Investigation of a reinforcement-based toilet training procedure for children with autism

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Abstract

Independent toileting is an important developmental skill which individuals with developmental disabilities often find a challenge to master. Effective toilet training interventions have been designed which rely on a combination of operant conditioning principles of positive reinforcement and punishment. In the present study, the effectiveness of a reinforcement-based toilet training intervention was investigated with three children with a diagnosis of autism. Procedures included a combination of positive reinforcement, graduated guidance, scheduled practice trials and forward prompting. Results indicated that all procedures were implemented in response to urination accidents. A three-participant reduced urination accidents to zero and learned to spontaneously request use of the bathroom within 7-11 days of training. Gains were maintained over 6-month and 1-year follow-ups. Findings suggest that the proposed procedure is an effective and rapid method of toilet training, which can be implemented within a structured school setting with generalization to the home environment.

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1. Introduction

Independent toileting is a developmental milestone which allows individuals to fully participate in community activities as well as develop a sense of personal responsibility and self-confidence. When an individual does not independently...
toilet him/herself it can lead to a number of negative consequences including diminished personal hygiene, physical discomfort, stigmatism, and reduced participation in community resources. Additionally, McCartney and Holden (1981) noted that failure to teach a person appropriate toileting skills may lead to "a feeling of hopelessness and lowered expectations, attitudes which may further interfere with habilitation attempts" (McCartney & Holden, 1981, p. 29). With autistic disorders in acquiring the skills of independent toileting, Ando (1977) noted that "it is much more difficult to toilet train autistic children than even profoundly mentally retarded children, in terms of both effort and length of time required" (Ando, 1977, p. 153).

Ellis (1963) outlined a theoretical framework for toilet training individuals with a diagnosis of mental retardation. This framework reflected a behavioral paradigm in which appropriate toilet training was taught through the systematic introduction of response cues and positive reinforcement contingencies. Subsequent experimental application of toilet training programs, based largely on Ellis' paradigm, yielded positive results (e.g., Hundzian, Maurer, & Watson, 1966; Kimbrell, Luckey, Barbuto, & Love, 1967; Levine & Elliot, 1970). Self-initiated use of the toilet, however, was not addressed. With the incorporation of a positive punishment component, Giles and Wolf (1966) were able to teach participants the skill of self-initiated (non-scheduled) toileting while eliminating toileting accidents.

Using a related theoretical perspective, Azrin and Foxx (1971) developed a toilet training procedure that utilized a combination of positive reinforcement, positive punishment, and scheduled toiletings to train self-initiated toileting in individuals with a wide range of developmental deficits. A combination of positive practice and full cleanliness training was used as the consequence for urination accidents. It was hypothesized that the full cleanliness training component was necessary for self-initiated use of the toilet to completely replace toileting accidents. The Azrin/Foxx procedures, which were experimentally shown to result in rapid success (e.g., Azrin, Bugle, & O'Brien, 1971; Sadler & Merkert, 1977; Smith, 1979), quickly became the standard for use with developmentally disabled individuals. The standard, or slightly modified Azrin/Foxx procedures have been successfully implemented with children with severe-profound mental retardation living at home (Sadler et al., 1977), and in an institution (Smith, 1979), children with autism (Ando, 1977), children with multiple severe handicaps (Lancioni, 1980) and adults with severe-profound mental retardation (Azrin & Foxx, 1971).

Also using a behavioral paradigm, Van Wagenen, Meyerson, Kerr, and Mahoney (1969) developed self-initiated toileting in children, both with and without disabilities, through the use of a forward prompting procedure and positive reinforcement. The Van Wagenen procedure differed from the Azrin/Foxx procedure in two major respects. First, whereas Azrin/Foxx used scheduled toileting times, Van Wagenen and colleagues did not rely on such schedules. Second, they prompted children to the toilet in response to the initiation of a urination accident, rather than consequence accidents with a punishment procedure. Experimental application of this procedure also resulted in self-initiated toileting in both typical and developmentally delayed children (Mahoney, Van Wagenen, & Meyerson, 1971; Smith, 1979).

A comparison study of these two toilet training procedures conducted by Smith (1979) resulted in comparable findings with both the Azrin/Foxx and Van Wagenen procedures. In conclusion, Smith indicated that the Azrin/Foxx procedure produced more rapid training, was more economical, less cumbersome and easier to fade than the Van Wagenen procedure. Upon close inspection of the study, the Azrin/Foxx procedure employed by Smith did not contain the full cleanliness training/positive practice component that had been included in previous published reports applying the Azrin/Foxx procedure. Given that self-initiated toileting was still gained in five out of five participants, the necessity of the consequence-based procedure may be called into question. The necessity of including a positive practice overcorrection procedure to teach self-initiated toileting has also been challenged by other researchers (e.g., Betts, 1978; Lancioni, 1980; Tierney, 1973).

