

*Reinforcement techniques can be used to turn the attention, and potential fear, of a child away from necessary procedures.*

## The use of contingent audiotaped material with pediatric dental patients

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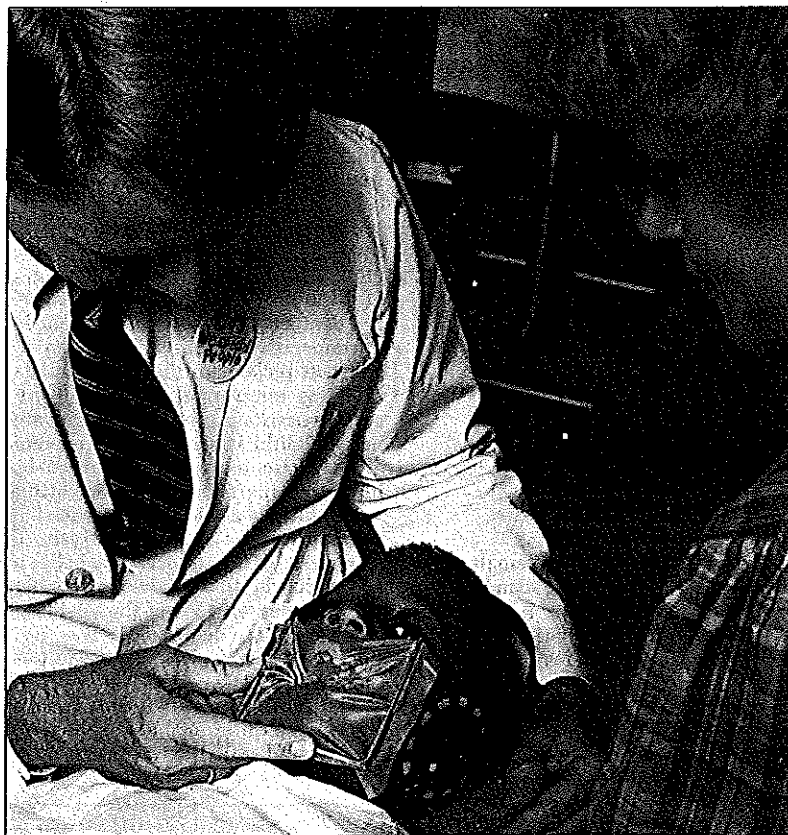
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**I**n the pediatric dental operatory, uncooperative patient behavior poses difficulties for the dental staff and increases the risk of discomfort and even injury to the child. It is well documented that early unpleasant dental experiences can contribute to later fear and avoidance of dentistry,<sup>1,2</sup> and evidence supports the view that negative attitudes toward dentistry begin principally in childhood and adolescence.<sup>3,4</sup>

The magnitude of the problem is suggested in the research by Weinstein and others,<sup>5</sup> which indicates that the average dentist in general practice encounters one to two problem children each week. Of the dentists surveyed, 15% reported difficulties with as many as four or more children each week. Our own research<sup>6</sup> indicates that many practitioners consider the uncooperative child patient to be among the most troublesome of problems in their clinical treatment.

Recently, investigators have begun to explore the use of operant behavior modification procedures to decrease fearful, uncooperative child behavior during dental treatment.<sup>7,8</sup> However, although these methods have proved effective in altering a wide range of maladaptive child behaviors in other settings, their



use in the dental setting poses problems. Specifically, to be maximally effective in altering behavior, reinforcement must be delivered soon after the occurrence of the desired behavior. This is difficult to achieve in the operatory without repeatedly interrupting treatment.

Similar difficulties hamper the use of so-called "time-out" procedures during dental treatment. This approach, which

involves the interruption of an enjoyable activity when undesirable behavior occurs, is quite effective in reducing the frequency of undesirable behavior. Again, however, the interruption of an ongoing enjoyable activity is a situation that is not easily arranged in the dental context.

Televised or videotaped material offers a potential solution, as these stimuli can

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be delivered or interrupted contingently with a flick of a switch. In a recent study,<sup>9</sup> the contingent use of videotaped cartoons resulted in clinically and statistically significant reductions in uncooperative child behavior during dental treatment. However, although this method is effective, it requires the availability of video playback equipment and a television monitor suspended from the ceiling above the chair.

