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## **THE EFFECTS OF A COMPANION ANIMAL ON DISTRESS IN CHILDREN UNDERGOING DENTAL PROCEDURES**

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The purpose of our pilot study was to evaluate the effects of a companion animal (dog) on physiologic arousal and behavioral distress among children undergoing a dental procedure. A repeated measures experimental design was used to study 40 children between the ages of 7 and 11 years who were undergoing procedures in a pediatric dental clinic. Half the children had the dog present during the procedure and half did not. Data were obtained before, during, and after the procedure. Behavioral distress was measured using the Observational Scale of Behavioral Distress; procedures were videotaped. Physiologic arousal was measured using a YSI telethermometer taped to the child's index finger. Student's *t*-test and repeated measures analysis of variance were used to answer the research question. No significant differences in behavioral distress or physiologic arousal were found between experimental and control groups. Further analysis revealed that for children who initially verbalized distress on arrival at the clinic, the presence of the dog decreased physiologic arousal during the time the child was on the dental table waiting for the dentist to arrive. Further research should be conducted to verify the effect of a companion animal on initial stress experienced by children for whom the visit to the dentist is most stressful.

Clients of all ages can be affected by stress during encounters with the health care system. Virtually all body systems can be affected, particularly the cardiovascular, gastrointestinal, and respiratory systems as well as the skin (Selye, 1976). In children, the effects of stress may lead to the development of irrational fears as well as physiologic and psychological reactions. Since good dental health requires ongoing follow-up care throughout the life span, the prospect of visiting the dentist may become an ongoing source of stress for children. Little research has examined non-pharmacologic interventions to diminish stress experienced by children at the dentist. Therefore, the purpose of our study was to evaluate the effects of a distraction intervention, a companion animal, on distress experienced by children during a dental procedure.

## **BACKGROUND**

Distraction is an effective strategy for coping with pain-produced distress by diverting attention from the sensations or emotional responses that result from exposure to painful stimuli. Any strategy used to block the awareness of a painful stimulus or its effects can be considered a distraction strategy (McCaul & Malott, 1984). Distraction strategies may diminish stress by competing with a stressful event for a child's attentional resources or by decreasing the child's capacity to process stressful events.

Distraction techniques have been successful in eliciting the relaxation response in children. Vessey, Carlson, and McGill (1994) examined the effectiveness of a distraction technique to alleviate children's perceived pain and behavioral distress during venipuncture. A kaleidoscope was

used successfully as a distracter during a phlebotomy procedure, diminishing the children's perception of pain. Since there is an inverse relationship between the strength of the stressor and the effectiveness of the distracter, a strongly attractive distracter combined with a mild to moderately stressful situation can effectively diminish the stress experienced by a child (Robin & tenBensel, 1985). The American Academy of Pediatric Dentistry (1999/2000) now recommends the use of distraction to allay fear and anxiety associated with dental procedures.

The search for effective interventions to diminish stress has led to the use of companion animals, capitalizing on the human-animal bond. This bond has been recognized since ancient times and has been found to provide physical and emotional benefits (Fine, 2000). In the past 30 years, research has documented beneficial results of the human-animal bond. Studies with adults have shown that touching an animal decreases anxiety and physiologic arousal (Baun, Oetting, & Bergstrom, 1991; Friedmann & Thomas, 1995). The lulling and repetitive nature of petting a companion dog provides a passive meditative focus on a nonthreatening stimulus that can relax a person by lowering the body's state of arousal (Katcher & Friedmann, 1980). These effects include lowered blood pressure (Baun, Bergstrom, Langston, & Thoma, 1984) and increased peripheral skin temperature (Schuelke et al., 1991/1992; Thoma, 1984). Ownership of one's own dog has been significantly related to survival following myocardial infarction, which the authors attributed to the stress-buffering effect of the pet (Friedmann, Katcher, Lynch, & Thomas, 1980; Friedmann & Thomas, 1995).

