Temperament and acceptance of dental treatment under sedation in preschool children

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The major aim of the study was to investigate whether differences concerning acceptance of dental treatment and amnesia after rectal sedation with midazolam can be explained by temperament traits in the child. Fifty children (1.5–4.0 years), consecutively referred for dental extractions because of dental trauma or caries, were sedated with midazolam 0.3 mg kg^{-1} rectally. Level of sedation (state of mind) was assessed according to Wilton before and 10 min after administration of the sedative. The children's acceptance of procedures during the oral examination, the administration of the sedative, and the dental treatment were assessed according to Holst. Acceptance of an injection of local anesthesia and tooth extraction was dichotomized as satisfactory ($n = 26$) or unsatisfactory ($n = 24$). The parent assessed temperament using the Emotionality Activity Sociability (EAS) Scale of Child Temperament. Amnesia was evaluated by the parent on the following day. The relation between temperament and outcome variables was analyzed using a multiple logistic regression analysis. Children regarded as shy by the parent were at significantly greater risk of unsatisfactory acceptance of the dental treatment ($P < 0.05$). High scores of negative emotionality were significantly related to less amnesia ($P < 0.05$). We conclude that parental ratings of their child's temperament are valuable in predicting a child's acceptance of dental treatment under sedation.
☐ *Child behavior; dental; midazolam; rectal sedation*

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Parents are often able to predict how their child will behave and cope in different situations. In healthcare, this has been found in the case of immunizations (1) and dental examinations (2, 3). Excepting earlier experiences of similar events, these circumstances might be explained by a parental understanding of constitutional temperament traits of the child. Individual traits can be distinguished in the first year of life, and these are relatively stable during the preschool years (4). Temperament is the individual disposition to behave and react in different situations (5). Personality as a whole, however, is modified by environmental influences and also through the child's own experiences.

Constitutional characteristics are studied in behavioral genetics, and twin studies have shown heredity to be important for activity level, negative emotionality, and approach–withdrawal reactions. For behavioral dimensions such as empathy and extroversion, almost half of the total variance in the population has therefore been attributed to genetic influence (6). Infants' behavior in unfamiliar settings is related to their threshold for becoming distressed and motorically aroused (7), and genetic influence is considered to be important in tolerances for limitations and novelty (8).

The significance of background variables for children's ability to cope at their first dental visit has long been of interest, and it has been shown that both cognitive maturity (9) and a child's reaction to strangers can be used as predictors (2). Further, parental support has been shown to be important, and children with responsive mothers have been found to be better able to cope at a dental examination (10). Radis (11) studied the influence of temperament on behavior in children at an initial dental examination and found that approach–withdrawal reactions had some importance. In the development of child dental fear, parents regard temperament as being both a protective and a risk factor (12).

When intervention is needed in pre-cooperative ages, dental treatment is often performed under sedation. In Scandinavian countries, benzodiazepines are the prevailing medicaments in outpatient dental care (13). Such agents have sedative and amnesic effects (14), both valuable for small children subjected to distressing procedures. Adequately sedated, children might still be unable to comply (15, 16), which renders the amnesic effect particularly important in preventing unpleasant memories.

On what parents base their predictions of child behavior is not clear. During dental treatment of children under sedation with a combination of oral antihistamine and submucosal opioids, and after separation from the parents, Lochary (17) suggested that the approach–withdrawal tendency might be an important determinant of child behavior. Whether constitution is significant for the outcome of treatment under sedation with benzodiazepine in doses appropriate for outpatient dental care, and with

Table 1. Level of sedation (state of mind) according to Wilton (1988)

Drowsy	Sitting or lying comfortably with tired or half-closed* eyes, responds to minor stimulation
Calm	Sitting or lying comfortably with open eyes, relaxed
Alert	Not clinging to parent, may whimper but not cry
Agitated	Clinging to parent, crying, or both

* According to Wilton: closed eyes.

parental support, has not been studied. The aim of the present study was to investigate whether differences concerning acceptance of dental treatment and amnesia after rectal sedation with midazolam can be explained by temperament traits in the child. In addition, the relationship between temperament traits and the dentist's assessments of child behavior on arrival at the dental clinic and during oral examination was studied.

Materials and methods

Subjects

Fifty children consecutively referred because of low age to three Clinics of Specialized Pediatric Dentistry in southern Sweden were included in the study. The children were all in need of tooth extractions under sedation because of dental trauma or caries with pulpal complications. Only Swedish-speaking families were included, and written, informed consent was obtained from the parents. All parents accepted participation. The entire study group consisted of 24 girls and 26 boys between the ages of 17 and 51 months. All children were healthy, aside from 11 with an allergic condition. Seven children had previous experience of medical treatment performed under sedation and 5 of medical treatment performed under general anesthesia.