A similar, but less costly and complicated approach is to use audiotaped material with a small cassette tape player and earphones. Like videotaped stimuli, audiotaped material (commercially available children's stories) can be used continuously during treatment and can be delivered or interrupted, contingent on child behavior, without interrupting treatment.

The study described in this paper evaluated and compared the effectiveness of audiotaped stories, used contingently and noncontingently, in reducing uncooperative behavior during dental treatment and in reducing the perceived aversiveness of the dental experience for the child.

### Method

#### Subjects

Subjects were 26 males and 19 females ages 4-9 years (mean age 77 months), seen in a university pediatric dental clinic. All children had had previous dental experience and all were in need of additional restorative treatment. No attempt was made to screen children on the basis of dental anxiety or behavior during dental treatment. However, children with severe physical or mental handicaps were not included in the study sample.

#### Procedure

The first restorative visit served as a baseline session for all subjects. At the second restorative visit 1-2 weeks later, subjects were assigned to one of three groups matched on the basis of age, gender, and level of disruptive behavior at the initial visit. "Control condition" subjects experienced restorative treatment as normally provided, with no additional manipulations. Subjects assigned to the "noncontingent (distraction) condition" were permitted to choose audiotaped stories, heard through headphones continuously through-

out dental treatment. Subjects in the "contingent (reinforcement) condition" were informed that audiotaped material would be available only as long as they remained quiet and cooperative. If uncooperative behavior occurred, tape presentation was immediately interrupted and was not reinstated until the child showed approximately 5 seconds of cooperative behavior. Verbal feedback, reminding the child of the contingencies, was given on the first occasion of uncooperative behavior/tape interruption.

The same dentist, an experienced pedodontist, provided restorative treatment to all subjects. The dentist interacted with the children in the fashion in which he customarily interacts with young patients.

#### Dependent measures

During restorative procedures, trained observers scored four categories of uncooperative behavior in 15-second intervals, using the observational system described by Allard and Stokes.<sup>10</sup> The four categories were body movement, head movement, crying, and use of restraint. Movements made in response to the dentist's instructions were not scored as uncooperative. Observation began when the assistant picked up the syringe. Data collection was interrupted when both the dentist and the assistant ceased looking at and touching the child's face and was resumed when either again touched the child's face with hands or instrument. Observation ended when the rubber dam was removed.

For purposes of data analysis, the four categories of uncooperative behavior were summarized into a single category. Reliability was assessed on 53% of the situations. Mean agreement on occurrence was 94.3%; on nonoccurrence, 97.7%; and mean total agreement was 98.7%.

Additional dependent measures included scores on a Children's Fear Survey Schedule,

modified by Melamed and others<sup>11</sup> to include dentally related items, and scores on the Venham Picture Test,<sup>12</sup> a forced-choice pictorial self-report measure of situational anxiety. Both devices were administered at the end of each visit.

### Results

One-way analysis of variance tests (ANOVA) indicated that, before the experimental manipulations, the groups did not differ significantly in age or on any of the dependent measures.

#### Behavioral observation

Because behavioral observation scores were expressed as proportions (percent of total intervals in which uncooperative behavior occurred), an arc-sin transformation was performed to stabilize the variance. Analysis of covariance was then carried out by means of the General Linear Models procedure (SAS), using dummy variable coding, which contrasted the two experimental groups against the control group. Results indicated a significant difference between treatment groups at visit 2 ( $F = 14.47, df = 3, 41, P = .0001$ ). Tests of individual parameters within the model disclosed a significant difference between the contingent group and the control group ( $t = 4.21, df = 41, P = .0001$ ). However, the noncontingent group did not differ from the control group on this measure ( $t = -.61, df = 41, P = .55$ ).

#### Self-report measures

To stabilize the variance, square-root transformations were performed on all self-report scores. As the Table indicates, visit 1 scores on the Venham Picture Test were low; in fact, almost half of the subjects endorsed no negative items and obtained a score of zero. Tests

Table ■ Mean scores for all groups at first and second restorative visits.

	Control		Noncontingent tapes		Contingent tapes	
	1*	2	1	2	1	2
Disruptive behavior (%)	31.4	37.4	28.5	28.7	30.4	6.1
Venham Picture Test	1.3	.6	1.7	1.4	2.6	2.5
Dental fear	29.5	25.8	34.2	33.1	31.1	31.7

\*Visit number.

of individual parameters within the analysis of covariance model showed no significant differences in visit 2 scores between the contingent group and the control group ( $t = .91$ ,  $df = 41$ ,  $P = .37$ ), nor was there a significant difference between the noncontingent group and the control group ( $t = .32$ ,  $df = 41$ ,  $P = .75$ ).