Levinson (1969), a child psychologist, published early studies of beneficial effects of animals with children. One of these studies involved using Levinson's own dog, Jingles, to establish rapport with a severely withdrawn child. This relationship made it possible for Levinson to interact therapeutically with the child, and Levinson came to believe that caring for a pet could lead to decreased stress and the child's acquisition of trust, self-esteem, responsibility, and autonomy. In addition, companion animals can assist children to move along the developmental continuum (Levinson, 1969, 1971, 1972).

The ability of an unknown dog to facilitate relaxation among healthy children in a mildly threatening environment was demonstrated in a study by Friedmann, Katcher, Thomas, Lynch, and Messent (1983). In this study, 36 children aged 9–16 years had their blood pressure and heart rate monitored while resting and reading poetry; in one study condition, a friendly, unknown dog was present and in the other the dog was absent. Significantly lower blood pressures were found while the dog was present regardless of whether the children were reading or resting (Friedmann et al., 1983).

Two studies specifically examined the effects of a companion animal in stressful health care situations with children. Nagengast, Baun, Megel, and Leibowitz (1997) examined the effects of the presence of a companion animal on physiologic and behavioral distress exhibited by children during a simulated physical examination. Twenty-three healthy children between the ages of 3 and 6 years were studied during routine physical examinations in a laboratory setting with and without a dog who was friendly but unknown to the children. Significant differences were found in physiologic and behavioral measures of stress when the dog was present during the physical examination. Hansen, Messenger, Baun, and Megel (1999) replicated this study in a pediatric clinic using a dog to direct the child's attention away from unpleasant stimuli associated with physical examinations. Again, significantly lower behavioral distress scores were found for the children whose physical examinations occurred in the presence of the dog.

Based on these studies, further research in other health care settings seems warranted. Since dental procedures can be stressful for children, this study was conducted to evaluate the effects of a companion animal on physiologic arousal and behavioral distress among children undergoing dental procedures.

## ***THEORETICAL FRAMEWORK***

### ***General Adaptation Syndrome***

Selye (1976) conducted the classic research on the stress response and described this reaction to stress as the general adaptation syndrome (GAS). Physiologic arousal is seen during the GAS and is characterized by autonomic nervous system activity and myocardial cell excitability. This process results in increased heart rate, blood pressure, palmar sweating, and secretion of saliva. Peripheral vasoconstriction results in decreased blood flow to the extremities and increased blood flow to muscles and brain. This sympathetic stress reaction is an adaptive response that prepares the body for fight or flight.

### ***Relaxation Response***

In contrast to the GAS, during relaxation the body's homeostatic mechanisms are maximized and the body responds with vasodilation that results in an increase in peripheral skin temperature and increased muscle relaxation (Selye, 1976). The relaxation response counteracts the physiologic arousal that accompanies GAS (Benson, 1975). The relaxation response results in a reduction in the activity in the sympathetic nervous system

and produces physiologic events that activate the parasympathetic branch of the autonomic nervous system. The relaxation response does not occur spontaneously; it must be consciously and purposefully evoked. A comfortable position facilitates the production of the relaxation response, and a focal object evokes the response (Benson, 1975). For these reasons, it was hypothesized that a companion animal would provide a distraction and focus for the child's attention and promote relaxation during dental procedures.

## **METHODS**

### ***Subjects and Setting***

This study was conducted at a private pediatric dental clinic located in Omaha, Nebraska. Dental procedures were performed in one large room containing 12 individual flat, padded dental tables. Only one dentist and one dental table were utilized for this study.

A convenience sample consisting of 40 pediatric dental patients participated in the study. Forty children between the ages of 7 and 11 years were selected as the sample for this study based on a power analysis that determined with 40 subjects and a medium effect size (0.4), a power of .80 could be achieved at a significance level of .05. The age group (7–11) was chosen to minimize differences in developmental abilities among the children. According to Piaget, this age group represents the concrete-operational stage of cognitive development (Hurley & Whelan, 1988). In the concrete-operational stage, children are able to classify, sort, and organize facts about their experiences. Thought processes have become more logical and coherent. According to Piaget, children in the concrete-operational stage have increased awareness of the body. When children between the ages of 7 and 11 were asked, "How does pain go away?" they responded, "Someone holds you, talks to you and gives you something to play with" (Hurley & Whelan, 1988, p. 22). This suggests that nurturing and distracting techniques can be helpful behaviors when working with children of the concrete-operational level.

