament and trait anxiety of nonpremedicated children could predict their levels of disruptive behaviors in the presurgical setting—their state anxiety in a dental situation. Selected demographic variables (age, gender, ethnicity) were also examined as potential predictors of behavior.

Methods and materials

Patient sample

A total of 55 healthy children (ASA class I), ranging from 2 to 5 years in age, were seen during a 2-month period as they presented for treatment at Children's Hospital in Winnipeg, Manitoba, Canada. Children were assigned to day-surgery for dental treatment under GA by their respective pediatric dentists. Selection for operating room treatment was based on three criteria: 1) children with behavioral problems or extreme uncooperative behavior; 2) children too young to cooperate in the dental chair; and 3) children with extended dental treatment required. Criteria 2 and 3 were also guided by geographic and language considerations. For example, it is more cost effective to provide operating room treatment to children who have travelled from distant communities rather than requiring repeated visits over long periods of time, as well as to children with whom practitioners are unable to communicate, due to language barriers.

Prior to treatment, patients' medical histories were screened by the attending nurse. Parents and guardians read an overview of the study and provided written informed consent as outlined by Human Ethics Committee standards.

Assessment protocol and procedures

All patients were assessed in three phases. In the first phase, after the nurses' screening and prior to moving the patient to the operating room area, we administered a structured interview to each patient's parent or guardian. This interview included three measures: 1) a questionnaire soliciting basic demographic data (age, gender, ethnicity); 2) the EAS, providing a temperamental profile for each child;[15] and 3) the CMAS,[16] measuring the child's level of trait anxiety. We deleted 19 age-inappropriate items from the CMAS, resulting in the 28-item revised version (CMAS-R) used in the interview protocol. Higher CMAS-R scores indicate higher levels of trait anxiety on a four-point scale (1 = not at all, 2 = just a little, 3 = pretty much, 4 = very much).[10] Because very young children may be unable to report their internal experiences, we used the parent's version of the CMAS. Although parents of the same child show high interrater reliability regarding their child's anxiety, parents and their children clearly provide different assessment perspectives on anxiety.[17] Nevertheless, parents remain an important source of information on anxiety in their children.[18]

In the second phase, we rated each child along the way to the operating room, using MBPRS.[19] The MBPRS is an observer-based measure of state anxiety—disruptive behaviors in a given setting. Prior to the study, we revised the original scale to fit the hospital operating-room setting (MBPRS-R). The MBPRS-R has four subscales, each corresponding to specific time intervals and locations in the presurgical setting: 1) playroom — the time interval in the playroom wherein the anesthetist spoke with parents (three items); 2) preseparation— the time interval wherein the child and parent left the playroom until they reached the front door of the op-

erating room (four items); 3) separation—the time of child's separation from the parent at the front door of the operating room (six items); and 4) postseparation—the time interval after separation wherein the child was escorted down the hall into the operating room, until 15 sec after mask induction (18 items). Each subscale score consists of the sum of item scores, divided by the maximum subscale score; with higher scores (range = 0–100) indicating higher levels of disruptive behaviors. A second independent MBPRS-R rater concurrently measured a randomly selected subsample of patients, to confirm interrater reliability.

In the third and final phase, the operating room (OR) team (anesthetist and nurse) rated each child using the Frankl scale,[20] providing a global, categorical rating of each child's behavior (1 = definitely negative, 2 = slightly negative, 3 = slightly positive, 4 = definitely positive). Prior to data collection, we trained the OR staff regarding the use of the Frankl scale. Target behaviors for Frankl rating included all behaviors prior to undergoing GA, from playroom until induction. Frankl ratings were determined through the OR team's consensus shortly after induction.

TABLE 2. AGE AND GENDER DISTRIBUTIONS OF PARTICIPANTS

Age Group in years	*Number (of Patients)*	*Gender (Males/ Females)*
2	16	8 / 8
3	23	10 / 13
4	7	5 / 2
5	5	1 / 4
Total	51	24 / 27

TABLE 3. MEAN SCORES AND STANDARD DEVIATIONS FOR EAS TEMPERAMENT SURVEY CATEGORIES (N = 51)

EAS Subscale	*Mean Score* ± SD*
Emotionality	2.95 ± .83
Activity	4.32 ± .69
Sociability	3.71 ± .69
Shyness	2.47 ± .92

*EAS scores range from 1 = not characteristic to 5 = very characteristic

TABLE 4. RELATIONSHIP BETWEEN TEMPERAMENT AND TRAIT ANXIETY: CORRELATIONS BETWEEN EAS AND CMAS-R (N = 51)

