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The efficacy of noncontingent escape for decreasing disruptive behavior during dental treatment

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THE EFFICACY OF NONCONTINGENT ESCAPE FOR DECREASING
DISRUPTIVE BEHAVIOR DURING DENTAL TREATMENT

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirement for the degree of
Doctor of Philosophy

in

The Department of Psychology

by

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TABLE OF CONTENTS

Abstract.....	iii
Introduction.....	1
Review Of Literature.....	3
Rationale And Hypothesis.....	22
Method.....	24
Results.....	29
Discussion.....	34
References.....	43
Appendix A: Observation Recording Form.....	49
Appendix B: Dentist Ratings.....	50
Appendix C: Pediatric Dental Clinic Rating Form.....	51

ABSTRACT

Researchers have developed and demonstrated the effectiveness of a number of interventions to manage disruptive behavior in the dental setting. However, these treatments vary in terms of their effectiveness, invasiveness, effort to implement, and acceptability to families. This study evaluated the effects of noncontingent escape for reducing disruptive behavior in a pediatric dental setting. Within a multiple baseline design across subjects, five children were provided response-independent breaks via an automated cuing device. Results demonstrated reductions in escape-related behaviors (e.g., crying, body movements) for all children. Additionally, the intervention was implemented with high integrity and was favorably rated by the dental patients.

INTRODUCTION

Nearly one in four children seen by dentists present with marked behavior problems (Allen, Stanley, & McPherson, 1990). Due to the inherent invasiveness of dental work, sudden movements and disruptive behaviors can expose the child to increased risk of injury. Numerous interventions have been established to expedite the treatment of disruptive children. Pharmacological interventions include general anesthesia, nitrous oxide, and conscious sedation. Aversive behavior management techniques (e.g., Hand-Over-Mouth, and physical restraint) also have been shown to reduce disruptive behavior. However, both pharmacological and invasive behavioral interventions often are not acceptable to parents (Murphy, Fields, & Machen, 1984; Perez & Zadik, 1999).

Techniques considered acceptable and less aversive have been created as an alternative to intrusive procedures. Voice control, distraction, modeling, Tell-Show-Do, and positive reinforcement, are techniques that emphasize altering the communication between the dentist and patient in order to reduce anxiety and improve compliance (American Academy of Pediatric Dentistry, AAPD, 2003). Criticisms of many of the aforementioned techniques include difficulty matching the appropriate intervention to the situation, time and effort to implement the behavioral protocols, and progress monitoring. Given the efforts needed to implement an intervention in a dental setting, escape procedures may be a better option. Specifically, escape procedures (i.e., systematic removal of aversive stimuli) are effective in reducing problem behavior as well as providing a “cost effective procedure that requires minimal time to prepare and/or implement” (Allen & Stokes, 1989, p. 389).

Escape procedures are predicated on the notion that disruptive behavior is exhibited in order to avoid an aversive event. Therefore, if escape is made readily available, avoidance to the aversive stimuli can be attained. Regular use of escape from aversives reduces the need to

engage in disruptive behaviors (Iwata, 1987). Allen, Loiben, Allen, and Staley (1992) successfully implemented a contingent escape procedure in a pediatric dental setting to reduce disruptive behavior. The contingent escape condition allowed for breaks for cooperative child behavior. Although the procedure was effective and rated as acceptable, poor adherence to the procedure was cited as a limitation.

The current study proposes the implementation of a noncontingent escape procedure in order to reduce disruptive behavior in a dental setting. Noncontingent escape allows for response-independent access to escape on a fixed-time schedule (Vollmer, Marcus, & Ringdahl, 1995). The procedure aims to disrupt the association between problem behavior and the availability of escape by providing escape arbitrarily (i.e., by a time schedule). A number of studies have demonstrated noncontingent escape as an effective intervention to reduce self-injury, noncompliance, and other escape-maintained behaviors (Kodak, Miltenberger, & Romaniuk, 2003; Vollmer, Marcus, & Ringdahl, 1995). Thus far, no single study has examined the efficacy of escape for reducing disruptive behavior in a health care setting. The present study used an automated cuing device to signal a dentist to initiate a break rather than relying on the dentist to self-initiate the break or monitor behavior. The ease of implementation and documented efficacy of the procedure should provide a successful behavior management tool that enables medical professionals to perform treatment safely and efficiently. The following review outlines the history of psychology in the dental setting, behavior management techniques implemented in this setting, as well as the literature supporting noncontingent reinforcement and escape.

REVIEW OF LITERATURE

Dentistry and Psychology

Psychology has been involved in the field of dentistry since the 1950's, particularly in the area of fear and anxiety associated with both dental pain and treatment. During 1965 and 1966, grants were made available for the promotion and expansion of the "sociodental field" (Cohen, 1981). This term was used to describe social and behavioral research in dentistry. This interdisciplinary group focused on problems such as public health education and community-wide projects (i.e., fluoridation of drinking water).

During the 1960's, greater emphasis was placed on studying epidemiology, prevention, and control of oral disease. In addition, the first predoctoral training programs began to focus on health motivation and human behavior. In the late 1960's, a group called the Behavioral Scientists in Dental Research was formed which advocated more social science involvement in the field of dentistry (Cohen, 1981). Thereafter, behavioral science has impacted dentistry by improving methods for measuring service provision via consumer satisfaction questionnaires as well as lending methods by which to analyze data from community-wide applications (Allen, Stanley, McPherson, 1990). In addition, behavioral science improved oral health research by providing models of behavioral definitions of problems, task analyses, and the clinical application of social learning principles (Allen et al., 1990; Cohen, 1981).

"Most dentists are aware of the roles that psychological factors can play in the development of dental and oral-facial diseases and disorders" (Albino, 2002, p. 176). The most common problem observed in adult patients in the dental setting is anxiety. Adults who fear dental treatment tend to delay needed work and are less likely to adhere to recommendations. Procrastination and noncompliance result in less positive dental outcomes as well as longer and

more painful visits (Albino, 2002). The poorer outcomes and more aversive visits may serve to further increase avoidance and oral disease.

Although adults may present with a long history of negative experiences and avoidance, most dentists agree that the pre-school child clearly requires the most energy and talent for effective management (Pinkam, 1999). Parents frequently are advised to bring their child in for an initial dental visit at around age three (Wright, 2000). This age is suggested because these children have acquired the rudimentary communication and compliance skills to successfully meet the demands of a dental appointment (Pinkam, 1999). Most children at this developmental age have the ability to grasp the general purpose of the visit, thereby allowing the dentist to complete the work without unmanageable fear of the novel person, procedures, and environment (Wright, 2000). The majority of children, even at age three, can tolerate a fairly long dental appointment. However, there remains a troublesome minority of children who are difficult to manage. For example, Holst, Hallonstein, Ek, and Edlund (1993) sampled 273, three-year-olds during their initial visits and found that 13% "behaved reluctantly" and 11% "reacted negatively." Factors contributing to poor cooperation may include fears transmitted from parents, a previous unpleasant dental or medical experience, inadequate preparation for the first dental visit, or dysfunctional parenting practices (American Academy of Pediatric Dentistry, AAPD, 2002-2003).

In addition to routine visits, children see the dentist for dental caries. Nearly 45% of school children and 94% of adults have experienced caries in permanent teeth (Casamassino, 1996). Studies indicate that 19% of children two to five years of age have untreated caries infections, and this number is as high as 30% among children living in poverty (Vargas, Crall, & Schneider, 1998). Often dental caries represent a child's first encounter with operative dentistry

(i.e., tooth preparation and restoration). This initial experience can have long-term effects on future behavior as well as on attitudes toward dental care (Albino, 2002).

Behavior Management in the Dental Setting

“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” (Stokes & Kennedy, 1980, p. 41). Professionals providing dental care to children typically face crying, wiggling, kicking, tantrums, or other avoidance behaviors (Carr, Wilson, Nimer, & Thorton, 1999; Pinkham, 1999). Managing disruptive behaviors may make dental procedures more difficult by requiring extra time, effort, and personnel. Surveys of clinicians have found that dentists consider the uncooperative child to be among the most troublesome aspects of their clinical practices (Kuhn & Allen, 1994). The American Academy of Pediatric Dentistry advocates the use of 11 techniques to manage children’s behavior during the dental visit. Techniques differ across various dimensions including invasiveness, needed training and equipment, and acceptability. Many of these techniques (e.g., Tell-Show-Do, Hand-Over-Mouth Exercise) have been used for decades, but lack empirical evidence to support their inclusion in the setting beyond tradition and editorial/anecdotal report.

Pharmacological Domain. The pharmacological domain involves the use of drugs to control pain, anxiety, or disruptive behavior. These techniques are viewed as the most invasive and risky, but are considered necessary for children who do not respond to other behavior management techniques or cannot comprehend the dental procedures (Murphy, Fields, & Machen, 1984; Pinkam, 1999). Pharmacological options include sedation (i.e., oral/inhalation) and general anesthesia. Medicating children undoubtedly enhances the efficiency of dental work; however, drugs that decrease respiration and depress the gag reflex, make the child sleepy,

or cause sleep are potentially dangerous (Carr, 1999). These dangers are particularly relevant to smaller children for whom the risk for harm is dramatically higher (Pinkham, 1999). The pharmacological domain requires parental education regarding the techniques, risks, and alternatives. Nathan (1989) warns that pharmacological approaches should never be a substitute for reasonable efforts to manage fearful and difficult children by nonpharmacological techniques.

Physical Domain. The physical domain of behavior management techniques ranges from hand restraint by a dentist or dental assistant to the use of tools such as the Papoose Board (Pinkham, 1999). The Papoose Board involves laying a child on a flat plastic board and preventing his ability to move with by wrapping him in a Velcro “blanket.” Similar to pharmacological methods, techniques such as the Papoose Board have proven useful with children who cannot effectively communicate because they are too disruptive or developmentally disabled (Carr et al., 1999). In a survey of 616 dentists across 48 states, physical restraint was used with 4% of children (Nathan, 1989). Before using physical restraint, it is advised that the professional consider other alternate modalities, the child's dental needs, and the child's emotional development (Wright, 2000). In addition, prior to use of immobilization, written informed consent is required (AAPD, 2002-2003).

Aversive Domain. The aversive domain involves consequating the patient with objectionable stimuli for engaging in disruptive behavior. The child must cooperate in order to avoid the aversive technique (Wright, 2000). Certain physical techniques can be regarded as aversive if they are used or seem to be used as punishment. One of the most controversial techniques, considered both a restraint and an aversive, is the Hand-Over-Mouth Exercise (HOME). This procedure requires the dentist to place his or her hand over the mouth of the disruptive child. While the hand is over the child's mouth, the dentist gives the child directions for acceptable behavior (Sturmev, 2003). Hand-Over-Mouth with Airway Obstruction

(HOMAR), a modification of HOME, involves the dentist closing both the child's mouth and nostrils. Airway obstruction is no longer advocated by the American Academy of Pediatrics, though a recent study found that 31% of dental training programs surveyed continue to teach HOMAR (Acs, Hersch, Testen, & Ng, 2001). HOME and its more controversial version, HOMAR, are not intended to scare the child, but instead to get the child's attention and quiet him so that the child can hear what the dentist is saying (Pinkham, 1999). The AAPD Guidelines (2002-2003) list populations for whom the technique is contraindicated including "children who are disabled, immature, and medicated children whose understanding is compromised" (p. 79). Benefits of the technique include cost effectiveness, although informed consent is needed prior to implementing the procedure.