Subjects were excluded if they had severe allergies to dogs, had previous traumatic experiences with a dog, needed general anesthesia for the dental procedure, were immunosuppressed, unwilling to participate, or the parent was unwilling for the child to participate. Three children who initially agreed to participate were excluded from the study. One child's procedure was canceled because of distress, the second child did not have any invasive dental procedures performed, and the dog left the third child during the procedure because of the child's prolonged screaming.

## **RESEARCH DESIGN**

An experimental repeated measures design was used in this study. Half the children ( $n = 20$ ) had the dog present during the procedure and half the children ( $n = 20$ ) did not. Random assignment to experimental and control groups was achieved through a computer-generated table of random numbers. The dependent variables were peripheral skin temperature and behavioral distress. The independent variable was the presence of the companion animal. Approval of both the Institutional Review Board for the Protection of Human Subjects and the Institution of Animal Care and Use Committee was obtained prior to the initiation of this study.

## **APPARATUS AND EQUIPMENT**

Behavioral distress was measured using the Observational Scale of Behavioral Distress (OSBD) (Jay & Elliott, 1986). Physiologic arousal was operationally defined as peripheral skin temperature and was measured by a Yellow Springs Instrument (YSI 400 series) telethermometer (Yellow Springs Instrument Company, Yellow Springs, Ohio).

### ***Behavioral Distress***

Behavioral distress is the visible manifestations of perceived threat and is measured by the OSBD (Jay & Elliott, 1986). The OSBD is an 8-item, objectively defined, behavior rating scale formulated to evaluate behavior distress in children 3 to 13 years of age who were undergoing a medical procedure (Table 1). The 8 operationally defined behaviors described in the OSBD scale are information seeking, cry, scream, restraint, verbal resistance, emotional support, verbal pain, and flail. The OSBD measures a wide spectrum of distress behaviors in children, and reliability and validity have been established (Elliott, Jay, & Woody, 1987).

Consistency of data collection was achieved in this study by having one researcher videotape all the participants throughout the dental procedures. To assess behavioral distress, a different researcher analyzed all videotapes to determine the frequency of each OSBD behavior category during each 15-sec interval. Calculation of OSBD scores was achieved by weighting the frequencies of each behavior. An overall distress score was obtained by totaling the weighted behavior scores. Intrarater reliability of the OSBD was achieved by calculating the percentage of agreement scores after reanalysis of 20% of the videotapes. The overall intrarater reliability was found to be 99.6%, with the percentage of agreement ranging from 98.8%–100%.

**Table 1. OBSD categories and behavioral definitions (Jay & Elliot, 1986)**

Category	Definition
Information-seeking	Any questions regarding the dental procedures.
Cry	The onset of tears or verbal cues of crying (e.g., "Boo-hoo," sniffing).
Scream	Loud vocal expressions at high/pitch intensity, often unintelligible.
Restraint	The child is physically held down with noticeable pressure.
Verbal resistance	Any verbal expression of delay, termination, or resistance (e.g., "No," "stop").
Emotional support	Verbal or nonverbal solicitation of hugs, hand holding, physical, or verbal comforting of the child.
Verbal pain	Any words, phrases, or statements that refer to pain, damage, being hurt, or discomfort.
Flail	Random movements of the arm and/or legs or whole body (i.e., flexing and extending the feet).

### *Peripheral Skin Temperature*

Physiologic arousal was measured by finger temperature using a YSI telethermometer, an electric temperature monitor that uses a finger probe to elicit a continuous reading of peripheral skin temperature. Prior to data collection, the monitor was calibrated by a biomedical instrumentation department. In this study, the temperature of the child's left index finger provided a measure of physiologic arousal, with decreases in peripheral skin temperature indicating a stress response and increases indicating relaxation.

