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REDUCING CHILD UNCOOPERATIVE BEHAVIOR DURING DENTAL TREATMENT THROUGH MODELING AND REINFORCEMENT

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The uncooperative behavior of grade-school children during dental treatment was examined. Forty children enrolled in a government dental program were observed during treatment conditions involving instructions concerning the appropriate behavior required by the dental practitioner, description of the objective procedures and subjective experience the child could expect, praise for appropriate behavior, and a colorful stamp for coming to the clinic. Eight of these children whose behavior was still too disruptive for effective dentistry were formally introduced to additional intervention procedures of tangible consequences for cooperative behavior, and observation of peers and by peers during actual dental treatment. Within a multiple baseline design, the intervention conditions were effective in decreasing the children's uncooperative behavior to acceptable levels.

DESCRIPTORS: children, dentistry, disruptive behavior, modeling, multiple baseline, peers, reinforcement

Essentially, a dentist has little to offer the young client except short-term pain and long-term gain. There is much about dentistry that is likely to maintain avoidance behavior by children. The dental operatory is unlike any of a child's natural settings—it is an environment in which the child lies on his or her back while two adults fill the mouth with numerous objects, some of which make unusual noises, some of which cause unusual sensations, and some of which inflict pain. Lest any child remain calm, siblings and peers typically discuss and exaggerate many of their own adverse dental experiences just prior to a child's dental appointment. It is not surprising, therefore, that young children undergoing dental treatment frequently display a range of uncooperative behaviors such as disruptive movements and crying. These actions may be physically dangerous to the child because of the potential damage to teeth and mouth by the dental instruments. Furthermore, these behaviors often interrupt dental treatment, thereby reducing the efficiency of the service, and occasionally, they discourage a dentist from working in pediatric dentistry. Nevertheless, restorative treatment is necessary for the long-term oral health of the young clients. Therefore, research in recent years has begun to document the value of applying behavior analysis procedures to reduce children's disruptive behavior and to provide positive consequences for children's cooperation during treatment.

Most recommended techniques for modifying child behavior during dentistry have involved various forms of preexposure to the dental setting and procedures. For example, in the studies by Melamed, Hawes, Heiby, and Glick (1975), and Melamed, Weinstein, Hawes, and Katin-Borland (1975), children in the experi-

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mental groups watched a film of a young child undergoing treatment. This model underwent a restorative procedure with a friendly dentist, who responded to his coping behavior with praise, and by giving a toy at the end of the session. Children in the control groups drew pictures in the same videotape room, or watched a film of a child in a setting unrelated to dentistry. The children's behavior during subsequent procedures of radiography, prophylaxis, and restorative treatment was documented by use of a behavior profile rating scale that showed the disruptive behavior of the experimental subjects to be significantly lower than that of the children in the control groups.

Comparisons between the effectiveness of similar symbolic modeling procedures and desensitization were made by Johnson and Machen (1973) and Machen and Johnson (1974). The modeling groups watched a film of a child displaying appropriate cooperation during treatment and being praised by the dentist. The desensitization group children were exposed to successively more anxiety-provoking stimuli from the dental operatory, e.g., mirror and explorer before dental handpiece and anesthetic syringe. During later treatment, the children were rated six times throughout an appointment according to four general categories: definitely negative, slightly negative, slightly positive, definitely positive. Johnson and Machen (1973) showed that the modeling group displayed more positive behavior than the desensitization or control group children during an initial clinical and radiographic examination and prophylaxis. Machen and Johnson (1974) found that both the modeling and the desensitization groups were equally effective and superior to the control group in reducing uncooperative behavior during appointments in which amalgam restorations were placed.

An examination of the use of a live model was described by White, Akers, Green, and Yates (1974). The children in that study observed a rehearsed "confederate" patient from behind a one-way mirror. Observations occurred on six occasions over a 3-wk period. The modeling group observed the child undergoing various treatments; one control group observed a dentist who named and manipulated the dental equipment; a second control group did not observe any dental setting. The dentist employed a checklist of approach behaviors (e.g., opened mouth, allowed anesthetic) and avoidance behaviors (e.g., crying, restless in chair) to document the behavior of the children during dental appointments. The modeling group procedures were shown to be significantly superior to the control groups as measured by the cooperation of the children.