Scores on the Dental Fear Survey were also low at visit 1 for all groups (Table). Tests of individual parameters with the analysis of covariance model indicated no significant difference between the contingent group and the

dures with child patients and adult patients reflects the fact that adults typically need to learn only new patterns of emotional responding. Children, however, need to learn new patterns of overt (cooperative) behavior, as well as adaptive emotional responses.

Literature supports the social learning theory position that acquisition of new behavior is facilitated by differential consequences contingent on performance and nonperformance of the target

self-reported fear among children who, although behaviorally somewhat uncooperative, reported little fear initially.

### Summary

Contingent reinforcement procedures such as those used in this study appear to be a practical and effective means of reducing uncooperative child behavior during dental treatment. The cost of the equipment is modest and, as the equipment can be operated by means of a foot pedal, contingent reinforcement procedures can be implemented without interfering with ongoing activities.

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The informed consent of all human subjects who participated in the experimental investigation reported or described in this manuscript was obtained after the nature of the procedure had been fully explained. There were no risks to subjects as a result of their participation in this research.

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## *Distraction is not always an effective approach with young children.*

control group ( $t = 1.02$ ,  $df = 41$ ,  $P = .31$ ), nor was there a significant difference between the noncontingent group and the control group ( $t = .88$ ,  $df = 41$ ,  $P = .39$ ).

### Discussion

Findings from the present study are consistent with results of an earlier study<sup>9</sup> that indicated contingent presentation of videotaped cartoons resulted in significant reductions in uncooperative child behavior during dental treatment. Of the two stimuli—videotaped cartoons and audiotaped stories—the audiotaped material appeared to produce a more robust effect: use of cartoons resulted in a 44% reduction in uncooperative behavior, whereas use of audiotapes was followed by an 80% reduction in uncooperative behavior. Although we cannot make direct comparisons between the results of separate studies, these findings do suggest that audiotaped material offers the more potent intervention. This, we think, is a result of the fact that children listening to audiotapes tended to close their eyes to concentrate on the material, thereby screening out the sights as well as the sounds of dental treatment. Children watching cartoons, of course, kept their eyes open and so could not block out the visual aspects of treatment.

Results of the present study are also consistent with the earlier study in that for neither study was distraction an effective means of reducing uncooperative child behavior during dental treatment. Weinstein and others<sup>5</sup> have also reported that distraction is not an effective approach with young children. Elsewhere, we have speculated that the difference in the effectiveness of distraction proce-

dures with child patients and adult patients reflects the fact that adults typically need to learn only new patterns of emotional responding. Children, however, need to learn new patterns of overt (cooperative) behavior, as well as adaptive emotional responses.

Literature supports the social learning theory position that acquisition of new behavior is facilitated by differential consequences contingent on performance and nonperformance of the target behavior. The robust effect obtained in the present study with contingent presentation of audiotaped material is in accord with this literature and supports the efficacy of contingency management procedures in reducing maladaptive behavior in the dental operator. From the clinician's perspective, it is important to note that the observed changes in child behavior were clinically meaningful as well as statistically significant. We have previously determined that, at approximately the 30% level of disruptive behavior, child behavior is at least somewhat problematic to the dentist. In the present study, control group subjects showed no change from visit 1 to visit 2 in the number of children who had 30% or more uncooperative behavior. In the noncontingent group, there was a 25% reduction in numbers from visit 1 to visit 2, whereas in the contingent group, only a single child remained at or above the 30% level (a reduction of 83%).

Failure to observe changes in self-reported situational anxiety as assessed by the Venham Picture Test might be the result, in part, of the fact that initial visit scores on this measure were low, allowing little room for change. In fact, almost half of the subjects endorsed no negative items and so earned a score of zero.

Similarly, as the Table indicates, visit 1 scores on the Dental Fear Survey were low: the overall mean at visit 1 was 31.6, which is quite close to the score of 30.55 reported by Cuthbert and Melamed<sup>13</sup> as the mean for a large group of 5- to 8-year-old children. This suggests that, as a group, our subjects were not highly fearful of dental treatment. Therefore, we would not expect dramatic changes in