### *Companion Animal*

The intervention in this study was an 8-year-old female Golden Retriever named Shamu, who was obedience-trained and certified as a therapy dog. Before the study began, the protocol was tested with the dog and 2 children having dental procedures at this clinic. During this pretest, Shamu's responses to the children and environment were evaluated. The dog was amenable to being petted by unknown children and nonresponsive to environmental noise (i.e., dental equipment and children's voices) within the treatment milieu. No changes were made in study protocol as a result of this pretest.

## **PROCEDURES**

A letter of introduction and brief explanation of the study was sent by clinic staff to all parents of children aged 7–11 years who were scheduled for appointments with the participating dentist from October–December 1999. One of the researchers greeted the parents and children in the clinic waiting room on the day of the scheduled procedure, explained the project, and obtained informed consent. In addition, the child was invited to sign an assent form. Demographic data were obtained prior to the child's entering the procedure room, which included the child's age, gender, race, presence of pets in the home, relationship with pets, past experiences and fear of dogs, and feelings about coming to the dentist. At this time, the child was randomly assigned to the experimental or control group.

The child was escorted to the examination room by the researcher and made comfortable on the dental table that was separated from the other tables in the room by a privacy screen. The YSI was introduced to the child and taped to the palmar surface of the child's left index finger. One researcher recorded finger temperatures throughout the dental experience at each of the 5-min interval time points.

A video camera was introduced to the child and positioned on a tripod at the foot of the procedure table so that the child's entire body and voice could be recorded. Recording began as soon as the child was comfortably positioned with the YSI telethermometer in place. A separately marked 8 mm videotape was used for each child for later coding of the OSBD.

The dog was introduced to the experimental participants immediately after the child was placed on the dental table, before initiation of any dental procedures. Shamu was positioned on a small bench near the child's right shoulder; the child was encouraged to pet, touch, and talk to her as desired during the dental procedure. The dog wore a cape over her back to contain any loose hair. At the end of the procedure, Shamu returned to her resting area in a room away from the children. During the procedure, the dentist sat at the head of the dental table and his assistant was placed to the left of the child's head. The researcher stood at the foot of the dental table to operate the video camera and record peripheral skin temperatures.

## **DATA ANALYSIS**

Data analysis utilized the SPSS program. Significance was established to be any probability value less than or equal to  $p = .05$ . Demographic data were analyzed using descriptive statistics (means, standard deviation, frequencies, and percentages). Repeated-measures analysis of variance

(ANOVA) and Student's *t*-test were used to determine the effect of the independent variable on the experimental and the control groups.

## **FINDINGS**

### ***Demographic Data***

Of the 40 children who participated in this study, 17 were males (42.5%) and 23 females (57.5%); 30 were Caucasian (83.5%), 2 were African American (5.6%), 2 were Asian (5.6%), 1 was Native American (2.8%) and 1 was of mixed racial background (2.8%). The subjects ranged in age from 7 to 11 years of age, with a mean ( $\pm$ SD) age of 8.85 ( $\pm$ 1.04) years for the control group, 8.4 ( $\pm$ 1.23) years for the experimental group and 8.63 ( $\pm$ 1.15) years overall. Twenty-four subjects (61.5%) had a dog in the home; 15 (38.5%) did not. Other pets in the home included cats (23.1%), fish (15.4%), multiple other animals (10.3%), and one bird (2.6%); 5 children had no pets in the home. All the subjects had positive relationships with dogs, and only 2 were mildly allergic to dogs.

Of the subjects, 26 (66.7%) had only one type of dental procedure, 11 (28.2%) had two different procedures, and 2 subjects (5.5%) had three different types of procedures performed. The procedures included fillings (50%), extractions (30%), crown placements (20%), sealants (20%), cleanings (7.5%), and other procedures (12.5%). The average time the child waited for the dental procedure to begin was 13 min, with a range of 5–40 min.

When asked how they felt about coming to the dentist, 17 children verbalized feelings of stress, such as: "I'm scared," "nervous," "stressful," "uptight," and "I feel like packing up my stuff and leaving." Twenty-three children verbalized feelings such as: "It's pretty cool," "No problems," and "It's OK, I like the prizes," which were not indicative of stress.