Four dentists, specialists in pediatric dentistry or students in post-graduate training, rated behavior and performed the dental treatment. Treatment procedures and criteria for assessing child behavior were thoroughly discussed before the study and performed according to a detailed manual. The study was approved by the Local Ethics Committee at the University of Lund.

Procedures

After an initial oral examination, the children were sedated with midazolam (Dormicum®, Roche, Stockholm, Sweden) 0.3 mg kg^{-1} rectally. During the treatment, the child was placed in the operating chair in the parent's lap. The dental procedures included application of topical anesthesia, injection of local anesthesia and extraction. The child remained in the clinic for 1 h after administration of the sedative.

The child's level of sedation (state of mind) was assessed according to Wilton's sedation scale (18) (Table 1) on arrival at the dental clinic and 10 min after administration of the sedative.

The child's acceptance of procedures was assessed according to Holst (19) (Table 2) during the oral examination, administration of the sedative, and dental treatment including injection of local anesthesia and extraction.

Temperament traits were assessed using the Swedish translation (20) of the Buss and Plomin Emotionality, Activity, Sociability (EAS) Scale of Child Temperament (21). This instrument is a 5-point scale with the endpoints 'does not apply' and 'applies very well', where higher scores indicate higher basic negative emotionality, activity, sociability, and shyness (Table 3). The parental ratings were performed after treatment, at home. As with

Table 3. EAS temperament traits

Emotionality	
1.	Child cries easily
2.	Child tends to be somewhat emotional
3.	Child often fusses and cries
4.	Child gets upset easily
5.	Child reacts intensely when upset
Activity	
6.	Child is always on the go
7.	When child moves about, she or he usually moves slowly (r)
8.	Child is off and running as soon as she or he wakes up in the morning
9.	Child is energetic
10.	Child prefers quiet, inactive games to more active ones (r)
Sociability	
11.	Child likes to be with people (apart from parents)
12.	Child adjusts easily
Shyness	
13.	Child tends to be shy
14.	Child makes friends easily (r)
15.	Child is very friendly with strangers (r)

EAS = Emotionality, Activity, and Sociability.
(r) = reversed.

Table 2. Ratings of acceptance, according to Holst (1987), and dichotomized categories

Level of acceptance	Categories of behavior	Dichotomized categories
Positive	Good cooperation	Satisfactory acceptance
Reluctant	Reserved attitude, follows directions poorly	
Negative	Crying, no cooperation	Unsatisfactory acceptance
No	Active physical resistance, protests, screaming	

Table 4. Statistical comparisons of dichotomized outcome variables for child background characteristics and behavior assessed by the dentist

	State of mind on arrival (SMA)			Acceptance of oral examination (AOE)			Acceptance of treatment			Amnesia		
	calm ($n = 38$)	alert/agitated ($n = 12$)	*P*	sat ($n = 38$)	unsat ($n = 12$)	*P*	sat ($n = 26$)	unsat ($n = 24$)	*P*	amnesia ($n = 21$)	no amnesia ($n = 25$)	*P*
Emotionality	3.0	3.6	0.01	3.0	3.6	0.01	3.0	3.2	0.31	2.9	3.3	0.04
Activity	4.2	4.5	0.12	4.2	4.4	0.44	4.2	4.2	0.98	4.1	4.3	0.31
Sociability	4.4	4.1	0.27	4.4	4.2	0.38	4.5	4.2	0.18	4.5	4.2	0.31
Shyness	2.0	2.4	0.11	1.9	2.5	0.04	1.9	2.3	0.05	2.0	2.1	0.89
Age	37	38	0.81	39	31	0.01	39	35	0.22	39	38	0.70
Gender f/m	17/21	7/5	0.41	19/19	5/7	0.61	13/13	11/13	0.77	10/11	13/12	0.77
SMA c/a							24/2	14/10	0.004	15/6	20/5	0.50
AOE s/u							23/3	15/9	0.03	15/6	20/5	0.50

Temperament characteristics as mean values. Age as mean in months.
SMA = state of mind on arrival, c = calm, a = alert or agitated.
AOE = acceptance of oral examination, s = satisfactory, u = unsatisfactory.

behavior scales, the ratings are calculated as a mean for each temperament trait.

To assess the amnesic effect, the dentist gave the child a toy animal to play with 8 min after administration of the sedative. The parents were asked to evaluate amnesia on the following day by asking the child whether he or she recalled the toy animal. For this purpose, a set of pictures with three different animals was given to the parent so that the child could point out which one he or she had played with before dental treatment.