Linguistic Domain. The linguistic domain includes communication techniques that target the dialogue between the dentist and the child. The best-known and almost universally used method is Tell-Show-Do. This technique is considered fundamental to obtaining a cooperative patient (Wright, 2000). The technique involves informing the child what will be done, introducing tools, and describing what sensations the child might experience (AAPD, 2002-2003). Tell-Show-Do requires the dentist to utilize child-friendly words for standard tools and procedures to help the child understand. For example, prior to drilling the dentist might say, "I'm going to take this whistle brush and use it to clean those bugs from your tooth. You may feel some pressure as I wash the bugs away." The technique is intended to reduce fears and anticipated pain through education and exposure to novel stimuli (Pinkham, 1999).

A second linguistic technique is voice control. This procedure requires the dentist to interject more authority into his to her communication with the child by changing the tone and raising the volume of a request (Greenbaum, Turner, Cook, & Melamed, 1990; Murphy et al., 1984). Greenbaum et al. (1990) divided 40 children ages 3.5- to 7-years into groups receiving

either voice control or "normal-voice" instructions. Children in the voice control group demonstrated lower levels of disruptive behavior and had quicker response suppression compared to the "normal-voice" instruction group. In conjunction with verbal directions, a serious facial expression has been found to be an integral component of this technique in that it shows the dentist is in charge (Murphy et al., 1984).

Voice control is a useful way of reframing a request that has been refused by the child, and can be described both as a punishment technique and a linguistic one (Pinkham, 1999). Voice control has been found to be effective at intercepting inappropriate behaviors as they start to happen and is moderately effective in decreasing a disruptive behavior chain in progress (Greenbaum et al., 1990). Despite its efficacy, some authors assert that punishment techniques, like voice control, can produce negative emotional arousal and rarely should be used (Ridley-Johnson & Malamed, 1986).

Reward Domain. The reward-oriented domain includes techniques that use positive reinforcement in an attempt to increase desirable behaviors. Reinforcers may include social praise, physical touch, and tangibles. Reinforcement is paired with other techniques (i.e., Tell-Show-Do) to increase the efficacy of either application. Stokes and Kennedy (1980) confirmed the utility of adding a positive reinforcement program to the repertoire of behavior management techniques in the dental setting. Prior to this study, dental professionals attempted to use exposure only (i.e., modeling, Tell-Show-Do) to reduce disruptive behavior. Stokes and Kennedy (1980) demonstrated that tangible reinforcement combined with modeling was more effective in reducing disruptive behavior than exposure-based procedures alone. The AAPD Guidelines (2002-2003) state that positive reinforcement in the form of both social (i.e., verbal praise, facial expression, positive voice modulation, etc.) and nonsocial (i.e., toys, tokens) reinforcers is essential to the process of establishing desirable patient behavior. However, Allen

and Stokes (1987) found that simply providing a prize contingent on cooperative behavior (i.e., lying still and being quiet) during treatment was insufficient to reduce the disruptive behavior of children, regardless of the magnitude of that disruptive behavior. Specifically, this study failed to demonstrate that providing the rewards typically found in a medical setting (e.g., stickers, praise) during practice and following treatment impacted disruptive behavior during treatment. In addition, this investigation provided further support to other research that has shown children do not improve with repeated exposure to dental treatment (Venham, Bengston, & Cipes, 1977). Nonetheless, authors generally agree that the use of communicative and reinforcement behavior management techniques are essential to effective pediatric behavior management (Belanger & Tilliss, 1993).

Choosing a Behavior Management Technique. A dental professional must consider a number of factors beyond the relative efficacy of a given behavior management technique (Perez & Zadik, 1998). Issues such as liability and legal concerns, acceptability, training and relative comfort level with a given technique, and preparedness for emergencies must be weighed (Nathan, 1989). As a result of increased litigation of practicing dentists, dental training programs are under pressure to teach not only effective management techniques, but to ensure that services are consumer-friendly (Carr et al., 1999; Kuhn & Allen, 1994; Pinkham, 1999). Although most dentists continue to use traditional management techniques, social attitudes have shifted in the last few years toward increased parental participation and input during the child's dental experience (Carr et al., 1999). New standards require that the patient (or parent) be provided detailed, comprehensive information about a proposed treatment (Choate, Seale, Parker, & Wilson, 1990). Prior to the use of a number of standard management tools, new standards in the field of dentistry require written permission. With emphasis on children's rights and the growing demand for informed consent, dentists can no longer assume that parents will

approve of any recommended behavior management technique. In fact, parental preference has had the largest influence on curricular content of behavioral management in dentistry training (Belanger & Telliss, 1993).

Studies examining parental attitudes and acceptance of behavior management techniques demonstrate fairly consistent ratings. Over time, dentists have decreased emphasis on the use of restraints and heavy drug regimens and have increased parent involvement in decision-making (Sturmeay, 2003). The use of restrictive methods has raised considerable concern, especially in light of the potential effectiveness of alternative less restrictive, more acceptable methods of behavior management during dental procedures (Allen & Stokes, 1987). When parents viewed videotaped segments of behavior management techniques, studies found that pharmacological techniques, Hand-Over-Mouth, Papoose Board, and physical restraint were unacceptable to most parents, while voice control and mouth prop (a plastic block that fits between the patient's teeth which prevents biting and decreases fatigue in the patient's jaw) were marginally acceptable (Peretz & Zadik, 1999). Parents indicated that many of these methods were harsh and punitive and that professionals were too quick to use these techniques before exhausting other methods (Norman, 1989). Only four techniques were rated as clearly acceptable and included voice control, mouth prop, positive reinforcement, and Tell-Show-Do (Murphy et al., 1984).

Sturmeay (2003) criticized the methodology of the early acceptability studies for the Hand-Over-Mouth Exercise (HOME). The author reported that past studies used "non-standardized measures of treatment acceptability such as visual analogue scales or ad hoc rating scales" (Sturmeay, 2003, p. 171). Sturmeay attempted to improve standardization of data collection by having the public read vignettes of different management techniques. In this study, HOME (without airway obstruction) was rated as acceptable as positive reinforcement and relaxation techniques. Sturmeay (2003) explained that people expect a certain amount of pain and

discomfort during dental treatment. However, one criticism of the study was that results were based on public perceptions of written descriptions of the techniques rather than on parents watching the implementation of techniques with their own children. In fact, a growing number of professionals currently discourage the use of Hand-Over-Mouth in any form and given the opportunity to witness its application, most parents discourage its use (Nathan, 1989). Carr et al. (1999) examined dental practices in the Southeastern United States and found that as a result of legal and ethical issues, pediatric dentists are utilizing less aversive behavioral management techniques than they did just five years ago.

Alternatives. Surveys over the last two decades clearly demonstrate that parents prefer noninvasive reinforcement techniques to sedation, restraint, and Hand-Over-Mouth. However, many dental respondents continue to rely heavily upon the traditional invasive management practices, in spite of the reservations associated with these procedures (Allen, Stanley, & McPherson, 1990). As the trend moves toward safer and less aversive modalities, fewer effective techniques to manage disruptive behaviors are available. As a result, the American Academy of Pediatric Dentistry has issued mandates in the past to encourage researchers to develop alternative noninvasive behavior management techniques (AAPD, 1988).

Research has demonstrated that dentists can obtain significant reductions in disruptive behavior by simply allowing children to observe one another during dental treatment (Kuhn & Allen, 1994). Early modeling research investigated the effectiveness of both filmed and live modeling. In the 1970's, commercial films were made available specifically for the preparation of the child for dental treatment (Melamed, Weinstein, Hawes & Katin-Borland, 1977). Results from a number of studies examining filmed modeling have varied and appear to be affected by the age of the child, whether the film preceded an initial or follow-up visit, film content, and previous dental behavior (Barenie & Ripa, 1977; Machen & Johnson, 1974; Zachary,

Friedlander, Huang, Silverstein, & Legott, 1985). In a survey of 400 pediatric dentists, only 17% reported ever using a preparatory film (Glasrud, 1984).

As discussed earlier, Stokes and Kennedy (1980) used a combined live modeling and tangible reinforcement procedure. The modeling component of the study was comprised of successive dental patients observing portions of a treatment session just prior to their own session and then being observed by the next patient. Live modeling requires no additional equipment, personnel, or alterations in the dental routine (Kuhn & Allen, 1994). This technique may serve to be a powerful adjunct to other behavior management techniques, though more evidence and modifications may be needed to justify potential breaches of patient confidentiality and privacy.

An additional alternative is contingent distraction. Distraction techniques have been found to be successful with adult patients for many years. Improvements in child behavior via distraction have yielded mixed results. Two studies were published comparing different modalities of distraction. Results indicated that audiotaped contingent distraction in the form of listening to recorded stories (Ingersoll, Nash, & Gamber, 1984) was demonstrated to be twice as effective as videotaped contingent distraction such as watching cartoons (Ingersoll, Nash, Blount, & Gamber, 1984). “Distraction is believed to gain control over an aspect of the patient’s capability to respond (i.e., paying attention) that is incompatible with disruptive behavior” (Kuhn & Allen, 1994, p.14). Ingersoll and her colleagues speculated that during audiotaped distraction, patients tended to close their eyes to attend to the material, whereas videotaped distraction required patients to watch a television monitor and by doing so were able to watch (i.e., attend) the dental treatment. Both of these procedures were considered contingent because the dentist controlled the distraction via a foot pedal. Distraction was provided only when the child was considered “cooperative.” Stark et al. (1989) evaluated the efficacy of a combined intervention

of distraction and external rewards. The authors presented a poster to the child and read a story about the depiction during dental treatment. If the child correctly answered questions about the story, the child could earn a balloon or a small trinket. Although initially effective in reducing disruptive behavior, the results demonstrated that improvements deteriorated across the number of visits. Distraction should not be discounted as a behavior management technique, though it appears further research is needed to increase the saliency of the “distractors” to facilitate maintenance.

A final alternative is contingent escape. Allen et al. (1992) implemented a contingent escape procedure with children ages three to seven years in a dental setting. Each patient was granted a brief break from treatment for cooperative behavior. The dentist provided a break contingent on laying still for increasingly longer time intervals (three to twenty seconds). If the child became disruptive during treatment, the dentist removed dangerous tools (e.g., drill bits, needles) but simulated treatment until the child demonstrated cooperative behavior. Results demonstrated that contingent escape was as effective as other behavior management techniques. Additionally, the dentist spent no more time engaged in the escape contingency than compared to traditional behavior management. However, over time the project dentist did not adhere to the protocol and began to drift toward using more traditional methods of behavior management. One explanation for this drift is the demand placed on the medical professional. In addition to completing dental treatment, the dentist was required to be vigilant to the child’s behavior and make determinations of “cooperativeness” according to the schedule of reinforcement. This scenario has been observed in similar situations with high task demands. “It may be very difficult for a caregiver to provide escape...while concentrating on instructional activities” (Vollmer et al., 1995, p.17). There remains a need to investigate viable options to be used in the dental setting that are based on well-established learning principles and are acceptable to the

provider and the patient. “Behavioral management procedures must easily fit into the routine practice, be time and cost effective, and be relatively easy to learn” (Kuhn & Allen, 1994, p.16).