When experimental and control groups were compared on the basis of demographic characteristics, no significant differences were found between groups for age, race, gender, or number of dental procedures. Chi-square analysis revealed a significant difference between groups in terms of having a dog in the home [ $\chi^2 = 4.74$ ;  $p < .05$ ]. In the experimental group 15 (78.9%) children had a dog in the home, whereas only 9 (45%) of the control group had a dog in the home.

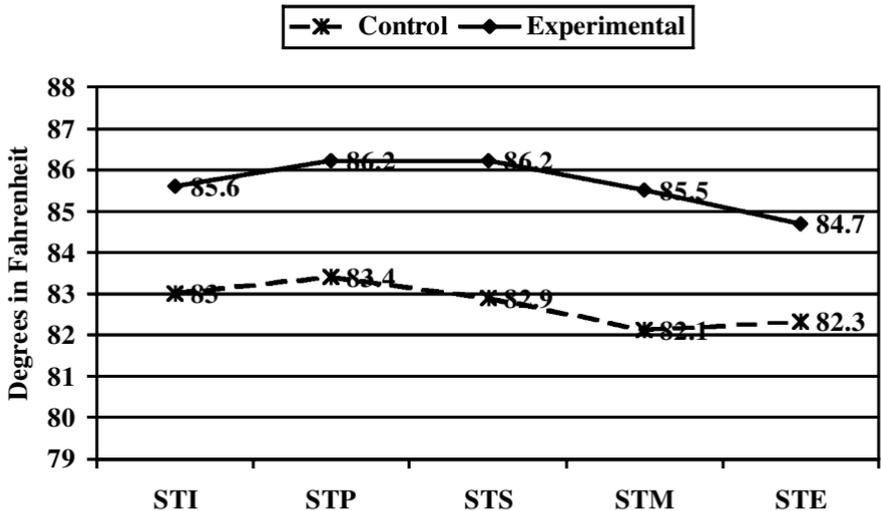
### ***Peripheral Skin Temperature***

Peripheral skin temperature was measured at 5-min intervals from the time the child was placed on the dental table until the end of the

procedure. As shown in Figure 1, both groups exhibited an initial increase in peripheral skin temperature, indicating some degree of relaxation, before the dental procedure began. At 5 min before the procedure began, the control group's peripheral skin temperature began to drop while the experimental group's temperature remained stable. Peripheral skin temperature dropped more rapidly for the children in the control group than the children in the experimental group. However, repeated measures ANOVA of the temperature readings (when the child was initially placed on the dental table, 5 min before the procedure, when the dentist arrived, midway through the procedure, and when the procedure ended) revealed no significant differences in peripheral skin temperature between the control and experimental groups,  $F(4,152) = .271$  and  $p = .810$ .

### *Observational Scale of Behavioral Distress*

Twenty-seven subjects exhibited some of the 8 distress behaviors, and 17 of the subjects did not exhibit any of the 8 behaviors. Crying was by far the most frequently observed behavior, followed by verbal pain and flailing



[STI = initial skin temp.; STP = 5 min preprocedure skin temp.; STS = skin temp. at start of procedure; STM = skin temp. midpoint from start to end; STE = skin temp. at end of procedure]

**Figure 1.** Mean peripheral skin temperatures measured at 5 different time intervals ( $n = 40$ ).

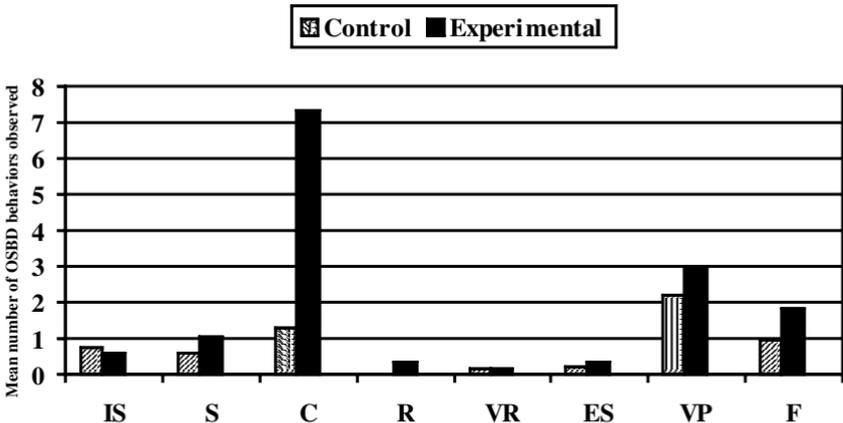
motions. Very few instances of information seeking, screaming, restraint, verbal resistance, and/or emotional support were noted (Figure 2).

