

Distraction and contingent reinforcement with pediatric dental patients

Behavior

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Many practicing dentists consider the fearful, uncooperative child patient to be among the most troublesome of problems in their clinical work.¹ Weinstein recently investigated the incidence of this problem and reported that the average dentist in general practice encounters one or two problematic children per week.² Fifteen percent of those surveyed reported difficulties with as many as four or more children per week. These findings, Weinstein concluded, "signify that a serious recurring problem exists for many practitioners."

The problem is one which has serious implications for the young patient, as well. A growing body of evidence supports the view that negative attitudes toward dentistry have their genesis principally in childhood and adolescence.^{3,4} Early unpleasant experiences can contribute to later fear and avoidance of dentistry and disinterest in preventive oral health activities, in general.⁵⁻⁸

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Recently, investigators have begun to explore the use of operant behavior modification procedures to decrease fearful, uncooperative child behavior in the dental operator.^{9,10} Although these methods have proved effective in altering a wide range of maladaptive child behaviors, their use in the dental setting poses problems. Specifically, to be maximally effective, reinforcement must be delivered in close temporal proximity to the occurrence of the desired behavior—a criterion which is difficult to achieve during actual dental treatment.

Similar difficulties accompany the use of time-out procedures. This approach, which involves interruption of a reinforcing event contingent on undesirable behavior, is an especially effective method for reducing the frequency of an undesirable behavior.^{11,12} Again, however, the cessation of ongoing positive reinforcement is a situation which is not easily arranged in the dental context.

The contingent use of television or videotapes offers a potential solution, as these stimuli can be delivered or interrupted with the flick of a switch. In fact, contingent use of television has been documented as effective in reducing inappropriate behavior in other contexts.^{13,14}

Television also has potential utility as a distractor. Distraction has repeatedly been shown to be an effective means of attenuating pain and stress in a variety of settings, including the dental operator.^{15,16} In one recent study, for example, video games were used successfully to distract adult patients undergoing dental treatment.¹⁷

In light of the American child's well-known love affair with television, it is somewhat surprising that the use of television and videotapes as a distractor during dental treatment had received no empirical attention. The study described in this paper was undertaken to evaluate and compare the effectiveness of videotapes employed as a distractor and as a contingent reinforcer, in reducing uncooperative behavior during dental treatment and in reducing the perceived aversiveness of the dental experience for the child.

METHOD

Subjects

Subjects were sixteen females and twenty-nine males, ages 3.5 to 9 years (mean age, seventy-eight 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. Children with severe physical or mental handicaps, however, 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, one to two weeks later, subjects were randomly assigned to one of three conditions. *Control Condition* subjects experienced restorative treatment as normally provided, with no additional manipulations. Subjects assigned to the *Cartoon-Distribution Condition* were permitted to view videotaped cartoons, displayed on a ceiling-mounted monitor, continuously throughout dental treatment. Subjects in the *Cartoon-Reinforcement Condition* were informed that cartoons would be displayed only as long as they remained quiet and cooperative. If uncooperative behavior occurred (see Dependent Measures), cartoons were immediately interrupted and were not reinstated until the child emitted approximately five seconds of cooperative behavior. Verbal feedback, reminding the child of the contingencies, was given on the first occasion of uncooperative behavior/cartoon interruption.

The same dentist provided restorative treatment to all subjects. The dentist behaved as he customarily does when treating patients.

Dependent measures

During restorative procedures, trained observers scored four categories of uncooperative behavior in fifteen-second intervals, using the observational system described by Allard and Stokes.¹⁸ 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 collapsed into a single summary category. Reliability was assessed on 71 percent of occasions. Mean agreement on *occurrence* was 86.8 per-

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

	Control		Cartoon distraction		Cartoon reinforcement	
	V ₁	V ₂	V ₁	V ₂	V ₁	V ₂
% Disruptive behavior	32.39	34.21	46.58	31.69	25.85	14.59
Venham	1.27	.93	1.73	1.40	1.33	1.00
Dental fear	29.83	29.33	28.33	29.50	36.57	31.57

cent; on nonoccurrence, 95.2 percent; and mean total agreement was 97.8 percent.

Additional dependent measures included scores on a *Children's Fear Survey Schedule*, modified by Melamed to include dentally-related items, and scores on the *Venham Picture Test*, a forced-choice pictorial self-report measure of situational anxiety.^{19,20} Both devices were administered at the end of each visit.

RESULTS

One-way analysis of variance tests indicated that, prior to 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 (S.A.S.), 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 ($F = 5.71$, $df = 3, 41$, $p = .002$). Tests of individual factors within the model revealed a significant difference between the *Cartoon-Reinforcement Group* and the *Control Group* ($t = 2.42$, $df = 41$, $p = .02$). The *Cartoon-Distraction Group* did not differ, from the *Control Group* on this measure ($t = -.69$, $df = 41$, $p = .49$).