Statistics

For statistical analyses, the variables were dichotomized retrospectively according to outcome. The main outcome variable was 'acceptance of treatment'. Acceptance was considered satisfactory if the child had been positive or reluctant about the two invasive procedures injection of local anesthesia and dental extraction (*sat* group; $n = 26$) and unsatisfactory if the child had displayed negative or no acceptance of either or both procedures (*unsat* group; $n = 24$) (Table 2). An additional outcome variable was the presence or absence of amnesia. Memories of the toy animal could not be assessed in 4 preverbal children, and thus 21 children were placed in the category *amnesia* and 25 in the category *no amnesia*.

In addition, the dentist's assessment of the child's *state of mind on arrival* in the clinic (SMA) and *acceptance of the oral examination* (AOE) constituted outcome variables. For this purpose the children were dichotomized as either calm or alert/agitated (SMA), or as satisfactory or unsatisfactory (AOE, *sat/unsat*).

Explanatory variables in all statistical analyses were the parental EAS temperament ratings, age, and gender. For the outcome variables *acceptance of treatment* and *amnesia*, the dentist's assessments of SMA and AOE were included as explanatory variables (Table 4).

Mean values of the EAS temperament traits were calculated for each dichotomized outcome group. Differences in outcome between the groups were tested with a likelihood ratio test (Table 4). Odds ratios were calculated and the relation between the background variables of temperament ratings, age, and gender and the 4 outcome variables was analyzed using a multiple logistic regression analysis (Table 5) (22). Factors that remained statistically significant in the multiple logistic regression analysis were those that simultaneously best explained the outcome variables.

All data were processed in SPSS, and a significance level of 5% was used in all tests.

Results

Concerning the main study outcome, *acceptance of treatment*, the indication for tooth extraction was dental trauma in 11 children and caries with pulpal complications in 15 children in the *sat* group and 10 and 14, respectively, in the *unsat* group. Ten minutes after administration of the sedative, 22 (85%) children in the *sat* group and 18 (75%) in the *unsat* group were assessed as drowsy.

EAS and state of mind on arrival

Children assessed as calm on arrival at the dental clinic had statistically significant lower scores of emotionality than those who were alert or agitated (Table 4). The multiple logistic regression analysis identified emotionality as a significant explanatory variable (Table 5). The risk that a child's state of mind would be assessed as alert or agitated was 3.8 times higher for each one-unit increase in the emotionality score.

EAS and acceptance of oral examination

Children with a satisfactory acceptance of the oral examination had statistically significant lower scores of emotionality and shyness. Older children also accepted the

Table 5. Multiple logistic regression analysis of statistically significant background characteristics

Variable	OR	*P*
State of mind on arrival		
Emotionality	3.8	0.012
Acceptance of oral examination		
Emotionality	5.1	0.007
Age	0.9	0.003
Acceptance of treatment		
Shyness	2.1	0.0499
State of mind on arrival	8.6	0.004
Amnesia		
Emotionality	2.5	0.042

examination significantly better (Table 4). Further analysis identified emotionality and age as significant explanatory variables (Table 5). The risk that a child would display an unsatisfactory acceptance was 5.1 times higher for each one-unit increase in the emotionality score. With increasing age, the reduction in risk per year of an unsatisfactory acceptance was 10%.

EAS and acceptance of treatment

A statistically significant relationship was found between acceptance of treatment and shyness. Treatment acceptance was also significantly associated with the dentist's pretreatment assessments and was better for the children who were rated as calm (SMA) or who satisfactorily accepted the oral examination (AOE) (Table 4). In the multiple logistic regression model, shyness and state of mind on arrival were identified as significant explanatory variables (Table 5). The risk of an unsatisfactory acceptance was doubled for each one-unit increase in the shyness score. The risk that a child assessed as alert or agitated on arrival would display an unsatisfactory acceptance was 8.6 times higher compared with those who were initially calm.

EAS and amnesia

Negative emotionality was found to be statistically significant for amnesia at both levels of analysis (Tables 4 and 5). For each one-unit increase in the emotionality score, recall of the toy animal was 2.5 times more prevalent.

Discussion

The results indicate that the temperament traits measured on the EAS scale can have an impact on acceptance of distressing procedures under sedation. Temperament also seems to be related to child behavior before sedation and how well they recall the treatment period. Children regarded as shy by their parent were at greater risk of an unsatisfactory acceptance of dental treatment. High scores on emotionality were associated with less calm children on arrival at the dental clinic, lower coping ability during the oral examination and less amnesia.

The children in the present study were treated for toothache because of caries or for trauma. We did not investigate whether the type of indication for referral could be important for child behavior during treatment, but the distribution of caries and trauma cases was the same in both groups. Children with caries represent a minority of the population, since this is a rare condition in these young ages. In a previous study, no relation between temperament and early childhood caries was found (23), but another study reported shyness in combination with the age that breast- or bottle-feeding was discontinued to be associated with caries (24). Children with dental trauma might be expected to represent the entire child population, although some can be more prone to meet with accidents.