Given the repeated success of the Azrin/Foxx procedure in teaching self-initiated toilet training, it is expected that it would be the most widely used method of toilet training today. In investigating the methods that are being used in agencies serving developmentally disabled populations, however, use of the Azrin/Foxx procedure, or the components contained therein, are rarely reported (Pfadt, Cicero, Hopkins, & Gerensler, 2000). The question then arises, why is a successful, research-based procedure not currently being used by professionals? Pfadt et al. (2000) discussed a number of possible explanations. First, due to changes in the political climate surrounding delivery of educational services to individuals with developmental disabilities, the use of restrictive consequence procedures is largely deemed unacceptable and in many cases prohibited. Second, overcorrection has been shown to be ineffective in some cases (Pfadt, Sullivan, & Paul, 1980) and may even be counterproductive with some individuals who have a wide repertoire of challenging behaviors which increase in severity when they are exposed to the overcorrection training protocol. Marohl, Laiselli, and Townsend (1980) reached a similar conclusion regarding overcorrection training noting that "as with any intervention, it has certain advantages and disadvantages associated with its use" (Marohl et al., 1980, p. 72). Third, changes in educational practices have lead to a greater reliance on proactive teaching procedures rather than consequence-based behavior reduction procedures. Fourth, both administrators and direct-care workers may be unfamiliar with technological advances in research-based toilet training procedures. Fifth, changes associated with the setting of service delivery (institutional to educational settings) has lead to the need to promote request-based toileting in classrooms, which is in contrast to toileting associated with institutions. Specifically, there is a need to promote the use of a request in educational settings, where the child is restricted from having free and independent access to the bathroom. Traditional toilet training interventions were largely designed for the
in institutional settings, where completely independent toileting is preferred. These obstacles have severely restricted the opportunities of students to receive intensive toilet training within educational settings. Unfortunately, this has lead to a dramatic increase in the number of untrained consumers and consumers who are only partially trained because they are dependent on a schedule (Pfadt et al., 2000).

A large portion of these perceived obstacles can be addressed by combining the intensity of the Azrin/Fox program (i.e., treatment delivery restricted to the bathroom setting, scheduled toiletings) with a forward chaining prompting procedure similar to that used by Van Wagenen. In this way, self-initiated toileting can be promoted through the use of a prompted teaching trial with no need to incorporate full cleanliness overcorrection (i.e., the prompted response is initiated immediately in response to the start of a urination accident). This combined program can, therefore, be seen as integrating the strengths of Azrin/Fox's schedule toilet ing (e.g., increasing the opportunities to reinforce appropriate urination, promoting rapid success, promoting high structure) and Van Wagenen's model (e.g., using a prompting procedure to shape an appropriate chain of behavior regarding toileting, in response to the need to urinate). The omission of the overcorrection procedure may avoid the political, philosophical, and educational concerns that may have contributed to the decline in service provision in the area of toilet training. Furthermore, the addition of a functional communicative training component into the scheduled toilet ing trials can promote request-based toileting in classroom settings. This training can be tailored to the communicative abilities of each consumer by using a variety of modalities including verbal language, picture exchange, and/or sign language as appropriate.

The following cases will investigate the effectiveness of the proposed toilet training package. If the toilet training method that is described in the present article does not produce at least comparable results to the original Azrin/Fox program, then there may be no benefit in altering this program. If the combination method can be shown to produce at least equal results, then this combined approach may promote a revitalized interest in toilet training by service providers in the field of developmental disabilities.

2. Method

2.1. Participants

Three participants were included in the training program; Kathy (6 years old), James (4 years old) and Tommy (4 years old). Participants were chosen by a combination of teacher opinion that the students were ready to begin toilet training, parent interest in beginning toilet training and the students meting all of the prerequisites for toilet training (Baker & Brightman, 1997). All three participants had a diagnosis of autistic disorder and attended a full day, behaviorally-based school program. At the time of this study, all three participants were untrained, wore diapers and had urination accidents on a daily basis. None of the participants had received any prior toilet training intervention beyond unsystematic prompting to the toilet. Each participant met the prerequisite skills for toilet training noted by Baker and Brightman (1997), which include the ability to sit for at least 5 min, an ability to follow simple directions, basic dressing skills and the ability to hold urine for at least 1.5 hr. With regard to communication skills, Kathy was non-verbal, and communicated through an electronic talking devise using pictorial representations of objects. James and Tommy communicated verbally through one-two word phrases, however, they also used a picture exchange communication system in order to enhance their vocabulary.

2.2. Setting

All training took place in a student bathroom within the child’s school. The bathroom that was chosen was designed primarily for children. It contained multiple stalls (three), multiple sinks (two) and a relatively large open area. A personal desk, a small table and two chairs (one for the student and one for the teacher) were placed in the open area of the bathroom. A bin of instructional and leisure materials was also readily accessible. The desk was used for instructional materials and the participant's communication book. On the small table were the teacher’s data sheets, an electronic timer, and reinforcers.