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 very low: in fact, over half of the subjects endorsed no negative items and obtained a score of zero. Test of individual factors within the analysis of covari-

ance model revealed no significant differences in scores between the *Cartoon-Distraction Group* and the *Control Group* ($t = -.33$, $df = 41$, $p = .74$), nor were there significant differences between the *Cartoon-Reinforcement Group* and the *Control Group* ($t = -.10$, $df = 41$, $p = .91$).

Scores of the *Dental Fear Survey* were obtained on only nineteen subjects. No significant differences emerged between the *Cartoon-Distraction Group* and the *Control Group* ($t = .69$, $df = 15$, $p = .50$). Although there was a tendency for subjects in the *Cartoon-Reinforcement Group* toward improvement on this measure, the difference did not achieve statistical significance ($t = -1.45$, $df = 15$, $p = .17$).

DISCUSSION

Results indicate that distraction, in the form of videotaped cartoons, is not an effective means of reducing uncooperative child behavior during dental treatment. While these results contradict those obtained in studies of distraction with adults, they are consistent with the findings of Weinstein, who reported that distraction is not an effective approach with young children.²

This discrepancy between results obtained with children and those obtained with adults reflects, at least in part, differences in the target behaviors in these two groups. With adult patients, the problem is not one of uncooperative behavior in the chair: research has shown that fearful patients cannot be distinguished from non-fearful patients on the basis of overt behavior.²¹ Instead, the goal of intervention is to produce changes in cognitive-emotional responding. With children, who often "act out" distress behaviorally, however, the goal is to produce improvement in overt behavior as well as in the child's emotional response to the situation.

Social learning theory would not lead us to expect distraction procedures to be a useful means of shaping behavior. Rather, a vast body of evidence indicates that acquisition of new behavior is facilitated by differential consequences contingent upon performance and non-performance of the target behavior. The finding that contingent use of videotaped cartoons significantly reduced uncooperative behavior—indeed, almost halved it—is in accord and supports the efficacy of contingency management procedures in reducing maladaptive behavior. As concerns the dental setting, specifically, our findings are in agreement with those of Weinstein, who found that social reinforcement (praise) for appropriate behavior was consistently followed by reduction in fear-related behavior.²

From the clinicians' perspective, it is important to ask whether the observed changes in child behavior were clinically meaningful as well as statistically significant. To determine the point at which uncooperative behavior, as we have defined it, becomes a problem for the dentist, we asked a group of fourteen practicing dentists to observe and rate videotapes of children undergoing dental treatment. At the 30 percent level of uncooperative behavior, over three-quarters (78 percent) indicated some difficulty in providing safe, high-quality treatment. In the present study, *Control Group* subjects showed no change from Visit 1 to Visit 2, in the number of children who exhibited 30 percent or more uncooperative behavior. In the *Distraction Group*, there was a 20 percent reduction in numbers from Visit 1 to Visit 2, while in the *Reinforcement Group*, the number of children whose behavior placed them in the problematic range decreased by 60 percent at the second visit.

A tendency toward reduction in self-reported fear of dentistry was observed in the *Cartoon-Reinforcement Group*. It is possible that, had scores on additional subjects been obtained, this difference might have reached statistical significance. This tendency was not observed in the *Cartoon-Distraction Group*, despite the fact that all children who viewed cartoons said they enjoyed the cartoons.

These findings are consistent with self-efficacy theory, which seeks to explain the relationship between psychological change and behavioral change.²² According to this theory, consequences serve an informational function: the performer observes what he must do to gain beneficial outcomes and avoid punishing ones; behaves accordingly; and, in succeeding, gains a sense of mastery. Mastery experiences in feared situations provide corrective feedback: the individual learns that he can cope effectively. Such performance-based approaches, then, not only lead to behavioral accomplishments, but are also a powerful means of extinguishing fear.

Failure to observe changes in self-reported situational anxiety as assessed by the *Venham Picture Test* may be due, in part, to the fact that initial visit scores on this measure were very low, allowing little room for change. Timing of administration of this measure might have resulted in low scores: this device asks the child how he feels at the moment; and, at the end of the dental visit, freed from the chair, the child is more apt to feel relief than anxiety. Correlations observed between this and other measures of anxiety and disrup-

tiveness are low, however, and even investigators who have administered this measure both before and after the visit have failed to find changes in it which parallel changes observed in other measures.^{23,24}

In summary, contingent reinforcement procedures such as those employed in this study appear to be a useful means of reducing anxiety and uncooperative behavior in children undergoing dental treatment. From a cost-benefit standpoint, this approach seems promising for routine office use. The equipment can be operated by means of a foot pedal without interfering with ongoing activities. Further, the initial expense of purchasing home video equipment is not great, relative to the cost of dental equipment, and the equipment can be used for a variety of other purposes.