EAS subscale	*r*	r^2	P
Emotionality	.53	.28	.0001
Activity	–.36	.13	.0113
Sociability	–.46	.21	.0009
Shyness	.30	.09	.0376

Data analysis and statistics

A series of Student's *t*-tests were conducted to determine significant differences between males and females for the EAS subscales, CMAS-R scores, and the MBPRS-R subscales. A chi-square analysis was conducted to determine significant differences between males and females on Frankl scores. Correlation analysis was used to determine the relationship between the EAS and the CMAS-R and to determine the ability of the EAS factors and CMAS-R scores to predict rated disruptive behaviors (MBPRS-R scores and Frankl scores). Multiple regression analysis was used to determine the best combination of predictors (among EAS subscales, CMAS-R scores, age, gender, and ethnicity) for rated disruptive behaviors.

Results

Three parents declined to participate and one did not speak English, resulting in a final sample of 51 subjects, 24 males (47%) and 27 females (53%). There were no significant age differences between boys (M = 2.96 years, SD = .86) and girls (M = 3.07 years, SD = 1.0) (Table 2). Of the sample, 21 were Caucasian (41%), 20 were Native Canadian (39%), and 10 were of heterogeneous ethnic background (e.g. Hispanic, black) (20%).

Results from Student's *t*-tests showed no significant differences between males and females for the EAS subscales, CMAS-R scores, and three of the four MBPRS-R subscales. However, during preseparation, males showed significantly more disruptive behaviors (M = 16.96, SD = 17.09) than females (M = 6.61, SD = 11.71), T = -2.55, df = 49, *P* = .014). Chi-square analysis showed no significant differences between males and females for Frankl scores.

Temperament and anxiety

In terms of temperament, the sample population showed moderate emotionality, high activity, high sociability, and moderate shyness (Table 3). The sample also showed low levels of trait anxiety on the CMAS-R (M = 1.89, SD = .25). The EAS subscales and CMAS-R scores correlated in a theoretically consistent manner: Trait anxiety correlated positively with emotionality and shyness, and negatively with activity and sociability (Table 4). Together, emotionality and sociability predicted trait anxiety (F = 21.48, df = 46, multiple R2 = .48, *P* = .0001).

Descriptors and predictors of disruptive behaviors

Patients were least disruptive during preseparation and most disruptive during separation. However, variability in disruptive behavior (MBPRS-R scores) was

Table 5. Mean scores, standard deviations, and interrater reliabilities BPRS-R subscales (n = 51)

MBPRS-R subscale	*Mean score* ± SD*	*Interrater reliability (%)*
Playroom	17.65 ± 27.05	100%
Preseparation	11.48 ± 15.26	79–100%
Separation	31.71 ± 34.45	87–100%
Postseparation	23.15 ± 17.77	89–100%

* MBPRS-R scores can range from 0–100, with higher scores indicating higher levels of disruptive behaviors

Table 6. Backward multiple regression analysis: significant predictor(s) of disruptive behavior

Behavioral Phase Predictor(s)	*F*	*df*	r^2	P
Preseparation Shyness	9.23	49	.16	.0038
Shyness + CMAS-R	5.42	46	.19	.0077
Shyness + age	6.61	48	.22	.0029
Shyness + male	8.47	48	.26	.0007
Shyness + age + male	7.07	47	.31	.0005*
Separation Shyness	5.12	49	.09	.0281*

* Best predictor(s) for phase

extremely large, as shown by the large standard deviations of the mean (Table 5). Interrater reliability for the MBPRS-R was confirmed in eight randomly selected cases (16%) from the sample population and ranged from 78 to 100% agreement across the MBPRS-R subscales (Table 5). After induction, the OR team consensually rated the sample as follows: 16 (31%) definitely negative, 17 (33%) slightly negative, six (12%) slightly positive, 12 (24%) definitely positive.

The maximum validity of a measure is the square root of the reliability, and the reliability of a measure must be equal to the square of any correlation that it has with another measure.[21] Thus, once validity is domonstrated, reliability becomes a secondary issue.[21] Because Frankl ratings and total MBPRS-R scores are different measures of the same target behaviors, their correlation provides a measure of their validity, which was very high ($r = -.83$, $P = .0001$). This suggests the reliability of both measures is also very high ($\sqrt{.83} = .91$).

Trait anxiety did not significantly predict disruptive behavior on any of the MBPRS-R subscales or on the Frankl scale. Shyness significantly predicted disruptive behavior during preseparation ($r^2 = .16$, $P = .0038$) and separation ($r^2 = .10$, $P = .0281$).