*T*-test analysis was performed on the total weighted OSBD measures. While the experimental subjects' scores were higher ( $M = 0.44 \pm .72$ ) than the control group ( $M = 0.21 \pm .29$ ), no significant difference was found between the groups,  $t(38) = 1.34$ ,  $p = .19$ . Comments by the children in the experimental group indicated that they enjoyed having Shamu's company during their dental visit, as revealed by such statements as, "I liked having Shamu with me while the dentist worked on my teeth," and "Shamu made me not afraid."

### Additional Analysis

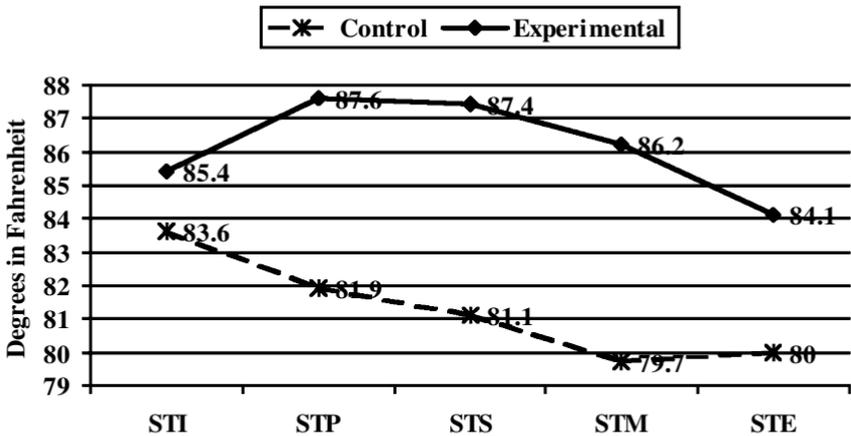
Examination of the demographic data showed that some children were stressed about coming to the dentist while some were not. This information led to further analysis of the data obtained from the children who verbalized stress on arrival at the clinic.

As shown in Figure 3, the stressed children in the control group experienced a steady decline in peripheral skin temperature from baseline to the end of the procedure. However, the children in the experimental group experienced an initial increase in skin temperature from baseline until the beginning of the dental procedure; the skin temperature of these children



[IS = information seeking; S = screaming by subject; C = crying by subject; R = restraint applied by caregiver; VR = verbal resistance by subject; ES = emotional support given by caregiver; VP = verbal pain expressed by subject; F = flailing movements by subject]

**Figure 2. Unweighted OSBD mean scores in the control versus experimental groups; control = 20, experimental = 20.**



[STI = initial skin temp.; STP = 5 min preprocedure skin temp.; STS = skin temp. at start of procedure; STM = skin temp. midpoint from start to end; STE = skin temp. at end of procedure]

**Figure 3.** Mean peripheral skin temperatures of the stressed subjects measured at 5 different time intervals ( $n = 17$ ).

declined after the procedure began. Repeated-measures ANOVA (using Greenhouse-Geisser correction) of the five time points (when the child was initially placed on the dental table, 5 min preprocedure, when the dentist arrived, midpoint during the procedure, and when the procedure ended) showed a significant interaction between temperature and intervention,  $F(4,60) = 4.21$ ;  $p = .013$ .

Follow-up within-subject contrast analysis showed significance at two data points between the experimental and control groups. Specifically, the children with the dog experienced an increase in skin temperature while waiting for the dentist to arrive, while the children who were not with the dog experienced a decline in skin temperature,  $F(1,15) = 7.16$ ;  $p = .017$ . The control group's skin temperatures declined more sharply from the beginning of the procedure through the midpoint, and then rose slightly at the end,  $F(1,15) = 6.214$ ;  $p = .025$ . The control group's peripheral skin temperatures were an average of  $1.8^{\circ}$  cooler than the experimental group when the children initially were placed on the dental table. At the end of the procedure, the control group's skin temperatures were an average of  $4.1^{\circ}$  cooler than the children in the experimental group.