Noncontingent Behavior Management

A relatively recent behavioral management tool whose efficacy has yet to be investigated in the dental setting and that may have benefits beyond previously used strategies is noncontingent reinforcement (NCR). NCR involves providing reinforcement to the individual regardless of the occurrence or absence of a target behavior. The schedule of reinforcement operates independent of the response and is dictated most often by time. The traditional model of NCR is comprised of three components: a) a fixed-time schedule determines when the individual will receive access to reinforcers during the session, b) extinction, during which the experimenter provides no programmed consequences contingent on the aberrant target behaviors; and c) fading, in which the schedule of noncontingent reinforcement is gradually decreased from a dense (continuous) to a lean schedule (e.g., one delivery per 5 minutes) (Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993).

Vollmer et al. (1993) generated the initial data to support the utility of NCR. In this study, a noncontingent reinforcement schedule was compared to differential reinforcement of other behavior (DRO) to reduce self-injurious behavior (SIB) in three females. All participants had a previous diagnosis of Mental Retardation and lived in a public, residential facility. The noncontingent reinforcement condition consisted of providing 10 seconds of attention according to a fixed-time schedule regardless of the presence of self-injury. The DRO schedule involved 10 seconds of attention at the end of a predetermined interval, provided that no SIB occurred. Both NCR and DRO schedules were gradually thinned. Though results demonstrated the two protocols were equally effective in reducing rates of SIB, the authors outlined several drawbacks to DRO procedures. One shortcoming is that DRO is more cumbersome to administer than

NCR. Differential reinforcement requires continuous monitoring and recording of behavior to reset reinforcement intervals (Vollmer et al., 1993). Additional limitations of DRO include: potentially low rates of reinforcement due to long passages of time between reinforcement opportunities, extinction-related anomalies including increased rate or magnitude of the problem behavior (i.e., extinction bursts), increased emotional responding, and novel forms of aberrant behaviors (Marcus & Vollmer, 1996).

Noncontingent reinforcement has several benefits that DRO procedures lack (Lalli, Casey, & Kates, 1997; Vollmer et al., 1995). First, due to NCR's "arbitrary" schedule of reinforcement (i.e., by time), consistent delivery of reinforcement is improved. Second, NCR results in lower probabilities of extinction bursts (issues related to extinction will be explored more fully in later sections). Finally and most importantly, NCR is easy to implement because the procedure is time-based rather than performance-based (does not require monitoring rates of behavior) (Hagopian, Fisher & Legacy, 1994; Lalli et al., 1997). For example, a parent or teacher must only be familiar with the time of reinforcement without struggling to use decision criteria required by other reinforcement-based interventions (Kahng, Iwata, DeLeon, & Wallace, 2000). The ease of implementation may result in greater adherence to the intervention protocol and ultimately to greater maintenance of clinical outcomes (Tucker, Sigafos, & Bushell, 1998).

There are a few noteworthy limitations associated with noncontingent reinforcement. Noncontingent reinforcement is a response-independent treatment procedure. As a result, reinforcer presentation may coincide with a disruptive behavior and incidentally reinforce that behavior. Vollmer, Ringdahl, Roane, and Marcus (1997) reviewed data from several NCR investigations and were unable to locate a published report of incidental reinforcement using a NCR package, presumably because the contingent relationship between aberrant behavior and the maintaining consequences is eliminated. Second, though lower probabilities of extinction

bursts were listed as an advantage of noncontingent reinforcement, extinction bursts may occur when an aberrant behavior does not meet reinforcement. One participant in a noncontingent reinforcement study demonstrated transient increases in disruptive behavior. The authors recommended a brief omission contingency to ameliorate this side effect (Vollmer et al., 1997). A final limitation, related to clinical settings, is that no alternative, adaptive behavior is reinforced (Vollmer et al., 1993; Vollmer et al., 1998)

Method of Action. There is consensus that noncontingent reinforcement is a useful means by which to change behavior; however, it is unclear why behavior change occurs. It is generally accepted that noncontingent reinforcement weakens the response-reinforcer relation by providing the reinforcer independent of the individual's behavior (Lalli et al., 1997). The mechanism most commonly cited as responsible for disrupting this relationship is a combination of extinction and satiation (Vollmer et al., 1995). Several analyses have examined the roles these two components play in breaking established contingencies.

Extinction is a reductive procedure in which reinforcement of a previously reinforced behavior is discontinued (Cooper, 1987). In other words, extinction procedures involve withholding the maintaining reinforcer following the response. The response-independent element of NCR is believed to function as an extinction procedure in that it degrades the reinforcement contingency. Lalli et al. (1997) examined the role of extinction by using a noncontingent schedule of reinforcement without extinction. For one participant, access to tangible reinforcement was made available according to a fixed-time schedule and with the occurrence of the disruptive behavior. The procedure resulted in decreased rates of the problem behavior, suggesting that another factor (i.e., satiation) may better account for the behavior change.

Satiation is the condition that results when an overabundance of a reinforcer is available leading to a reinforcer losing its potency (Heron, 1987). This condition is considered a type of establishing operation (EO) that decreases the effectiveness of a reinforcer and occurs as a function of prior access to that reinforcer. Access results in a reduction in problem behavior (Hagopian, Crockett, Van Stone, DeLeon, & Bowman, 2000; Michael, 1982). The dense time-based schedule used in noncontingent reinforcement is believed to reduce the motivation to engage in problem behavior because reinforcers are made available freely and frequently (Vollmer et al., 1998). Luiselli (1994) demonstrated the efficacy of a satiation procedure to reduce self-stimulatory behaviors (i.e., grabbing and mouthing) by providing free-access to an alternative source of reinforcement (i.e., a soft chewing object). However, continuous access to reinforcement may not be feasible in many educational and clinical settings (Tucker et al., 1998). Practical applications of reductive techniques, like NCR, demonstrate the need for thinning dense schedules of reinforcement, thus making extinction a required component of NCR (Lalli et al., 1997). Definitive conclusions have yet to be made about the roles of extinction and satiation in noncontingent reinforcement (Thompson, Iwata, Hanley, Dozier, & Samaha, 2003; Vollmer et al., 1998). Other operant principles previously investigated that may contribute to the understanding of NCR include competing schedules of reinforcement (Crockett, Van Stone, DeLeon, & Bowman, 2000), stimulus control and verbal instructions (Lalli et al., 1997), behavioral momentum (Mace & Belfiore, 1990), and other EO's (Iwata, Smith, & Michael, 2000; Wilder & Carr, 1998).

Schedule of Reinforcement. In the original model of noncontingent reinforcement, Vollmer et al. (1993) asserted that a continuous and initially dense schedule of reinforcement was necessary to set the occasion for extinction and satiation to disrupt the contingent relation between the response and reinforcer. A common practice has been to set the initial NCR

schedule at an arbitrarily determined dense schedule (e.g., 20 seconds) and to gradually thin the schedule (Vollmer et al., 1995). Although it would be easier to conduct noncontingent schedules without a fading component, it is possible that the dense schedule may not be ideal under certain conditions, leading to a less effective intervention (if too thin) or inefficiency (if too dense). For example, a dense schedule maintained at 20 seconds in the classroom would inevitably interfere with teaching and the student's productivity (Kahng et al., 2000).

Recent research has explored how the schedule of reinforcement may be altered to be maximally effective in reducing problem behavior as well as pragmatic for behavior change agents. Hagopian et al. (1994) demonstrated that the initial dense schedule of reinforcement can be effectively thinned without affecting the procedure. The study included four five-year-old children with development delays who evinced disruptive behaviors maintained by attention. The authors leaned the schedule of response-independent reinforcement based on low occurrences of the target behavior. Most important, Hagopian et al. (1994) demonstrated the importance of beginning with a dense schedule (Tucker et al., 1998).

The most common method for thinning NCR schedules is to increase the interval by fixed increments (e.g., by adding 10s or 20s) when responding remains below a preset criterion (Hagopian et al., 1994; Lalli et al., 1997; Vollmer et al., 1993). This approach has met with good success (Kahng et al., 2000); however, other methods also have proven efficacious. Lalli et al. (1997) demonstrated the utility of starting schedules based on the mean latency of the first occurrence of problem behavior during baseline. The schedules in this study were increased by 30, 60, or 120 seconds. Schedule thinning based on the calculated time between behaviors (i.e., interresponse time) has shown to be just as effective as thinning based on fixed, arbitrary increments of time (Kahng et al., 2000). These findings indicate that NCR may be introduced more easily in applied settings than originally believed (Kahng et al., 2000; Lalli et al., 1997).

The issue of the optimal initial schedule of reinforcement has yet to be resolved. Nonetheless, once the terminal schedule is reached, given that it is time-based and not influenced by the client's behavior, the procedure has potential for high implementation integrity (Vollmer et al., 1997).

Functional Relationships. Wilder, Fisher, Anders, Cercone, and Neidert (2001) asserted that as long as the NCR schedule provides increased access to reinforcement compared to maintaining contingent schedules, the procedure is likely to be effective in interfering with the functional relationship and ultimately reduce the disruptive behavior. Specifically, NCR disrupts the association between the behavior and the consequence that maintains that behavior (e.g., attention, tangible) by providing the maintaining reinforcer independent of the presence of the behavior. The type of reinforcer delivered during treatment often is predicated on the outcome of a functional analysis (Iwata, Dorsey, Slifer, Bauman, & Richman, 1994). Functional treatments have been shown to be more effective than treatments that are arbitrarily chosen (Carr & Durand, 1985). Indeed, "noncontingent reinforcement is a viable intervention if the reinforcers being provided are from the same class of reinforcers maintaining undesirable behavior" (Vollmer et al., 1995, p. 15). For example, if attention was determined to be the maintaining variable of disruptive behavior, attention would be provided regardless of the presence of that disruptive behavior.

Noncontingent reinforcement schedules have been used to significantly reduce disruptive behaviors maintained by attention (Vollmer et al., 1993), automatic reinforcement (Luiselli, 1994), and access to tangibles (Marcus & Vollmer, 1996) by providing the respective reinforcer independent of behavior. Vollmer et al. (1995) was the first study to extend NCR to escape-motivated behaviors. Escape behavior results in the termination of an aversive stimulus, thereby negatively reinforcing that behavior. Vollmer et al. (1995) demonstrated that providing

noncontingent escape (i.e., the removal of aversive stimulation on a response-independent schedule), via breaks from demands, reduced SIB to near zero-levels in a four-year-old boy. Behaviors maintained by escape are affected similarly as those maintained by other functions of behavior. Therefore, it is believed that NCE operates via the same methods as NCR (i.e., extinction and satiation) (Ebanks & Fisher, 2003; Iwata, Smith, & Michael, 2003; Vollmer et al., 1995).