Backward multiple regression analyses showed that shyness, age, and gender were the best combination of predictors for disruptive behaviors during preseparation. Shyness alone was the best predictor for disruptive behavior during separation (Table 6).

Discussion

Anxiety and temperament

Trait anxiety appears unrelated to disruptive behaviors, but it was difficult to detect any relationship because of the low levels of trait anxiety in our sample. There was a strong relationship (mulitple $r^2 = .48$) between temperament and trait anxiety. Children higher in emotionality and lower in sociability tend to be higher in terms of trait anxiety.

Although temperament and trait anxiety are related, only temperament predicted disruptive behaviors in the presurgical setting. Of the temperament factors, shyness predicted disruptive behaviors during specific phases of treatment: preseparation ($r^2 = .16$) and separation ($r^2 = .09$). Knowing the patient's age and gender nearly doubles the predictive validity of shyness for disruptive behavior during preseparation (multiple $R^2 = .31$), but not during separation. In other words, just prior to separation from their parents, younger, shyer boys will tend to show more disruptive behaviors.

In part, these findings replicate previous dental research: Different temperament measures (TTS, BSQ, EAS) appear to converge on similar findings (Table 7). Item content of the approach/withdrawal subscales of the TTS and BSQ suggest that they measure sociability and shyness.[15] Because of its shorter length, the EAS Temperament Survey may be a more user-friendly measure (20 items) than the TTS and BSQ (100 items each). The present study extended previous work by examining the role of separation from parents and suggest that interpersonal (parent–child) factors are more important environmental influences than the presurgical setting, per se.

Table 7. Comparison of temperament studies in dental settings

Study	*Temperament Measure and Category*	*Predicted Behavior*	*r2*	P
Lochary et al (1993)	TTS - approach	struggling	.15	.0015
	TTS - approach + adaptability	struggling	.34	.009
Radis et al (1994)	BSQ - approach	less quiet	.18	.0022
	BSQ - approach	crying	.18	.0023
Quinonez et al (present study)	EAS - shyness	disruptive	.16	.0038
	EAS - shyness + age + male	disruptive	.31	.0005

Limitations

Study limitations center on some of our measures and methods. The interrater reliability of the MBPRS-R was confirmed in only a subset of patients and the reliability of the CMAS may have been affected by our revisions. However, our validity coefficients (with the Frankl scale and EAS, respectively) suggest adequate reliability for both measures. It should be noted that despite the widespread use of the Frankl scale in dental research, the scale is not consistently reliable.[20] Frankl scale reliability should therefore be assessed whenever the scale is used.

Future studies should evaluate multiple constructs from multiple perspectives to improve convergent and discriminant validity.[21] Further development of age-appropriate anxiety measures for children is a high research priority.[2]

Implications for pediatric dentistry

Temperament research has discovered that 15–20% of infants are shy.[24–26] Considerable evidence suggests that shyness is heritable, stable, and predictive of multiple specific phobias several years later.[9–11] Several studies in dental settings have shown a similar link between shyness and being distress prone (Table 7). Thus, improved awareness of temperamental influences can help predict children's behavior, as well as assist in the preparation of both children and parents in reducing anxiety, thereby improving treatment predictability and delivery. Perhaps lessening the distress of our younger, shyer patients will increase their receptivity to future dental care. Longitudinal studies are necessary to address this important issue.

Conclusions

1. Temperament and trait anxiety are related constructs. Individual EAS scores (higher emotionality and shyness, and lower activity and sociability) predict higher CMAS-R trait anxiety scores.
2. Trait anxiety does not appear to predict patients' disruptive behavior in the presurgical setting.
3. EAS shyness predicts disruptive behaviors in nonpremedicated children undergoing GA for dental treatment, and appears to be moderated by age, gender, and interpersonal factors (i.e., separation from parent). During preseparation, younger boys with higher levels of shyness tend to be more disruptive.

This research was conducted in fulfillment of the BSc Dentistry research project of Dr. Quinonez at Children's Hospital, Winnipeg, Manitoba, Canada. Dr. Quinonez is a pediatric dental resident at the University of North Carolina at Chapel hill. Mr. Santos is a doctoral candidate in Clinical Psychology at the Department of Psychology, University of Manitoba. Dr. Boyar is Head of Hospital Dentistry at the Health Sciences Centre and Associate Professor at the Faculty of Dentistry, University of Manitoba. Dr. Cross is Head of Pediatric Dentistry at Winnipeg's Children's Hospital. Special thanks to Dr. Guillermo Quinonez, Dr. Felicity Hardwick, Dr. Collin Dawes, Dr. Robert Henry, Dr. Michael Roberts, Dr. William Vann, and Dr. Frank Hechter for useful discussions, and to the operating room staff at Winnipeg's Children's Hospital.