The EAS Temperament Survey is an instrument used to assess children's individual pattern of behavior and response to daily events. High scores on the EAS dimension of shyness are considered comparable to low scores for the synonymously used term *approach* on related instruments (21). Parental rating of child behavior using detailed age-specific questionnaires is a common method in investigations on temperament. Since in the present study most of the children needed urgent treatment, it was not possible to complete the questionnaire in advance. The parental rating could possibly have been influenced by the treatment conditions. However, mean values on emotionality and shyness for the entire group are in accordance with normative data for Swedish children presented earlier (25).

An evaluation of the reliability of the assessments by the dentists involved would have been ideal, but could not be performed because of the unpredictability of the moment at the time of the treatment. Assessment of procedure acceptance, however, is essential in child dentistry, and in the present study an instrument with strict criteria for the behavioral ratings was used.

Temperament characteristics might predict how a child responds emotionally in a stressful situation. Shyness is considered a risk factor for behavior problems (26) and reported to be prevalent in about 10% of children (27). Shy children tend to be inhibited and become more anxious in novel settings, as suggested by adreno-cortical responses and elevated heart rates, and might therefore be more vulnerable to stressful events. Shyness and behavioral inhibition are expressed as a reluctance to interact with unfamiliar adults and to retreat from unfamiliar events (7), both relevant in the dental setting.

Evidence indicates that shy children might need special consideration in dental care. Children with dental fear have been found to have higher shyness scores than non-fearful children or the norm for Swedish children (25). Three-year-old children with an inclination to respond unfavorably to novel settings have been found to exhibit less quiet behavior during an initial dental examination

compared with approachable children (11). Children with high EAS shyness scores displayed more disruptive behavior prior to dental treatment under general anesthesia than those with low scores (28). In children receiving dental treatment under oral midazolam sedation, questions about temperament concerning shyness and approach were found to be associated with pretreatment behavior (29). For dental treatment with a combination of oral and submucosal sedation, children who tended to be withdrawn were found to be more likely to display non-cooperative behavior compared with approachable children (17). Our finding, that shyness seems to be related to an unsatisfactory acceptance of dental treatment under sedation, when a different sedation regimen is used and parents are present, is in agreement with these findings.

In pre-cooperative children, sedation is used to prevent the initiation of stress-related reactions. After the administration of midazolam, children with a satisfactory acceptance of treatment and those with an unsatisfactory acceptance were equivalent regarding sedative effect. Acceptance of treatment and ability to cope, however, has not been shown to relate significantly to level of sedation (15). For shy children with a potentially low threshold to becoming distressed and motorically aroused, sedation might be insufficient to prevent such physiological responses.

Negative emotionality develops from the primordial emotion of distress and pertains to both fear and anger (21). Children with a high basic emotionality have an innate disposition to become easily and intensely upset. The temperament trait of emotionality was found to have an impact on behavior before sedation. The relation between negative emotionality and state of mind on arrival as assessed by the dentist indicates that signs of wariness in a child are easily recognized. In the subsequent oral examination, the behavioral response of discomfort was still more obvious in children scoring high on emotionality. These children tend to express their feelings of distress overtly, but might also be more sensitive to potential anxiety-provoking stimuli. It is not certain, however, that this is equally obvious in other dental care situations. Most of the children in the present study probably perceived that the visit could be stress provoking.

Negative emotionality is also associated with dental fear, and fearful children score higher compared with non-fearful (25). Children with high emotionality scores were found to respond with increased anxiety before surgery under general anesthesia and not benefit from a behavioral preparation program (30). Distraction might help children to cope and reduce momentary distress and crying (31). Our experience is that most children, even if distressed, seem to benefit from distraction and can be calmed down between procedures during treatments performed under sedation.

We found a connection between high scores on negative emotionality and better recall of the toy animal. Amnesia has been found to parallel drowsiness in most cases (14), but in our study all children scoring high on emotionality, except one, were assessed as drowsy. Being given a toy is not an emotional situation that would explain heightened recall. The association between temperament and better recall may be that children scoring high on negative emotionality might be more wary of their surroundings and therefore have a better remembrance of what happened during the session. Increased arousal is suggested to lead to increased memorability (32).

Our results indicate that parental temperament ratings and the dentist's initial evaluation of the state of mind can be predictive of a child's behavioral responses during dental treatment under sedation. To include questions on temperament traits in the anamnestic interview can help the dentist to understand the child and plan treatment better. It might also make the parent feel more involved and better prepared to support and handle the child to prevent a negative experience. However, environmental conditions might also influence the outcome of distressing treatments, and attributing child behavior to temperament characteristics should be made with care.

We conclude that parental ratings of child temperament together with dentists' assessments of child behavior seem to be valuable in predicting a child's acceptance of dental treatment under sedation.

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