REFERENCES

1. Ingersoll, T.G.; Ingersoll, B.D.; Seime, R.J. *et al*: A survey of patient and auxiliary problems as they relate to behavioral dentistry curricula. *J Dent Ed*, 42:260-263, 1978.
2. Weinstein, P.; Getz, T.; Ratener, P. *et al*: The effect of dentists' behaviors on fear-related behaviors in children. *J Am Dent Assoc*, 104:32-38, 1982.
3. Lutch, H.: Dental phobia. *Brit J Psychiat*, 119:151-158, 1971.
4. Shaw, O.: Dental anxiety in children. *Brit Dent J*, 134-139, 1975.
5. Kleinknecht, R.; Klepac, R.; and Alexander, L.: Origins and characteristics of fear of dentistry. *J Am Dent Assoc*, 86:842-848, 1973.
6. Shoben, E. and Borland, L.: An empirical study of the etiology of dental fears. *J Clin Psychol*, 10:171-174, 1954.
7. Sermet, O.: A study of the dentally anxious child. MSc Thesis, University of Wales, 1971.
8. Kegeles, S.: Some motives for seeking preventive dental care. *J Am Dent Assoc*, 67:90-95, 1973.
9. Kohlenberg, R.; Greenberg, D.; Reymore, I. *et al*: Behavior modification and the management of mentally retarded dental patients. *J Dent Child*, 39:61-67, 1972.
10. Stokes, T. and Kennedy, S.: Reducing child uncooperative behavior during dental treatment through modeling and reinforcement. *J Appl Behav Anal*, 13:41-50, 1980.
11. Hobbs, S.A. and Forehand, R.: Important parameters in the use of time out with children: A reexamination. *J Behav Ther Exper Psychiat*, 8:365-370, 1977.
12. MacDonough, T.S. and Forehand, R.: Response-contingent time out: Important parameters in behavior modification with children. *J Behav Ther Exper Psychiat*, 4:231-236, 1973.
13. Baer, D.M.: Laboratory control of thumbsucking by withdrawal and re-presentation of reinforcement. *J Exper Anal Behav*, 5:525-528, 1962.
14. Greene, R.J. and Hoats, D.J.: Reinforcing capabilities of television distortion. *J Appl Behav Anal*, 2:139-141, 1969.
15. Kanfer, F.H. and Goldfoot, D.A.: Self-control and tolerance of noxious stimulation. *Psychol Rep*, 18:79-85, 1966.
16. Mellford, R. and Weiland, B.: Modification in autonomically mediated physiological responses to cold pressor by word association. *Psychophysiol*, 2:1-9, 1965.
17. Corah, N.L.; Cale, E.N.; and Illig, S.J.: The use of relaxation and distraction to reduce psychological stress during dental procedures. *J Am Dent Assoc*, 98:390-394, 1979.
18. Allard, G.B. and Stokes, T.F.: Continuous observation: A de-

- tailed record of children's behavior during dental treatment. *J Dent Child*, 47:246-250, 1980.
19. Melamed, B.; Hawes, R.; Heiby, E *et al*: The use of filmed modeling to reduce uncooperative behavior of children during dental treatment. *J Dent Res*, 54:797-801, 1975.
 20. Venham, L. and Gaulin-Kremer, E.: A self-report measure of situational anxiety for young children. *J Ped Dent*, 1:91-96, 1979.
 21. Kleinknecht, R.A. and Bernstein, D.A.: The assessment of dental fear. *Behav Ther*, 9:626-634, 1978.
 22. Bandura, A.: Self-efficacy: Toward a unifying theory of behavioral change. *Psychol Rev*, 84:191-215, 1977.
 23. Klorman, R.; Michael, R.; Hilpert, P. *et al*: A further assessment of predictors of the child's behavior in dental treatment. *J Dent Res*, 58:2338-2343, 1979.
 24. Siegel, L.J. and Peterson, L.: Stress reduction in young dental patients through coping skills and sensory information. *J Consult Clin Psychol*, 48:785-787, 1980.

COPING THROUGH THE HELP OF SELF-TALK

Frequently stress is situational. Patients may not feel stressed during the whole dental appointment, but only at certain times, perhaps during certain procedures. For some, it may be when they first enter the operatory and perceive the sights and smells. For others it may be during the injection process, the placement of the rubber dam, or perhaps only during the time the high speed drill is used.

It is important to pinpoint whether the stress is experienced during the entire appointment or related only to a specific time or procedure. Even if the stress is present during the entire appointment, it is still helpful to encourage the patient to view anxiety or pain as a series of phases rather than one large trauma. In this way the problem is more manageable and the clinician can teach the patient skills in coping with one aspect during one appointment and another at the next.

Teaching the patient self-talk that will help reduce anxiety or response to pain is a technique which can be utilized in a variety of ways in the operatory.

Weinstein, P. and Getz, T.:
Changing human behavior.
St. Louis: The C. V. Mosby Company.
1978, p 113.