Only two studies have exported NCE to applied settings. Coleman and Holmes (1998) demonstrated the efficacy of scheduled breaks in decreasing disruptive behaviors and improving compliance with the presentation of instructional demands during speech therapy sessions. A formal functional analysis was not conducted. Instead, the authors hypothesized escape to be the function of the disruptive behavior due to the high correlation of the target behavior with the instructional activity. The study included three four-year-old children with a previous diagnosis of a Pervasive Development Disorder. Each participant received a 30-second break on a fixed-time schedule cued by a timer. The initial schedule of escape was arbitrarily set for one-minute and was arbitrarily leaned in 30-second blocks if the child engaged in low rates of disruptive behavior. Finally, speech therapists (i.e., the behavior change agents) were “highly satisfied” with the treatment. This study extended previous research of NCE by demonstrating that service providers (i.e., speech therapists) in a clinical setting, with little formal training in behavioral analysis, can effectively implement the technique.

More recently, Kodak et al. (2003) implemented a noncontingent escape procedure during instructional activities with two four-year-old males diagnosed with Autism. During the NCE condition, 10-second breaks were provided every 10 seconds and the schedule increased gradually to every two minutes. Results indicated that NCE was an effective treatment for

increasing compliance and decreasing problem behavior (i.e., throwing academic materials, resisting physical prompts).

The results from Coleman and Holmes (1998) and Kodak et al. (2003) support the practical utility of the NCE approach, considering issues of effectiveness, ease of implementation, and treatment acceptability. In addition, NCE may serve not only as a reductive procedure, but may provide professionals, paraprofessionals, and caregivers with opportunities to teach new skills.

RATIONALE AND HYPOTHESES

Nearly 22% of all children seen by pediatric dentists present with significant management problems (Allen et al., 1990). Sixty percent of dentists report interests in safer, cost-effective strategies for managing young disruptive children. In addition, more than 70% of dentists reported concern about ethical, legal, or safety issues related to the use of traditional, invasive management procedures (Allen et al., 1990). However, when children become disruptive, dentists report relying on more invasive, risky procedures rather than using alternative techniques such as contingent rewards, distraction, or modeling (Carr et al., 1999). Despite proven efficacy, dentists have been slow to accept new management procedures because of issues related to cost (i.e., time, personnel, equipment, skill to prepare and implement). There is a need for cost-effective procedures that require minimal time to prepare and implement (Allen et al., 1992; Allen & Stokes, 1987).

Interventions using escape as a management tool are cost-effective, noninvasive, and directly tied to the function of the disruptive behaviors that interfere with dental treatment. The physical sensations associated with dental treatment may be aversive stimuli and the dental setting associated with these sensations may set the occasion for avoidance behaviors. Disruptive behaviors often result in temporary escape from dental procedures. The pause in dental treatment in response to disruptive behaviors may serve to reinforce that behavior and increase its likelihood of occurring in the future (Allen & Stokes, 1987; Kuhn & Allen, 1994). Allen et al. (1992) demonstrated the efficacy of providing contingent escape; however, the effort required to implement the procedure during a high demand task (i.e., dentistry) limited procedural integrity and ultimately the intervention's validity and effectiveness.

The purpose of the present study was to fill a gap in the literature by implementing a noncontingent escape procedure in an effort to reduce disruptive behaviors during dental

treatment. An automated device cued the dentist to provide the participants with noncontingent breaks (i.e., escape). It is believed the response-independent breaks interfered with the functional relationship between disruptive behavior and escape from necessary dental work. In addition, the procedure proved to be cost-effective and relatively easy to administer with integrity without changing the dental procedures. This study was the first to use noncontingent escape in a health care setting. Considering the number of children who require aversive medical treatments, the clinical utility of the procedure across dentistry and other disciplines may prove to be very high. The present study addressed the following hypotheses:

1. Noncontingent escape will result in a significant decrease of occurrences of disruptive behavior compared to baseline conditions.
2. Participants in the study will rate noncontingent escape favorably.
3. Dentists not affiliated with this study will rate excerpts from video-recorded treatment sessions. It is hypothesized that ratings will demonstrate that children in the noncontingent escape treatment condition are more cooperative compared to control conditions.

METHOD

Participants and Setting

Five children ranging from four- to seven-years-old (three females and two males) were recruited for this investigation from the patient pool at the University of Nebraska Medical Center (UNMC) pediatric dental clinic. To be eligible, each participant was referred from the pediatric dentistry clinic for demonstrating “definitely negative” or “negative” levels of disruptive behavior as indicated by a “1” or “2” respectively on the Frankl Scale (Frankl, Shiere, & Fogels, 1962) during previous dental treatment. The Frankl Scale is a four-point subjective index of “cooperativeness” recorded in all patients’ dental chart after every visit. Frankl ratings have been found to highly correlate with objective observations of child behavior in the dental setting (Allen, Huftless, & Lazelere, 2003). In addition to previously being uncooperative, the child required at least three additional visits for tooth preparation and restoration procedures in order to be included in the study. Participants were selected from a range of three to nine years-old, which reflects children that typically present with the most behavior management challenges. The visits were scheduled once a week with each visit lasting between 45-90 minutes. There were no restrictions based upon gender, race or ethnic origin. Children with cognitive disabilities and those who are non-English-speaking were excluded.

Apparatus

Data were collected using an interval recording coding form. During the Treatment condition, a MotivAider® was attached to the dentist’s waistband to signal time-based breaks. This pager-sized device emits a pulsing vibration on a fixed-time schedule. In addition, a video camera recorded all baseline and treatment sessions. The camera was placed on a tripod in one corner of the examination room.

Measures

Child Behavior. Disruptive behaviors including body movements, complaints, moaning, and crying were recorded on a 15-second interval schedule (See Appendix A). In addition, any child behaviors that resulted in the dentist having to stop treatment (i.e., an unscheduled escape) were coded as a “disruption.” Scoring began when the dentist or dental assistant looked at and touched the child’s mouth. Scoring was discontinued five seconds following the dentist looked away or stopped touching the child.

Dentist Behavior. Verbal reprimands to manage behavior during dental treatment (e.g., "hold still," "put your hands down," "stop crying") were coded on a 15-second interval schedule. The initial positioning of the child and directions to reposition the child following breaks were not considered a reprimand (e.g., "lay back," "scoot up," "open your mouth"). Also, the number of physical restraints of the child was recorded. Restraints included holding of any part of the child’s body by a dental assistant to restrict movement. Light touches to calm or comfort child were not scored.

Dental Ratings. Two pediatric dentists unfamiliar with the investigation rated the cooperativeness of the participants from randomly selected sections of the video recorded sessions (See Appendix B). Ratings were made using a 6-point Likert scale (6=extremely disruptive to 1=extremely cooperative). The scale has been found to correlate highly with observations of disruptive behavior (Allen & Stokes, 1987; Stark et al., 1989).

Consumer Satisfaction. Following a dental visit, participants completed the Pediatric Dental Clinic Form, which assessed how satisfied the children were with their treatment (see Appendix C). The form included two questions: 1) how the child liked coming to the dental visit and 2) how they liked being able to take breaks (only answered during the treatment condition).

Reliability

A pre-doctoral intern scored child and dentist behaviors. Another pre-doctoral intern, naïve to the experimental hypothesis, served as a reliability observer. Each observer was trained to 85% agreement. Reliability observations were conducted on 29% of the observations. Interobserver reliability was determined by calculating the number of agreements between observers on the occurrence and nonoccurrence of disruptive behavior, dividing by the number of agreements plus disagreements, and multiplying by 100. Overall reliability for disruptive behavior was 91% (range, 79% to 100%).

Treatment Integrity

To ensure the integrity of the independent variable, the project dentist's use of the noncontingent escape contingency was recorded. The observers maintained a simple frequency count of the occurrence of each break. The total number of actual breaks was compared to the total projected by the schedule of breaks. Integrity of the noncontingent escape procedure was calculated for 55% of dental visits and was found to be 94% (range, 86-100%).

Design and Procedure

Design. The investigation used a multiple-baseline across subjects design. Baseline and experimental conditions were introduced across subjects after varying number of visits. The design was chosen because of its ability to demonstrate experimental control, which is of particular importance during treatment formation (Kazdin, 1982). Though a reversal design might provide stronger evidence of experimental control, issues related to child safety limited design options.

Baseline. Procedures during baseline were those typically followed at the dental clinic. A routine restorative dental visit typically began with the dentist examining the teeth requiring restoration (i.e., repairs), applying the topical anesthetic (Benzocaine), and injecting the local

anesthetic (Lidocaine). Next, the dentist placed a mouth prop between the upper and lower teeth and began removal of the tooth decay via a dental handpiece (i.e. drill). The appointment concluded with the placement of the dental restoration (e.g., filling, crown). Prior to each step of the treatment the dentist explained what will be done and the sensations that the child might experience (i.e., Tell-Show-Do), and delivered praise for being cooperative. Following treatment, each patient received a prize (e.g., stickers, balls, toy jewelry).

Treatment. The dentist was fitted with a MotivAider® and instructed to follow standard dental procedures. Prior to the start of treatment, the dentist showed subjects the device and said, “Look at this pager. It tells me when we are supposed to rest. Whenever it buzzes, we will stop and take a break.” Initially, the frequency of the breaks occurred often (e.g., 15-20 seconds). The length of these intervals was selected based on a relatively rich schedule compared to what is typically available in this setting. The dentist set the device so that increasingly longer periods of time passed before a break is taken. The observer prompted the dentist to lean the schedule by 10-20 second increments based on low occurrences of disruptive behavior for a terminal schedule of one minute.

Prior to the start of dental treatment, the dentist conducted two minutes of practice. All breaks lasted approximately ten seconds. The child was positioned in the dental chair and the dentist stated, “Let’s practice our breaks. Some breaks will happen often and sometimes they may take longer.” The dentist placed instruments to be used during treatment inside the child’s mouth, but only feigned dental treatment until the MotivAider signaled the break. Upon feeling the vibration, the dentist stated, “It’s break time.” Breaks occurred at ten-second intervals for the first minute and at 20-second intervals for the second minute. The practices were conducted in order to allow the child the opportunity to experience breaks and how they would be provided. The initial schedule of ten seconds was used to yield a high number of exposures to

noncontingent escape. The 20-second fixed-time schedule allowed practices to occur with a leaner schedule of reinforcement. At the end of the practice sessions, the dentist proceeded with the standard treatment until the next break was signaled. During breaks, the dentist removed all instruments and fingers from the child's mouth. The child was allowed to sit up and move freely. When breaks ended, the child was repositioned as is typically done at the onset of treatment. Dental burs, needles, or other sharp instruments were immediately removed to reduce the risk of injury in cases of disruptive behavior.

Customer Satisfaction and Independent Dentist Ratings. Following treatment, participants completed the Pediatric Dental Clinical Rating Form (Appendix C). Two dentists not affiliated with the study were asked to view randomly presented video-recorded segments from both baseline and treatment visits. After each four-minute segment, the dentists rated cooperativeness on the Dentist Ratings Form (Appendix B).