2.3. Procedure

The training was implemented for the entire school day (approximately 5.5 hr per day).

2.3.1. Baseline

Baseline data were collected for 3 days prior to training. Consistent with training, baseline data were collected within the school setting for 5.5 hr per day. During the baseline phase, the frequency of urination accidents and spontaneous requests to use the bathroom were recorded. The students were not prompted to use the bathroom and no training was provided.

2.3.2. Teacher training

Training was conducted primarily by classroom teachers who had previously received extensive training in applied behavior analysis. All training was conducted with a 1:1 teacher-student ratio. Prior to implementing the toilet training intervention, all teachers received supplemental training on the use of a detailed training manual (copies of which are available from the author). The training was conducted by the experimenter and consisted of a didactic component, role play and in vivo practice. Daily observations were conducted by the experimenter in order to ensure adherence to treatment protocol. Follow-up training, either informational or “hands on,” was provided if the need was indicated through observations or by requests from the staff.
2.3.3. Preference assessment

A preference assessment was conducted for each participant in order to identify items to use as reinforcers. Reinforcers were chosen based on a combination of observations of positive affect, increased compliance to demands and repetitive requesting of an item. For Kathy, painting and music were used as reinforcers. For James, several play activities including a car garage and a tricycle were used. For Tommy, sour candy was used.

2.3.4. Communication systems

Each child’s speech therapist was consulted regarding functional modes of communication. Kathy used an electronic talking device, using picture representations of objects. James and Tommy were taught to request using a combination of expressive speech and picture exchange.

2.3.5. Preparation of the participants

Upon arrival at school, participants were directed into the student bathroom where excess clothing was removed. Participants were dressed in limited clothing consisting of brief style underwear, an undershirt and socks. Limited clothing was required in order for the teacher to detect a urination accident immediately upon its occurrence. The participants were given free access to liquids in order to increase the need to urinate. A variety of liquids were offered in order to prevent satiation. Participants were verbally encouraged to drink if liquid intake was low. Free access to liquids was provided throughout the morning. However, liquid intake was restricted in the afternoon.

2.3.6. Toilet training procedure

The toilet training program comprised of a combination of a prompted schedule and immediate prompting to the toilet in response to accidents. Similar to the Azria/Flax procedure, with the addition of a request component, a timer was set for 30 min intervals. Every 30 min, the student was prompted to request the use of the bathroom (either through a verbal request or picture exchange). This request was prompted without the use of an instructional SD ("give me bathroom picture") or question ("what do you have to do?"). For a student using a picture exchange, physical prompts were first used and eventually faded to a gestural prompt. For a student using a verbal request, a verbal prompt was used (either a full verbal prompt such as "bathroom" or a partial verbal prompt such as "ba..." was used as necessary). All prompting was provided by the teacher implementing the training. Once the student was prompted to request the toilet, he/she was brought to the toilet and prompted to undress and sit. The student was encouraged to sit on the toilet for approximately 1-3 min. It was felt that requiring the child to sit for longer than 3 min, in the absence of urination, would only serve to undermine the conditioning between the stimulus of the act of urinating and the act of urinating. If a urination occurred, the student was prompted to stand up from the toilet, re-dress him/herself and flush the toilet. A combination of behavior specific verbal praise and tangible positive reinforcement was delivered at that time.

If, however, the student did not urinate, he/she was prompted to stand and re-dress him/herself. A verbal statement, "OK, you don't have to pee," was delivered. No verbal praise or tangible reinforcers were given. A graduated guidance procedure was used for all toilet related daily living skills.

In addition to the prompted schedule described before, approaching the toilet in response to accidents was provided. Immediately upon noticing the start of a urination accident, the teacher would deliver a statement that was meant to startle the student, thereby temporarily interrupting the flow of urine (i.e. "no, no, no, hurry up, you pee on the potty"). Simultaneously, the student was quickly prompted to the toilet, the teacher would lower the student’s pants and he/she would be encouraged to re-initiate the urine flow while sitting on the toilet. This method of accident correction is similar to that used by Van Wagenen and colleagues. If urination in the toilet was achieved, tangible reinforcement and verbal praise were delivered. If no further urination occurred, the student was prompted to stand and re-dress. The student was changed out of his/her wet clothes without any further consequence. Request training was not provided during these trials. It is important to note that the startle response and subsequent prompting sequence that were initiated in response to urination accidents served as positive teaching trials not negative consequences.