Kohlenberg, Greenberg, Reymore, and Hass (1972) taught severely retarded persons to sit back in their chairs, pay attention to the dentist, and keep their mouths open by using shaping and edible reinforcers (fruit juice squirted into the mouth). They found that after two 45-min special training sessions with the experimenters, the subjects opened their mouths more, and required fewer physical restraints from the dentist than did a control group. After noting the fact that these procedures required extra time and personnel, Kohlenberg et al. suggested that the most advisable technique would be for the dental practitioner to use behavior management procedures during regular dental treatment.

The present study was designed to evaluate the use of both observation of real-life models and tangible consequences in developing cooperative behavior in normal young children. The procedures were specifically designed to be applied during actual restorative treatment in an ongoing dental program, rather than relying on preexposure films, exposure to rehearsed models, or special training sessions. These procedures were regarded as being more cost efficient because they did not require extra equipment, extra time in preparing models, or extra training personnel. Furthermore, all the experimental manipulations were introduced with little rearrangement of the typical dental routine, and the consequences employed were naturally available without cost in the dental operatory.

In addition, the present study was designed to allow a more intensive analysis of children's behavior than has occurred in previous studies. Continuous recording facilitated a detailed examination of the children's behavior within an appointment and across a number of successive restorative appointments.

METHOD

Subjects and Setting

The eight children in this study were enrolled in a government sponsored dental program for children in the Province of Manitoba, Canada. The 7-year-old children attended second grade at the elementary school of a small town in rural Manitoba. Many of the children were from farming families, and most were from families generally characterized as middle class.

The study was conducted in a dental clinic situated in the school building. This dental operatory was at the end of a room 5 m by 3 m. It was furnished in a manner similar to a regular dentist's office, containing a dental chair and equipment for radiographs, prophylaxis, and restorative treatment.

The dental clinic was operated by a dental nurse and a dental assistant, under the supervision of a dentist in charge of all such programs in the region. The dentist visited the school before the dental nurse. He examined the children's teeth and prescribed the work to be completed by the nurse. After completing the treatment of children in one school, the nurse moved to another school in the district. The quality of the nurse's work was regularly monitored by a dentist.[1]

Children usually attended the clinic on a number of occasions. Typically, the first visit involved familiarization with the setting and its equipment. Children were told about the operation of the dental instruments and were encouraged to hold them. During the second visit, the children's teeth were cleaned and a fluoride treatment given. In addition, the children were instructed how to brush their teeth and were informally quizzed about their knowledge of dental health. After these preliminary appointments, restorative treatment commenced. Each child attended up to four appointments as the teeth were worked on by quadrants of the mouth, i.e., upper right, one appointment; lower left, another appointment. For the children in this study, an average of 10 days separated appointments. At each appointment time, the child came from his or her regular classroom to the dental clinic. The length of the treatment varied according to the type of procedures employed on any day, e.g., a filling appointment took about 30 min, extraction appointments about 20 min, and nerve-treatment appointments about 45 min. The anesthetic drug, Prilocaine, was routinely administered by the nurse prior to the dental treatment.

Measurement

The uncooperative behavior of the children during restorative dental treatment was noted by an experienced observer who sat at the side of the dental operatory, approximately 2 m from the child being observed. The observer did not assist in the implementation of the experimental procedures, nor participate in the dental clinic activities. Four categories of uncooperative behavior were scored according to a 15-sec interval recording procedure. These observation categories were determined after extensive discussion with the nurse concerning those be-

[1]Similar government programs have operated in Australia, New Zealand, and in the Province of Saskatchewan, Canada. Obviously, the quality of the service provided by the specially trained nurses is a relevant consideration. Recently, three dentists conducted a study of the quality of the work completed by Saskatchewan dental nurses. They found that on a number of dimensions, the restorations and crowns placed by the nurses were as good as or significantly superior to the quality of similar work completed privately by dentists. (Ambrose, E. R., Hord, A. B., & Simpson, W. J. A quality evaluation of specific dental services provided by the Saskatchewan Dental Plan. Final report submitted to the Province of Saskatchewan, 1976.)

haviors disruptive to effective dentistry. An occurrence of any of these behaviors was noted by coding H, B, C, and/or D within an interval, according to the following definitions:

H—Child made any head movement, except facial muscle movements or movements of the lower jaw.