1. Sethna N: Conscious sedation in children. Continuing Medical Education: 38th Annual Review Course in Anaesthesia. McGill University, Montreal, 79–86, 1996.
2. Kleiman MB: Fear of dentists as an inhibiting factor in children's use of dental services. ASDC J Dent Child 49:209–213, 1982.
3. Kent GG: Psychology in the dental curriculum. Br Dent J 154:106–109, 1983.
4. Kaufman E, Bauman A, Lichtenstein T, Garfunkel AA, Hertz DG: Comparison between the psychopathological profile of dental anxiety patients and an average dental population. Int J Psychosom 38:52–57, 1991.
5. Alexander C, Gross JB: Sedative doses of midazolam depress hypoxic ventilatory response in humans. Anesth Analg 67:377–82, 1988.
6. Eli I: Oral psychophysiology: Stress, pain, and behavior in dental care. Boca Raton, FL: CRC Press, 1992.
7. Thrash WJ, Russel-Duggan J, Mizes JS: The origin and prevention of dental fear. Clin Prev Dent 6:28–32, 1984.
8. Goldsmith HH, Buss AH, Plomin R, Rothbart MK, Thomas A, Chess S, Hinde RA, McCall RB: Roundtable: What is temperament? Four approaches. Child Dev 58:505–529, 1987.
9. Clark LA, Watson D, Mineka S: Temperament, personality, and the mood and anxiety disorders. J Abnorm Psychol 103:103–116, 1994.
10. Rothbart MK, Ahadi SA: Temperament and the development of personality. J Abnorm Psychol 103:55–66, 1994.
11. Biederman J, Rosenbaum J, Hirshfeld D, Faraone S, Bolduc E, Gersten M, Meminger S, Kagan J, Snidman N, Reznick S: Psychiatric correlates of behavioral inhibition in young children of parents with and without psychiatric disorders. Arch Gen Psychiatry 47:21–26, 1990.
12. Lochary ME, Wilson S, Griffen AL, Coury DL: Temperament as a predictor of behavior for conscious sedation in dentistry. Pediatr Dent 15:348–52, 1993.
13. Radis FG, Wilson S, Griffen AL, Coury DL: Temperament as a predictor of behavior during initial dental examination in children. Pediatr Dent 16:121–27, 1994.
14. Thomas A, Chess S: Temperament and Development. New York: Brunner/Mazel, 1977.
15. Buss AH, Plomin R: Temperament: Early Developing Personality Traits.Hillsdale, NJ: Erlbaum, 1984.
16. Reynolds CR, Richmond BO: What I think and feel: a revised measure of children's manifest anxiety. J Abnorm Child Psychol 6:271–80, 1978.
17. Engel NA, Rodrigue JR, Geffken GR: Parent–child agreement on ratings of anxiety in children. Psychol Rep 75:1251–60, 1994.
18. Roberts N, Vargo B, Ferguson HB. Measurement of anxiety and depression in children and adolescents. Psychiatr Clin North Am 12:837–60, 1989.
19. Melamed BG, Weinstein D, Katin-Borland M, Hawes R: Reduction of fear-related dental management with use of filmed modelling. J Am Dent Assoc 90:822–26, 1975.
20. Frankl SN, Shiere FR, Fogels HR: Should the parent remain with the child in the dental operatory? J Den Children 29:150–63, 1962.
21. Sechrest L: Reliability and validity. In Research Methods in Clinical Psychology. New York: Pergamon Press, 1984.
22. Hosey MT, Blinkhorn AS: An evaluation of four methods of assessing the behavior of anxious child dental patients. Int J Paediatr Dent 5:87–95, 1995.
23. Gittelman R: Introduction: children's manifest anxiety scale—parent ratings. Psychopharmacol Bull 21:933–35, 1985.
24. Caspi A, Elder GH, Bem DJ: Moving away from the world: Life-course patterns of shy children. Dev Psychol 24:824–31, 1988.
25. Kagan J, Snidman N: Infant predictors of inhibited and uninhibited profiles. Psychol Sci 2:40–44, 1991.
26. Kagan J. Temperamental contributions to social behavior. Am Psychol 44:668–74, 1989.