RESULTS

The effect of noncontingent escape on disruptive behavior during dental treatment was evaluated by visual inspection (Heward, 1987; Kazdin, 1982). Intervention effects were quantified by calculating the percentage of intervals that disruptive behavior was observed across baseline and noncontingent escape conditions. Overall results suggest a 22% decrease in disruptive behavior. The within-session down trend (i.e., George's and Kevin's baselines) is a common occurrence during dental treatment. Procedures in the early part of a visit are more invasive (i.e., injections, fitting of the rubber dam, more noise and vibration) and tend to occasion more escape behavior than compared to the latter part of a visit. Therefore, results are best evaluated by comparing condition means of disruptive behavior and interval by interval. As shown in the graphs, noncontingent escape appeared to decrease disruptive behavior for all children. Kevin was the only participant in which the disruptive behavior topographies responded differently. Combined disruptive behaviors are presented in Figures 1 and 2. Figures 3 and 4 display the effects noncontingent escape had on verbal and physical disruptive behavior independently. Appendices D and E further summarize data presented in Figures 1-4. Finally, Appendix F summarizes the number of intervals that physical restraint was necessary for all participants.

Direct Observation Data

Melissa. Melissa was a seven-year-old Caucasian female. Figure 1 shows the percent of intervals Melissa was recorded being disruptive. During baseline, she was disruptive an average of 78% of intervals (range = 67-92%). During the treatment phase, Melissa's negative behaviors decreased to a mean of 36% (range = 94%). It should be noted that the averages of disruptive behavior decreased across the three successive intervention visits (73%, 22%, and 12%, respectively). Additionally, Melissa required physical restraint by the dental assistant during

eleven of the intervals in baseline, and four, one, and zero times in her subsequent treatment visits.

Elaine. Elaine was a six-year-old Hispanic female. Figure 1 shows the percent of intervals Elaine was recorded being disruptive. During baseline, she was disruptive an average of 69% of intervals (range = 0-100%). Elaine's average disruptive behavior increased from 53% in the first baseline condition to 80% in the second visit. During the treatment phase, Elaine's negative behavior decreased to a mean of 23% (range = 8-67%). Elaine never required physical restraint.

George. George was a seven-year-old African American male. Figure 1 shows the percent of intervals George was recorded being disruptive. During baseline, he was disruptive an average of 55% of intervals (range = 8-100%). George's negative behavior decreased to a mean of 8% (range = 0-33%) during the lone treatment condition. George was physically restrained during 21 of the intervals across his three baseline visits (five, seven, and nine, respectively) and was not restrained during treatment.

Tanya. Tanya was a five-year-old African-American female. Figure 2 shows the percent of intervals Tanya was recorded being disruptive. During baseline, she was disruptive an average of 87% of intervals (range = 8-100%). During the treatment phase, Tanya's negative behaviors decreased to a mean of 46% (range = 0-92%). Tanya was restrained during 18 of the intervals in her single baseline visit and during two intervals in each of her subsequent treatment visits.

Kevin. Kevin was a four-year-old Caucasian male. Figure 2 shows the percent of intervals Kevin was recorded being disruptive. During baseline, he was disruptive an average of 45% of intervals (range = 16-92%). During the treatment phase, Kevin's negative behavior decreased to a mean of 35% (range = 8-58%). It should be noted that Kevin's disruptive

behaviors responded differentially to treatment compared to the other participants (See Figure 4). The occurrence of crying/ complaining increased from an average of 15% of baseline intervals to 34% in treatment. On the other hand, Kevin's body movements, noncompliance, and other disruptive behaviors decreased from 30% in baseline to 6% in the treatment phase. Kevin was physically restrained during nine intervals over his three baseline visits (six, zero, and three, respectively) and zero intervals in his treatment visit.

Customer Satisfaction and Cooperativeness Ratings

Data from the Pediatric Dental Clinic Rating Form indicated that the participants rated baseline visits an average score of five out of ten (i.e., between the subjective ratings of "I did not like it" and "It wasn't that bad") and rated treatment visits an average score of one out of ten (i.e., between "I liked it" and "It was okay"). Additionally, the children rated how much they liked having breaks. Results indicated an average score of 0 (i.e., a subjective rating of "I liked it").

The two pediatric dentists-observers rated the children as "not cooperative" during baseline sessions, with ratings typically 2 or less (range, 1 to 2). During visits with noncontingent escape, ratings were 3 or higher (range, 3 to 6).