B—Child moved any part of body 15 cm (6 inches) or more in one continuous motion—small repetitive back and forth motions were cumulated to 15 cm if they were continuous, i.e., there was no pause between these small movements. It should be noted that body movements were found to be valid measures of disruptive movements of the head, i.e., head movements could not be scored by the observers when the nurse was holding the head, but when body movements were scored, the nurse noted disrupting movement of the head.

C—Child cried, complained, or moaned about dental procedures, the dental setting, or pain, e.g., "I don't like the needle," "Will it take long?"

D—Child behavior caused a delay in dental work for a continuous 5 sec or more. The commencement of the delay was marked by the nurse's comment concerning delaying tactic, or her withdrawal of instruments following a problem behavior. In fact, head and body movements and crying usually led to delays in treatment, e.g., the child's head had to be repositioned, the nurse had to pause during body movements or wait until crying ceased. Many of these behaviors caused brief delays in treatment; however, only delays greater than 5 sec were scored.

Head movements and cries were scored in the interval in which they occurred, or both intervals if there was an overlap. Body movements and delaying tactics were scored in the intervals in which they fulfilled the definition requirements—the interval in which they occurred, or in the second interval only if they began in one interval and fulfilled the requirements of the defined behavior in the next interval. Any movements in response to the nurse's instruction or head nods in response to the nurse's questions were acceptable, and therefore were not scored as uncooperative behavior.

Observation began when the seated child was lowered back into a supine position ready for treatment and ended when the chair was raised to a sitting position for the child, when the nurse's light was turned off, or when the nurse verbally signalled the end of treatment, whichever was first. Whenever the nurse ceased working directly on a child's teeth, e.g., to answer the telephone, to cut and shape a crown for a child's tooth, it was acceptable for the child to move around in the chair. Therefore, data were not scored if the nurse left her chair, commenced to cut a stainless steel crown, or verbally indicated she was stopping work for a moment. When the nurse returned to her work, noted by turning on the light, touching the child's mouth with hands or instruments, or by verbal cue from the nurse, scoring resumed. The length of an appointment reported in this paper refers only to the length of actual treatment time and does not include the periods of nontreatment.

The major data presented in this report concern the percentage of the observation intervals in which any of the categories of uncooperative behavior occurred. The data will be presented as the percentage of uncooperative behavior during consecutive 10-min intervals of dental treatment. This facilitates the detailed tracking of a child's behavior as time in restorative treatment increases, and allows for the fact that different children had appointments of different lengths.

Reliability

Data of two independent observers were compared on 15 of the 44 baseline appointments (34% of appointments), and 9 of the 20 (45%) intervention appointments. Because of the low rates of uncooperative behavior observed for many of the children during baseline and for all children during intervention conditions, an occurrence reliability score was calculated: for each category, an agreement was scored if both

observers noted a behavior in an interval, while a disagreement was scored if one observer noted that behavior but the second observer did not. The number of agreements was divided by the number of disagreements plus agreements, and multiplied by 100 to yield the interobserver reliability percentages. The occurrence reliabilities averaged 86% for the general category of uncooperative behavior, 80% for head movements, 86% for body movements, and 80% for cries/complaints. No delays were scored by either observer during reliability appointments.

Baseline

The dental nurse conducted all restorative procedures and implemented all the experimental manipulations during her regular clinical treatment. Baseline conditions operated during the first few restorative appointments. In this study, baseline was not a no-treatment condition, but an active treatment consisting of the following components:

Instructions. After telling the child which teeth would be worked on, the nurse asked each child to "sit very still and quiet . . . and be my helper."

Information. All procedures were explained and the child was given information about both the objective procedures (e.g., "I'm now going to put the button [clamp to hold the rubber dam] over your tooth") and the subjective experience the child could expect ("It may pinch slightly and feel very tight around the tooth").

Praise. The nurse praised the child for cooperative behavior and, as much as possible, ignored uncooperative behavior.

Smile stamp. At the end of the appointment, the child was given noncontingently a colorful "toothy" smile stamp on the hand, both for coming and to remind the child of the side of the mouth to eat on that day.

Intervention

The intervention conditions included the baseline treatment components of instruction, information, praise, and stamp, as well as the following additional components:

Consequences. If a low level of uncooperative behavior was displayed, the child received a small trinket, which was the capsule in which the silver-alloy amalgam was mixed. These capsules were a natural waste product in the dental treatment. They varied in color, so a child could earn different colors on different visits. (The observer and the nurse agreed on every occasion except one, that a child had or had not displayed an acceptable low level of uncooperative behavior.)