## DISCUSSION

The results of this study did not support results of previous studies that indicated a companion animal can be beneficial in reducing behavioral

distress during anxiety-provoking procedures. Hansen et al. (1999) found significantly less behavioral distress among pediatric patients when a companion dog was present during physical examinations in a pediatric clinic. These findings are similar to those of Nagengast et al. (1997), who found significant differences in behavioral distress among children who had a dog present during a simulated physical examination. The presence of the dog in the study reported here, however, did not appear to affect behavioral distress.

In this study, the effect of the dog on physiologic arousal is consistent with the results of adult companion animal studies. Thoma (1984) and Schuelke, et al. (1991/92) found that adults with hypertension who were allowed to pet their own dogs showed significant increases in peripheral skin temperature compared with petting an unfamiliar dog. In our study, the increase in peripheral skin temperature for the stressed children in the experimental group was greater than the increase of 2.6°F found in an earlier study by Baun et al. (1984). However, Nagengast et al. (1997) found no significant differences in peripheral skin temperature among children undergoing simulated physical examinations with and without the presence of a dog.

The results of this study are compelling in regard to physiologic arousal for the children who were most stressed. These findings became clear only when the stressed children were separated from those for whom the dental visit was not stressful, and the impact of the dog's presence was most clearly apparent while the children waited for the dental procedure to begin.

Several factors may have influenced the findings of this study: the setting, characteristics of the sample, and measures used to indicate stress. The setting of the study was a dental office with a large open bay where dental procedures were performed. The philosophy underlying the design of this room was that children would be less stressed by seeing what is happening to the other children in the room. In this study, a screen was placed around the research participants so that they could not see other children; however, the participants could still hear other children. Wondering what was happening to others could have increased the research subjects' distress.

We were surprised to find that the majority of the children were not stressed about coming to the dental office. An assumption was made that the children in this age group would be stressed about visiting the dentist. However, this study revealed that some children looked forward to seeing the dentist (and receiving a reward) and did not perceive the visit to be stressful.

The use of the OSBD as a tool to determine behavioral indicators of distress had its limitations in this dental setting. For safety reasons, the

dentist or his assistant routinely restrained all the children. The dental assistant placed her arm across each participant's upper chest to prevent sudden arm movements, and the dentist secured the child's head. Because of these standard precautions, the child was not able to move freely during the procedure, which may have prevented capturing the full range of possible distress behaviors using the OSBD. A different instrument might yield clearer indications of behavioral distress in children during a dental procedure.

An additional limitation of this study was our inability to control for the type and number of procedures experienced by the children. Some children had extensive dental work while others had relatively simple procedures. In our study, no difference in average number of procedures was found between groups, but the types of procedures may have differed. Also, as noted, the time the children waited for their procedures to begin ranged from 5–40 min. In our study, no significant difference in waiting time was found for the experimental and control groups. However, for children who are frightened at the dental office, extended waiting periods could contribute to increased stress. An additional factor we could not control was the dentist's use of premedication. We were fortunate in that equal numbers of children in each group received premedication (one child in each group) and nitrous oxide (three children in each group); however, these medications were intended to reduce the child's distress manifestations, and so may have affected our results.

This study showed that the children who were most stressed about coming to the dentist experienced less physiologic arousal when the dog was present compared with those who did not have the dog. The study also demonstrated the feasibility of including an animal in the care of children in a busy dental clinic. Several parents, on learning of this study, requested that the dog be present for their child's procedure. Most of the children who were not with the dog during their dental work requested to meet Shamu after their procedure. Other children not included in the study were also eager to pet the dog.

Future research using a larger sample should be done to determine the effect of a companion animal with children for whom the dental visit is most stressful. In addition, further research should use a site in which children are treated individually in a private room, and it should control for the number and types of procedures performed, waiting time, and use of sedative medications.

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