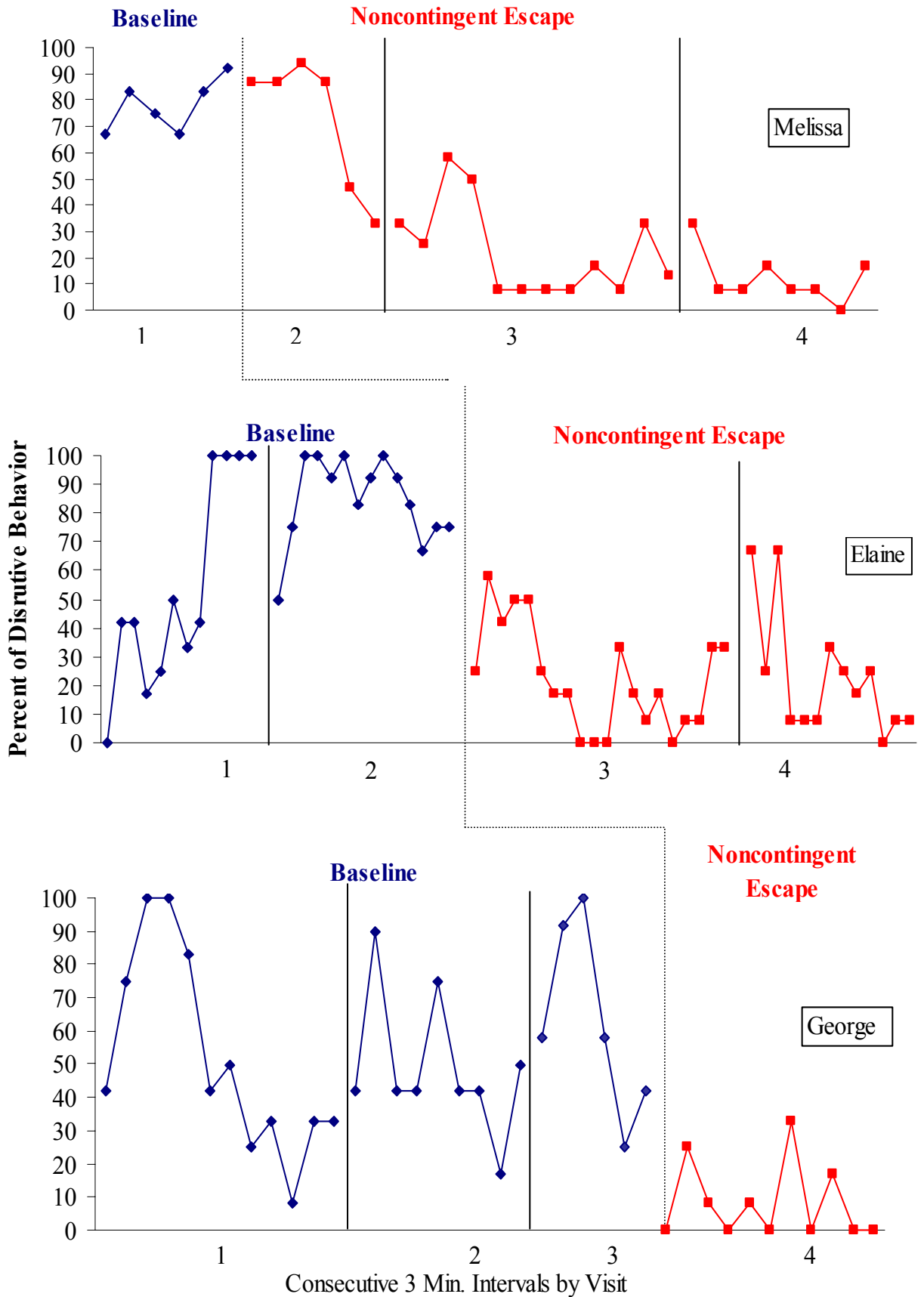


Figure 1. Disruptive Behavior Across Dental Visits

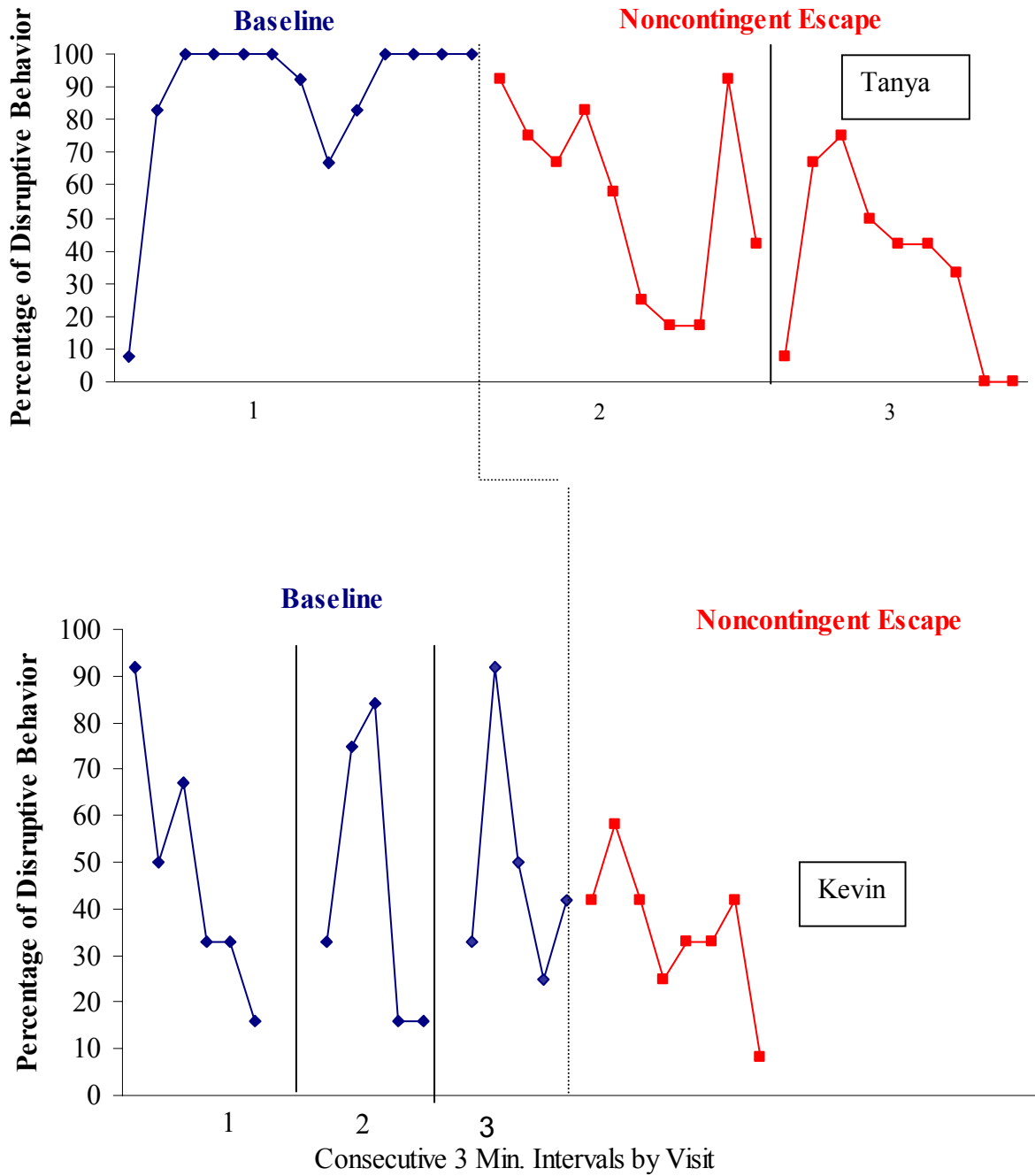


Figure 2. Disruptive Behavior Across Dental Visits

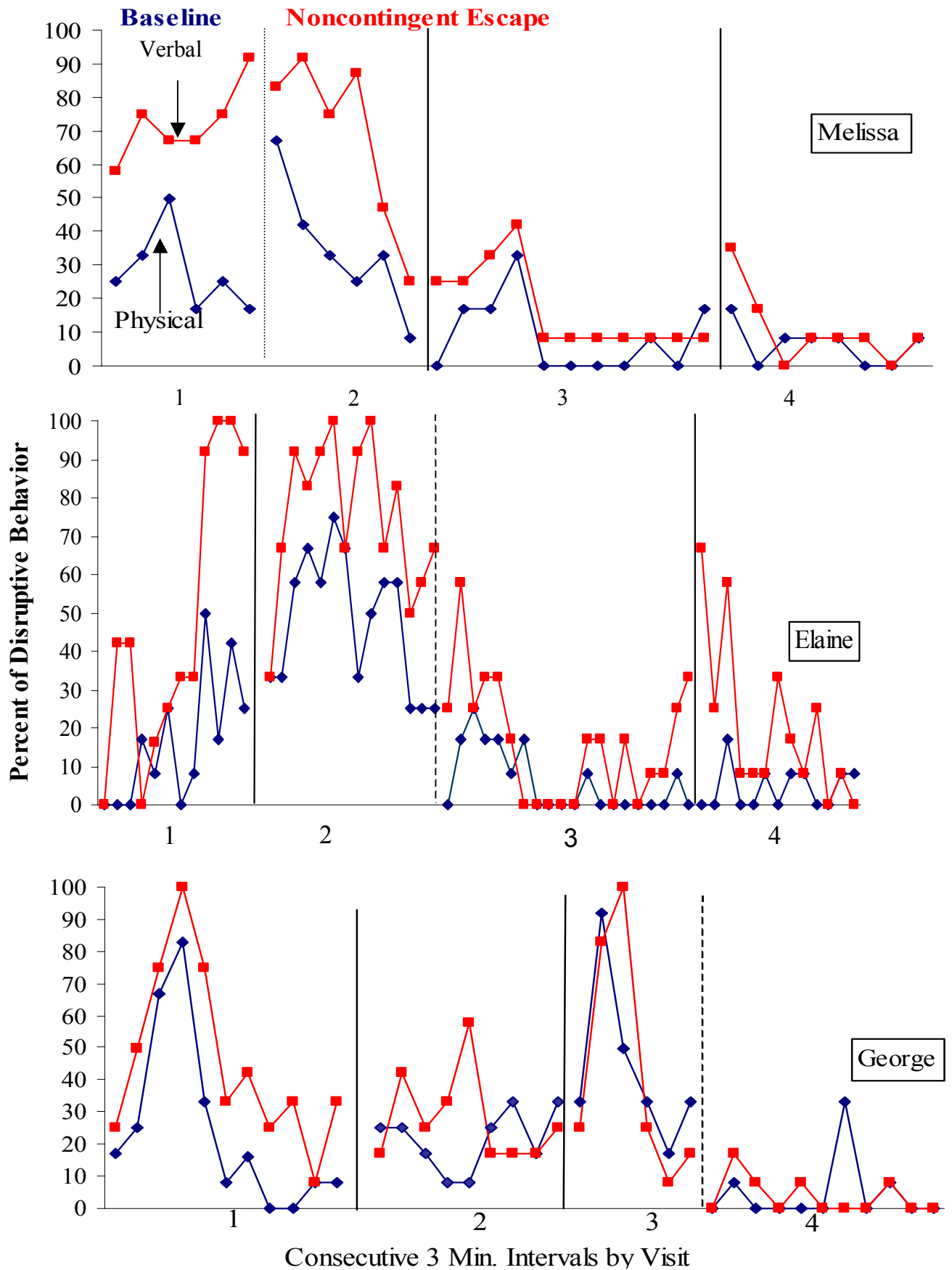


Figure 3. Verbal and Physical Disruptive Behavior

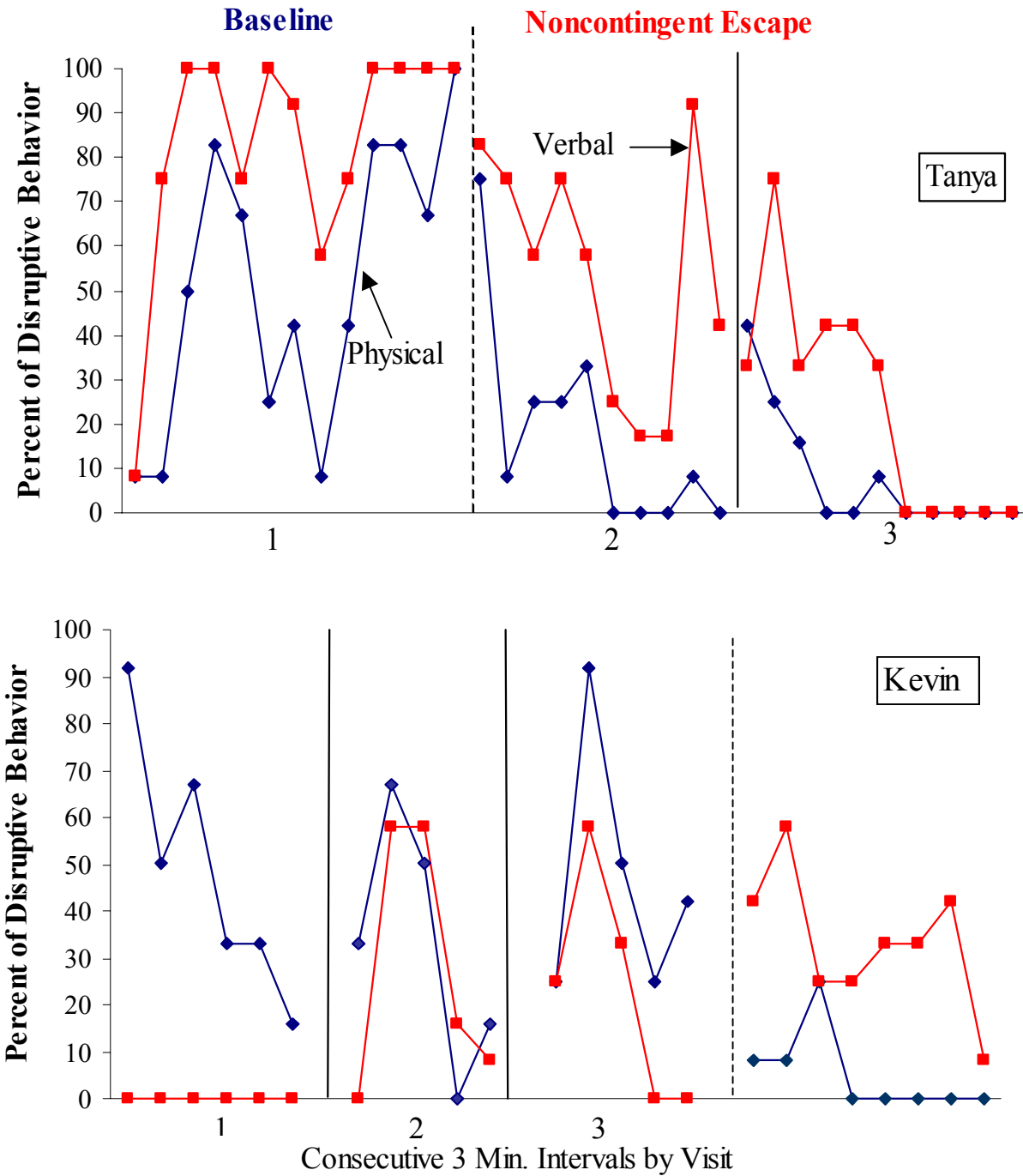


Figure 4. Verbal and Physical Disruptive Behavior

DISCUSSION

The efficacy of noncontingent escape during dental treatment with children was evaluated. Noncontingent breaks were delivered on a fixed-time schedule via an automated cuing device. The initial schedule of reinforcement was set at 15-seconds with a ten second break. As behavior improved, the schedule was thinned so that breaks were cued for a maximum time length of 60-seconds. Overall, the observational data suggested that noncontingent escape was associated with decreased occurrences of disruptive behaviors for all participants, as hypothesized. Furthermore, independent dentist ratings supported these results by scoring participants more cooperative in treatment than in baseline visits. Additionally, the participants rated receiving breaks favorably and preferred their dental visits with breaks to baseline visits.

This study extends previous research demonstrating that exposing children to temporary escape can be an effective means by which to manage disruptive behavior in the dental setting (Allen et al., 1992; Allen & Stokes, 1987). Also, it appeared that longer exposure to noncontingent escape was associated with greater reductions in disruptive behavior, as evidenced by both Melissa's and Elaine's treatment behavior. Moreover, longer exposure to dental treatment without the intervention resulted in increased or stable rates of disruptive behavior, thus providing further support for the tendency for behavior to not improve over time in the dental operator (Allen et al., 1992; Venham et al., 1977). Allen et al. (1992) demonstrated that escape-based procedures, unlike traditional interventions that often increase total treatment time, require less time. Though time managing the child's behavior was not explicitly measured in this study, it appeared that visits were no longer in the baseline condition compared to treatment visits.

A large improvement compared to many of the behavior management techniques in the dental setting is the increase in ease of implementation. No more than a few minutes were spent

explaining the protocol to the dentist and familiarizing him with the cuing device. No expensive equipment was necessary nor was standard dental treatment altered. Many of the other behavioral management studies cited limitations related to procedural drift, time spent training personnel or preparing the child, and knowledge and effort to appropriately implement techniques (Allen et al., 1992; Allen et al., 1988; Allen & Stokes, 1987; Stark et al., 1989; Stokes & Kennedy, 1980). The current study resulted in high treatment integrity and no booster sessions (i.e., additional training) were necessary. The improved ease of implementation may mean the technique is more likely to be used and adhered to, thereby increasing the effectiveness of noncontingent escape and decreasing the need to rely on more invasive means to manage behavior (Tucker et al., 1998).