In addition, if the child displayed a low level of uncooperative behavior, that child was allowed to raise the next child in the pneumatic dental chair. This was done by a foot pedal to raise the chair and a hand lever to lower the back of the chair. At the end of an appointment, the child was told by the nurse why he or she did or did not receive these consequences, e.g., "you moved around too much."

Observation. During the intervention, the child came about 10-15 min early for the appointment and was invited to watch the prior child being treated. The data showed that the actual observation time for all children in the intervention conditions averaged 12 min. Using the formula smaller/larger $\times$ 100, there was 99% agreement on the scoring of the number of 15-sec intervals in which a child was observed by a peer. The children usually observed the prior child with the rubber dam in place as well as observing the filling and capping of teeth. Sometimes the drilling and/or extraction of teeth were observed. The child also observed either the prior child receive tangible consequences for good behavior or fail to receive those consequences if uncooperative.

In addition to observing the prior child, each child was observed by a peer during their own dental appointment. That is, the following child came early and watched the child undergoing treatment.

Procedural reliability data were also collected by the independent observers. They agreed on

all occasions as to whether a child observed a peer in treatment, whether that peer received the reinforcer, whether the child was observed by a peer, and whether the child received the reinforcer.

Design

Forty children were observed on their first restorative visit to the clinic. These children provided normative data concerning the levels of uncooperative behavior among normal children in a rural grade school.

Extensive observation of other children prior to the current study led both the nurse and the first author to conclude that children above the level of 20% uncooperative behavior were "problem" children, and that children displaying less than 20% uncooperative behavior were not seriously disruptive. The children targeted for formal intervention procedures were those eight who showed rates of uncooperative behavior greater than 20% and who were scheduled for the full program of four restorative visits, which allowed for the most detailed and representative behavior sample available.

Intervention procedures were instituted according to a multiple baseline design. That is, interventions occurred with different children after varying amounts of actual time in treatment: 20 to 90 min. In fact, interventions also occurred after either one or two complete days in restorative treatment.

RESULTS

The mean length of the first restorative appointment for the 40 children was 30 min, with a standard deviation of 16 min. On those visits, the mean uncooperative behavior was 17%, with a standard deviation of 15%. Eight children had baseline levels of more than 20% uncooperative behavior and four restorative visits. Formal intervention procedures were introduced with each of these children. The same procedures were introduced informally with the other children, thereby allowing them to earn similar consequences for cooperative behavior.

Figure 1 presents the percentages of uncooperative behavior for each child. All children had four appointments, which are shown separated by the solid or dotted vertical lines. The shaded bars show the daily mean percentages of uncooperative behavior. On the superimposed line graphs, each data point represents 10 min of dentistry, except that the last point for each day may represent more or less than 10 min: if 5 or more min were accumulated in a new interval, a new data point was plotted; if less than 5 min accumulated, those extra minutes were combined with the previous 10-min interval and plotted as one data point. The interventions occurred after one full appointment with four children, and after two full appointments with the other four children. The multiple baseline design is marked by the solid vertical lines showing the interventions after 20, 30, 40, 50, 60, 70, and 90 min of dental treatment.

In general, the baseline data show that the level of uncooperative behavior did not decrease as time in treatment increased. In fact, uncooperative behavior sometimes increased within an appointment (see Wesley, Beverly, Kristen, and Carl), and some children (see Roslyn, Kristen, and Carl) increased further in the subsequent preintervention appointment.

All of the children showed a prompt decrease in the percentage of uncooperative behavior after the beginning of the intervention period. Bess decreased from a baseline mean of 33% to an intervention mean of 3%. Wesley decreased from 42% to 17%, Beverly from 46% to 15%, Roslyn from 35% to 6%, Rachel from 25% to 7%, Neil from 24% to 11%, Kristen from 31% to 20%, and Carl from 34% to 15%. Anecdotally, the children appeared more relaxed during the intervention conditions.