Additionally, the present study contributes to the relatively small amount of literature that has evaluated the effects of noncontingent escape in clinical contexts and is the first to evaluate its effects in a health care setting. Ringdahl et al. (2001) assert that fixed-time schedules should not be used to alter clinically relevant behaviors because so little is known of these schedules. Many researchers are choosing to study novel, arbitrary responses in an attempt to better understand how these schedules might influence "in vivo" behavior (Carr, Bailey, Ecott, Lucker, & Weil, 1998; Ecott & Critchfield, 2004; Lindberg, Iwata, Roscoe, Worsdell, & Hanley, 2003; Ringdahl et al., 2001). Ringdahl et al. (2001) admit there are a number of distinctions between laboratory and applied research evaluating time-based schedules and results from these two settings are "seemingly discrepant." Therefore, it makes sense that to better understand fixed-time schedules and support their validity, research should be done in applied settings with behaviors that are clinically relevant by the behavior change agents specific to those settings. The present study extends the results of Coleman and Holmes (1998) and provides further

support to the practical utility of noncontingent escape by demonstrating that service providers with little formal training in behavior analysis can implement the procedure in a clinical context.

The data gathered during the observations suggest decreases in all topographical areas of problem behaviors (i.e., crying, body movements, and other disruptive behaviors) with exposure to the treatment condition. Additionally, the number of physical restraints decreased for the four children who required restraint in baseline. However, Kevin's disruptive behavior responded differentially to noncontingent escape and requires further examination. Specifically, his rates of body movements and other disruptive behaviors decreased while the rates of crying increased with the introduction of noncontingent escape.

Kevin's increase in emotional responding may be attributed to the lack of reinforcement for other escape-related behaviors (Skinner, 1953). That is, noncontingent reinforcement may have resulted in the extinction of physical attempts to escape. Indeed, Kevin's crying could indicate an extinction-related phenomenon considering that noncontingent reinforcement is predicated on a combination of extinction and satiation (Vollmer et al., 1993). Crying is a behavior that is likely intermittently reinforced in other settings and may be more resistant to extinction, whereas body movements probably do not lead to escape in non-medical settings. According to Skinner (1953), "behavior during extinction is the result of the conditioning which has preceded it... if only a few responses have been reinforced, extinction occurs quickly. A long history of reinforcement is followed by protracted responding. The resistance to extinction cannot be predicted from the probability of a response at any given moment" (p.70). Therefore, consideration should be given to the history of reinforcement (Cooper, 1987).

Kevin's crying intensified with the presentation of the drill. During noncontingent breaks, Kevin calmed and crying subsided. It may be possible that the dental equipment operated as conditioned aversive stimuli. That is, the presentation of the equipment may have

been paired with uncomfortable sensations and respondent conditioning occurred. "A stimulus is known to be aversive only if its removal is reinforcing ...and elicits reflexes and generates emotional predispositions which often interfere with the operant to be strengthened" (Skinner, 1953, p. 171). It may be that escape was never fully possible for Kevin due to the inability to provide escape from conditioned stimuli (i.e., dental setting and equipment). There is evidence that extinction may be responsible for the decreases in other disruptive behaviors; however, satiation of the reinforcer never occurred. Skinner (1953) speculates that the presentation of an aversive stimulus resembles a sudden increase in deprivation, making satiation more difficult. Inadequate satiation could result in attempts to continue to access escape despite having a relatively rich schedule of reinforcement.

A final explanation of Kevin's increase in crying in the treatment condition is that crying was accidentally reinforced. Considering that escape was provided on a consistent schedule every 15 seconds, it is possible that a break co-occurred with Kevin's crying and an "adventitious" contingency was formed. Vollmer et al. (1997) reported the first case in which noncontingent reinforcement resulted in bursts of responding when reinforcement presentation followed aberrant behavior. The authors suggest a brief omission contingency be used to extinguish the contingency. Kevin did not remain in the treatment condition for sufficient time to demonstrate an adventitious contingency, much less time to instruct the dentist to adjust the schedule of reinforcement.

Some basic researchers assert that noncontingent reinforcement may not be the result of extinction (i.e., disruption of the response-reinforcer contingency) and satiation (i.e., disruption of the establishing operation) (Ecott & Critchfield, 2004; Lattal, 1995). Rather, NCR may operate via the strengthening of other alternate behaviors that replace an undesirable behavior. Ecott and Critchfield (2004) highlight that noncontingent reinforcement studies merely

demonstrate the deceleration of a behavior without measuring the effects on other behaviors and competing schedules of reinforcement. Strengthening one behavior comes at the expense of other behaviors. It could be argued that if adventitious reinforcement accounted for Kevin's increase in crying, the strengthening of crying replaced physical attempts to escape.

There are several noteworthy limitations to the current study. First, it is unknown how the dentist's behavior may have impacted the child's behavior. The dentist was instructed to provide his routine dental care without adjustments beyond adding breaks. The dentist provided praise throughout the visit and a tangible reward (e.g., sticker, rubber ball, toy dinosaur) at the visit's conclusion across both baseline and treatment conditions. Positive reinforcement did not appear to affect the child's behavior as evidenced by inspection of baseline levels of disruptive behaviors. However, it is unknown how the combination of rewards (i.e., social and tangible reinforcement) and noncontingent reinforcement affected the participants' behavior. Praise during the visit may have differentially reinforced desirable behaviors (i.e., laying still, following dentist directions, remaining calm). Stokes and Kennedy (1980) found that positive reinforcement combined with modeling made modeling more effective in decreasing disruptive behavior. Additionally, Kodak and Miltenberger (2003) speculated that praise might be an effective reinforcer to appropriate behavior only after noncontingent escape reduces escape behavior. Noncontingent escape, like other extinction-based procedures, may be more effective when combined with other techniques (Cooper, 1987; Marcus & Vollmer, 1996). Unfortunately, in the present study there was no way to measure the effects of these potential reinforcers without changing the dentist's routine of patient care.

A second limitation is there was no determination of the history of the schedule of reinforcement in other settings. Ringdahl et al. (2001) found that the schedule of reinforcement in treatment had to differ from baseline reinforcer rates when using fixed-time schedules. The

initial reinforcer rate was arbitrarily set at 15-seconds in order to provide a rich schedule of reinforcement to optimize the chance for reducing the disruptive behavior (Hagopian et al., 1994; Wilder et al., 2001). It could be that Kevin's increased crying may be attributed to similar rates of reinforcement across conditions.

Another limitation associated with the schedule of reinforcement is the absence of a systematized method to lean the schedule of reinforcement. The length of time between breaks was determined by low levels of disruptive behavior without a preset criterion. It would have been impossible to calculate the levels of disruption in the dental operator and adjust schedules accordingly with work ongoing. Some amount of experimental control was compromised in light of making the technique easier to implement for the dentist, which may in turn have contributed to treatment integrity. The reduction of control was considered a casualty of conducting research in an applied setting.

Although, results indicated decreases in disruptive behavior for all participants, consideration of the magnitude and immediacy of the changes from baseline to treatment, both within and between participants, leave many questions to be answered. The most relevant questions are what mechanism(s) may account for the improvements observed and why the treatment was more efficacious for some than for others. The method of action for noncontingent reinforcement procedures has been considered extensively in the literature (Ecott & Critchfield, 2004; Hagopian et al., 2000; Lalli et al., 1997; Thomson, et al., 2003; Tucker et al., 1998; Wilder et al., 2001; Vollmer et al., 1998). Results from this study unfortunately do not further elucidate the contributions that extinction, satiation, adventitious reinforcement, or choice responding may have had on the target behaviors. Further replication demonstrating greater experimental control is necessary prior to drawing definitive conclusions regarding the efficacy as well as the mechanism of noncontingent escape for decreasing disruptive behavior in the dental setting.

Additionally, there are some practical limitations of the study that are noteworthy. The cuing device affected the types of schedules available for investigation in the study. There is evidence that variable schedules are equally effective in reducing responses (Carr, Kellum, & Chiong, 2001; VanCamp, Lerman, Kelley, Contrucci, & Vorndran, 2000), and may better represent the natural world (Ringdahl et al., 2001). All reinforcer schedules were fixed as a result of technological limitations. Also, the cuing device could only prompt one schedule of reinforcement, requiring the dentist to suspend dental treatment momentarily to lean reinforcement schedules. Finally, because children were seen for a maximum of four appointments, time limited the opportunities to significantly lean the schedule, make adjustments to the magnitude and type of reinforcers available, and/or collect follow-up data.

Future studies might seek to manipulate the magnitude of the reinforcer. In the present study, the reinforcer was maintained at 10-second breaks delivered at fixed intervals. The dentist was given no instructions related to how to structure the break. Several studies have demonstrated that reinforcers with greater magnitudes are more effective than medium- or low-magnitude reinforcers (Carr, Bailey, Ecott, Locker & Weil, 1998; Wilder et al. 2001). Research conducted in an academic setting suggests that breaks with access to preferred activities are more effective than breaks alone in reducing disruptive behavior (Golonka, Wacker, Berg, Derby, Harding, & Peck, 2000). In the dental setting, a short preference assessment could be completed prior to the start of treatment and chosen items could be provided during noncontingent escape. Additionally, future studies might evaluate different types of schedules (i.e., variable and fixed) as well different methods for leaning schedules of reinforcement (i.e., dense-to-lean, fixed-lean, mean latencies, etc.) to maximize both the efficacy and effectiveness of noncontingent escape in the dental setting (Hagopian, Toole, Lon, Bowman, & Lieving, 2004; Lalli et al., 1997).

Further research should seek to replicate these results with other dental professionals and other children requiring restorative dental work. Children in the present study were selected based on past disruptive behavior in the dental operator. Providing noncontingent escape to children with lower levels of disruptive behavior or children with no history in the dental setting might prevent problems via early intervention (Allen et al. 1992).

Additionally, noncontingent escape should be investigated in other medical, rehabilitation, and residential settings where disruptive behavior interferes with needed treatment, particularly in light of growing legislation emphasizing patients' rights and preferences (i.e., restraint, isolation, pharmacological interventions, punishment). Noncontingent escape appears to be a noninvasive, well-tolerated alternative to manage disruptive behavior in the pediatric dental setting and highlights the need for further research exporting sound methods of behavior change to settings that are intrinsically aversive (i.e., for example physical and occupational therapy clinics, burn units, diabetic clinics, etc.).

Although results from this study demonstrate initial support for the efficacy of the intervention, there remains a number of obstacles that impede the clinical application (i.e., the effectiveness) of behavior management techniques such as noncontingent escape. Allen et al. (1992) assert that improved behavior may not be sufficient to ensure adherence in dental practices. Evidence clearly suggests that the climate in health care has changed in recent years due to increased legal risks and ethical concerns. No longer in dentistry are professional community standards sufficient to determine acceptable behavior management techniques. Despite consistent mandates from the American Academy of Pediatrics (AAPD, 2004) to rely upon the least invasive and accepted procedures, practicing dentists are more likely to employ pharmacologic and immobilization techniques compared to alternative techniques to manage disruptive behavior (i.e., communication, distraction, modeling) (Adair, Schafer, Rockman, &

Waller, 2004; Belanger and Tilliss, 1993). As is so often true, time equals money. Dentists are paid by the number of procedures completed. Currently, behavior management is not reimbursed by third-party payors, while pharmacological techniques (i.e., conscious sedation, general anesthesia) may be covered under non-dental (i.e., medical) insurance. Efforts to obtain reimbursement for behavior management techniques are even more difficult because of the ambiguities associated with the dual insurance system (medical and dental) (White & Monopoli, 2004). As a result, stopping to manage disruptive behavior or acquiring equipment to manage behavior is financially punitive to the dentist, likely leading to low adherence to alternative techniques.