Every child observed the prior child at least once, and every child was observed by a peer at least once. The procedural data showed that on 85% (17/20) of the appointments, the children undergoing treatment were observed by a peer. On 78% of those occasions when the

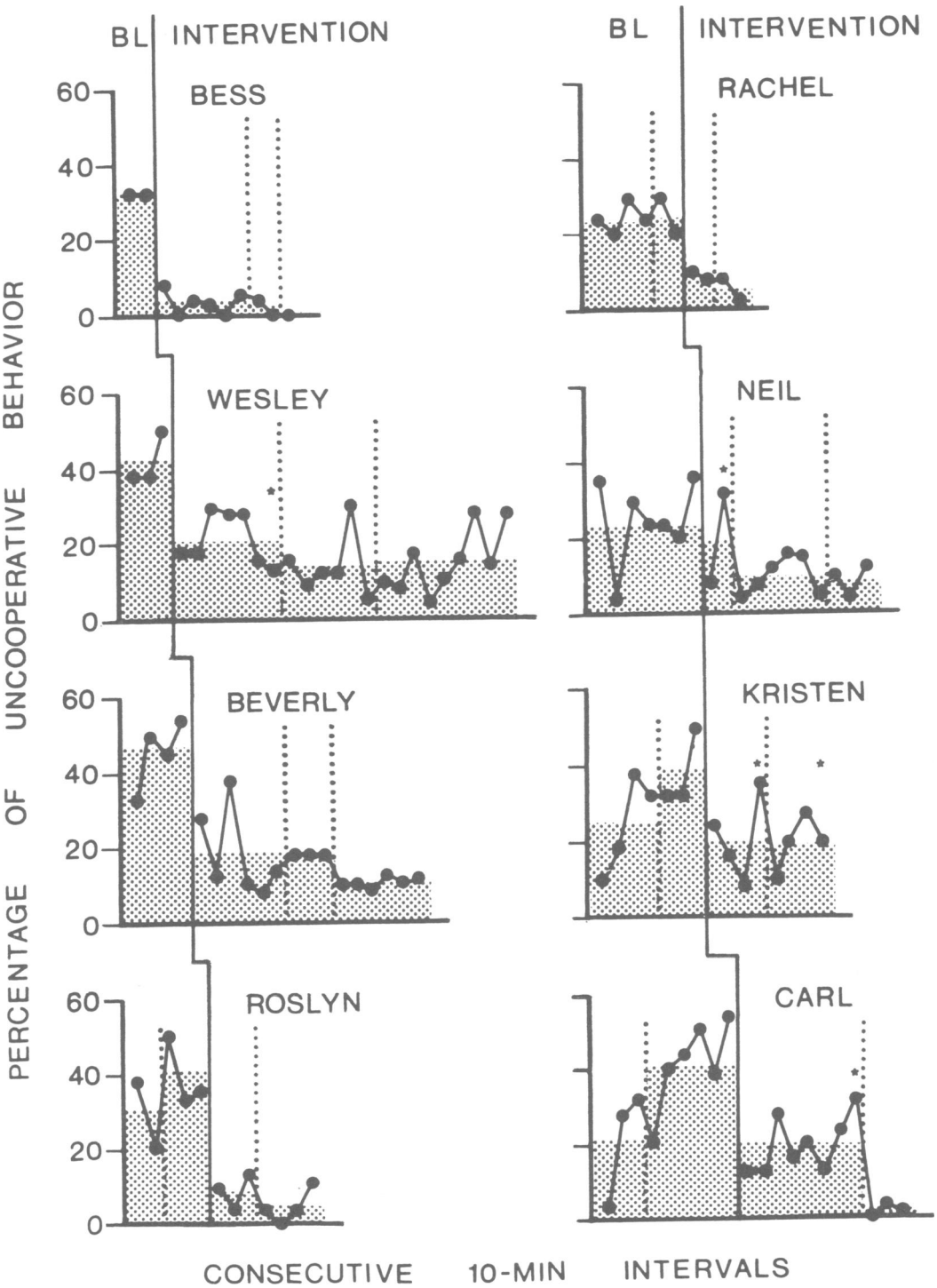

Fig. 1. Percentages of uncooperative behavior for each child. Appointment days are separated by the solid and the dotted vertical lines. The shaded bars show the daily mean percentages, and the line graph shows behavior during consecutive 10-min intervals of dental work. The asterisks at the end of some appointments mark the days on which the child was not given the tangible reinforcers.

children observed the prior child, they observed that peer's behavior being reinforced.