As the culture of acceptable care evolves, the onus falls on researchers to expand the armamentarium of clinicians with empirically-supported treatments. New treatments should be devised and packaged with cost-benefit relationships in mind to justify third-party reimbursement. Finally, these treatments should be disseminated at the curricular level of training programs to insure that adherence is reinforced and to emphasize the detriments and risks associated with traditional procedures.

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APPENDIX A: OBSERVATION RECORDING FORM

Name: _____ Age: _____ Sex: _____ Date: _____ Observer: _____

Body/Head Movement (B): Movement of any part of the **Body** 15 cm or more, in either one continuous motion or smaller repetitive (back and forth) motions, that cumulated to 15 cm without interruption of 1 second or more. OR any **Head** movement of 15mm or more, except facial muscles or movements of lower jaw. Do not score movements in response to dentist instructions.

Complaints/Crying (C): Any crying, moaning, gagging, or complaining about dental procedures or pain. Complaints in response to questions by the dentist are not scored.

Restraints (R): Holding of any part of the child's body by dental assistant to restrict movement. Do not score light touches to calm or comfort child.

Disrupt (D): The child's movement or complaining/crying cause the dentist to stop the dental procedure during the interval.

Verbal Reprimands (V): any verbal directions to manage behavior not including the initial directions to position the child (e.g., lay down, scoot up) and to open the mouth and similar directions following a break.

Noncontingent Escape (NCE): Scheduled breaks cued by the MotivAider.

***Coding of target behaviors is indicated when the dentist is looking at and completing dental work. Coding will cease following 5 seconds of not looking at the child or completing work.

1. B C R D V NCE	2. B C R D V NCE	3. B C R D V NCE	4. B C R D V NCE	5. B C R D V NCE	6. B C R D V NCE	7. B C R D V NCE
8. B C R D V NCE	9. B C R D V NCE	10. B C R D V NCE	11. B C R D V NCE	12. B C R D V NCE	13. B C R D V NCE	14. B C R D V NCE
15. B C R D V NCE	16. B C R D V NCE	17. B C R D V NCE	18. B C R D V NCE	19. B C R D V NCE	20. B C R D V NCE	21. B C R D V NCE
22. B C R D V NCE	23. B C R D V NCE	24. B C R D V NCE	25. B C R D V NCE	26. B C R D V NCE	27. B C R D V NCE	28. B C R D V NCE
29. B C R D V NCE	30. B C R D V NCE	31. B C R D V NCE	32. B C R D V NCE	33. B C R D V NCE	34. B C R D V NCE	35. B C R D V NCE
36. B C R D V NCE	37. B C R D V NCE	38. B C R D V NCE	39. B C R D V NCE	40. B C R D V NCE	41. B C R D V NCE	42. B C R D V NCE

APPENDIX B: DENTIST RATINGS

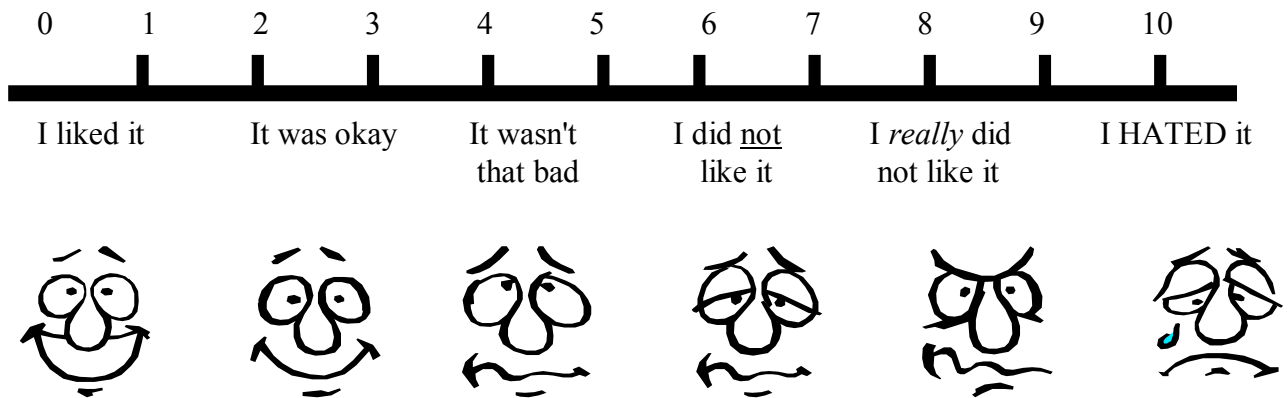
In your opinion, how cooperative was the patient in the video:

1-----2-----3-----4-----5-----6
Not Cooperative Cooperative Extremely Cooperative

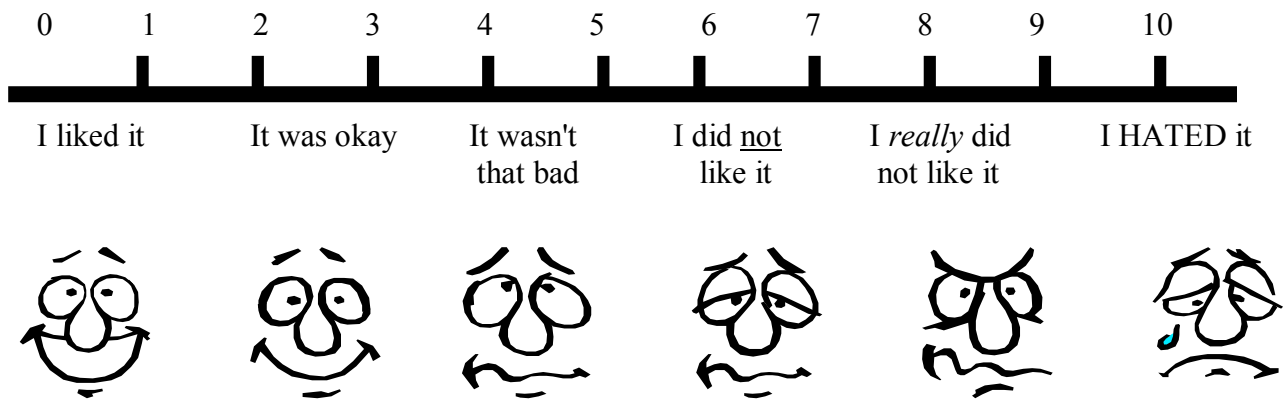
APPENDIX C: PEDIATRIC DENTAL CLINIC RATING FORM

Name: _____ Age: _____ Gender: M or F Date: _____

1. How did you feel about getting your teeth worked on today?



2. How much did you like having breaks?

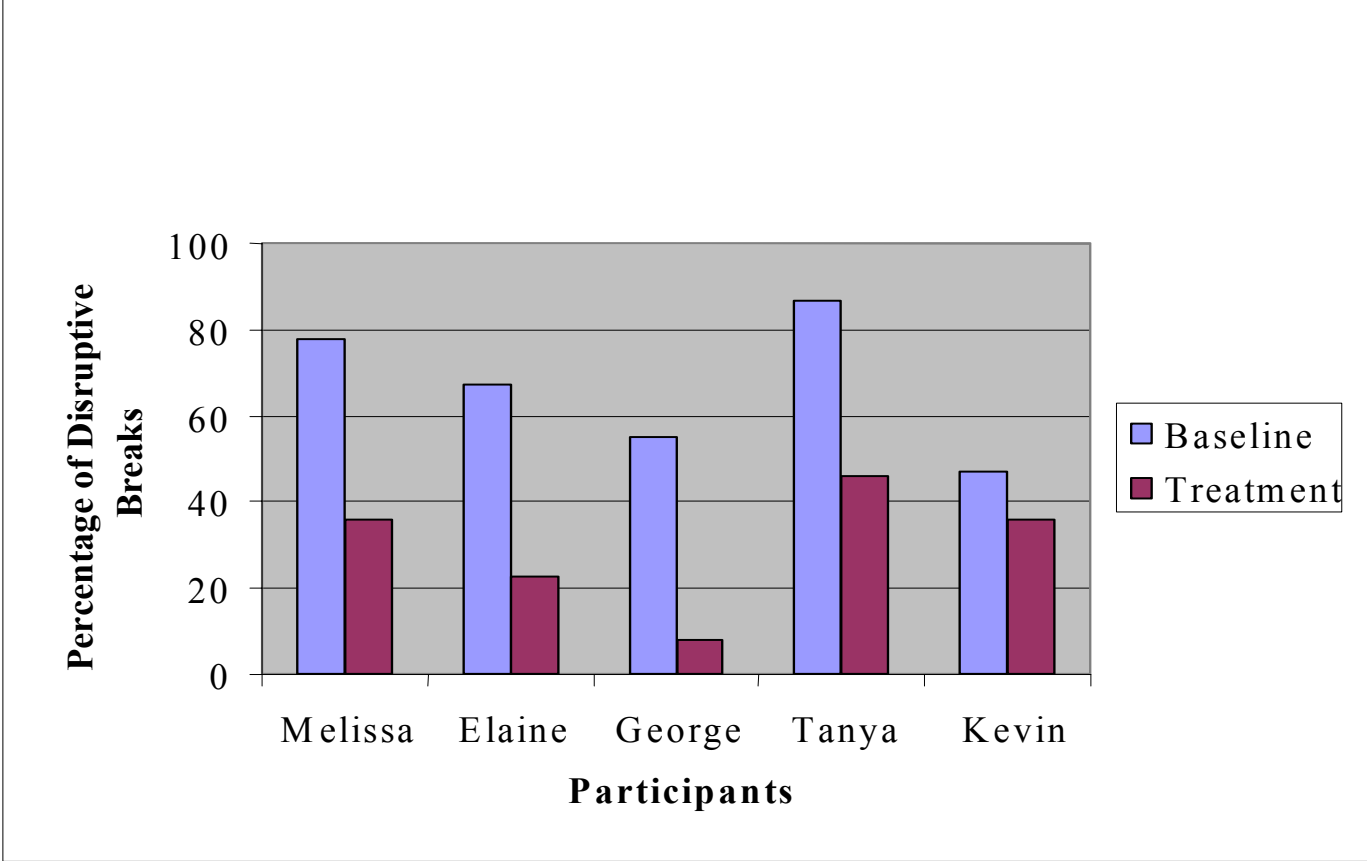


APPENDIX D: SUMMARY OF DISRUPTIVE BEHAVIOR PERCENTAGES

	Visit 1	Visit 2	Visit 3	Visit 4
Melissa	78%	73%*	27%*	12%*
Elaine	53%	67%	22%*	23%*
George	44%	49%	61%	8%*
Tanya	81%	57%*	35%*	-
Kevin	49%	45%	48%	35%*

* Noncontingent escape visits

APPENDIX E: AVERAGED DISRUPTIVE BEHAVIOR ACROSS BASELINE AND TREATMENT CONDITIONS



APPENDIX F: SUMMARY OF INTERVALS INVOLVING RESTRAINT

	Visit 1	Visit 2	Visit 3	Visit 4
Melissa	11	4*	1*	0*
Elaine	0	0	0*	0*
George	5	7	9	0*
Tanya	18	2*	2*	
Kevin	6	0	3	0*

* Noncontingent escape visits

VITA

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