Although the primary data (Figure 1) concern the total percentage of uncooperative behavior, data relating to the topography of that behavior were also scored. During the baseline conditions, body movements constituted the most frequent uncooperative behavior for six of the children, head movements for one child, and cries and complaints for one child. For all children, the mean percentage of baseline observation intervals in which body movements occurred was 22%, for head movements, 10%, and for cries and complaints, 5%. Delays occurred in less than 1% of the intervals in both experimental conditions. During the intervention conditions, body movements were scored in 8% of the intervals, head movements in 4%, and cries and complaints in 1%.

DISCUSSION

Tangible reinforcement and observation of and by peers were shown to reduce the level of uncooperative behavior of young children undergoing dental treatment. These results are noteworthy because the conditions prior to the intervention were also treatment conditions involving instructions concerning the appropriate behavior desired, the provision of objective and subjective information about the dental procedures, and praise for cooperative behavior. Thus, compared with the initial treatment tactics, the addition of tangible consequences and observation involving peers resulted in a prompt decrease in the uncooperative behavior. All of the children's uncooperative behavior was reduced to a level considered to be acceptable by the dental practitioner, who was the most relevant observer of the children's disruptive behavior and was one consumer of these procedures.

This study also examined children's behavior during dental treatment using continuous and detailed observation procedures. These observation procedures constitute a methodological improvement over the rating scales typically used in dental research (e.g., Machen & Johnson, 1974; Melamed, Hawes, Heiby, & Glick, 1975; White, Akers, Green, & Yates, 1974). These data also have the advantage of facilitating an examination of the children's behavior throughout an appointment and across a number of appointments. In addition, the topographical characteristics of the children's problems can be reliably examined. The data thus showed that, without the additional intervention procedures, the level of uncooperative behavior does not spontaneously decrease as the number of appointments or as the length of time in treatment increases. The results also demonstrated that improvements occurred in all topographical areas of problem behavior.

Unfortunately, the typical dental approach of working by quadrants of the month meant that only four restorative appointments were available for observation of any child, and the baselines were necessarily brief. A stronger test of the possibility that children habituate to the dental setting and procedures might have involved experimental designs either with some children having longer baselines (e.g., three days) or with some control children not undergoing the intervention procedures. Nevertheless, the present study shows behavior changes across experimental conditions, with the levels and trends of the intervention data clearly different from the baseline data. Furthermore, other research (Kohlenberg et al., 1972, Venham, Bengsten, & Cipes, 1977, and Venham & Quatrocelli, 1977) has shown that uncooperative behavior does not decrease across successive dental appointments.

The intervention procedures involved two components: reinforcement and observation. It is possible that observation was more important for some children and the reinforcer was more important for others. Anecdotally, we noted that some children were particularly interested in observing others, but after some initial enthusiasm, other children were less interested. Furthermore, some children seemed to be influenced most by the reinforcement, e.g., a

child would sometimes say, "Do I get my capsule?" as soon as the nurse said the appointment was finished. It was noted, with children like Carl, for example, that the withholding of the tangible consequences on one day (first day of intervention) seemed to have a marked effect on the subsequent percentage of uncooperative behavior. The similar withholding of reinforcement with Kristen did not, however, seem to have the same effect, even though her level of uncooperative behavior was reduced from her baseline level. Although the procedures constitute a package, we do not believe a component analysis is necessary. The procedures were designed to be used in an ongoing program. The only requirement was that they be both effective and inexpensive. The procedures are particularly suitable because the manipulations were not very intrusive and did not cost anything in terms of materials or professional time for implementation. Furthermore, the contingencies were arranged so that all children received the positive consequences for low uncooperative behavior, not just those children who had previously displayed high levels of disruption. A comparison of reinforcement and observation procedures may be useful, however, using the current methodology. Such an analysis may document the relative and combined effects of these package components.

The present procedures were part of a comprehensive program for children's dental health. Although the immediate goal was to alleviate the dental problems of young children through appropriate dental techniques, issues of prevention were also an important concern of the program (Gelfand & Hartman, 1977). It is hoped that if the child's initial exposures to dentistry are positive, then further problems in similar circumstances may be averted and children will not avoid future contacts with a dentist. The long-term impact of positive initial treatment therefore needs further study. Preventive education was also a goal of the dental program. Children were taught about the importance of good dental health through diet and hygiene. For example, they were encouraged to brush and floss their teeth regularly, and to restrict their eating of candy to mealtimes. Procedures that accomplish and maintain these behaviors are in need of systematic analysis.

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