2.3.7. Additional training

All three participants resided at home with their parents. No formal training was conducted in the home, however, some of the parents reported providing some additional training at home, using methods similar or identical to those being used in school (a written description of training procedures was sent home for purposes of consent). No direct training was provided to the parents by the experimenters. Regarding Kathy, parents reported providing some partial training for approximately 1 hr per day at home. No additional training was provided for James. However, his parents reported using periodic prompts to the bathroom at certain times of the day (before bed, after dinner, etc.). Similar to Kathy’s, Tommy’s parents reported providing approximately 1 additional hour of training per day. Tommy’s parents reported that they followed the toilet training plan that was being conducted in school as closely as was possible.

2.3.8. Fading procedure

Once a spontaneous request was observed, followed by urination on the toilet, the prompted schedule component of the plan was discontinued on the following school day. At this point, the participant was forced to either request when he/she needed to use the toilet or have an accident. No prompts to the toilet or reminders to request were provided by the trainers. Reinforcement continued to be delivered for appropriate urination on the toilet and forward prompting to the toilet continued to be provided in response to accidents. When spontaneous initiations were observed for 3 consecutive days, along with accidents maintaining at a zero frequency, other components of the training procedure were quickly faded. Liquid intake was returned to the typical amount noted at pre-training for each participant.
participant. Full clothing was re-introduced while the participant was still receiving all training in the bathroom. Once success continued to maintain while the student was on a normal liquid intake and in full clothing, he/she was gradually faded out of the bathroom into their normal classroom. This fading procedure consisted of moving the participant further from the bathroom, in small increments, in the direction of their classroom. Distance from the bathroom would be increased upon approximately every independent request noted from the previous area. All reinforcement and forward prompting procedures continued to be implemented throughout the fading process. Once successfully faded to the classroom setting, reinforcement for appropriate urination on the toilet was gradually thinned.

2.3.9. Data collection

Data were collected on a daily basis during school hours. Teachers recorded the frequency of urination accidents and spontaneous requests. An accident was defined as any release of urine outside of the toilet. Once initiated, an accident was recorded regardless of whether or not urination was completed in the toilet. A spontaneous request was defined as any verbal or picture request made by the student, in the absence of prompts, followed by appropriate urination in the toilet. Baseline frequencies of accidents and requests were collected for 3 days prior to the implementation of training. (A copy of the data form is provided in the training manual and is available from the senior author.)

Formal reliability checks were not conducted throughout the study. The experimenters decided that formal inter-rater reliability data was not necessary for the following three reasons. First, the target responses (urination accidents and spontaneous requests) were operationally defined and clearly observed by all trainers. Second, previous experience with toilet training data indicated high inter-rater reliability. Third, informal reliability checks during the current study indicated clear agreement on target behaviors and data collection systems across all trainers.

2.3.10. Experimental design

The current study is an AB design across three participants. Each participant was subjected to two phases; a baseline phase followed by a treatment phase. Six-month and 1-year follow-up interviews were also conducted. These follow-up interviews were conducted in order to assess long-term maintenance of the target skill. At 6-month and 1-year intervals, the students’ teachers and parents were interviewed regarding current toileting status. Teachers and parents were asked to report on the amount of urination accidents that are observed versus the amount of spontaneous requests that are observed at that point in time. Formal data collection was not conducted during follow-up probes.

3. Results

Fig. 1 shows the frequency of accidents and requests per day for all three participants. The top panel shows that during baseline, Kathy’s frequency of accidents ranged from two to three per school day. On day 4, the toilet training intervention was initiated. Spontaneous requests were observed starting on day 5. Uritnation accidents did not, however, drop to zero until day 9 (7 days into training). Spontaneous requests were noted consistently starting at day 10. Independent requests to use the bathroom were being maintained at an exceptionally high rate (as high as 17 per school day) until day 14, probably due to a combination of the restriction to the bathroom environment, the continued flooding of liquids and the potent reinforcement that was being used for successful urination on the toilet. On day 15, when these components of the training began to be faded, independent requests to use the bathroom decreased to an acceptable
level (between one and two per school day) and accidents maintained consistently at zero. Positive results were reported to generalize to the home environment in the same time frame as manifested in the school program. Six-month and 1-year follow-up interviews with Kathy’s parents and teacher indicate that toileting gains have maintained over time.

The middle panel of Fig. 1 shows that James’ frequency of accidents ranged from one to two per school day during baseline and no independent requests were made. On day 4, the toilet training intervention was begun. For the first 6 days of training, James continued to have urination accidents daily and showed no signs of independent initiation. On the seventh day of training, accidents dropped to zero and James began to independently request to use the bathroom. Independent requests were maintained at one to three per school day and accidents remained at zero throughout the intervention. Similar to Kathy, despite the lack of additional training provided in the home, positive results generalized to the home environment. Six-month and 1-year follow-up interviews with James’ parents and teacher indicated that toileting gains have maintained over time.

The bottom panel of Fig. 1 shows that Tommy’s frequency of accidents ranged from two to three per school day and no independent requests were made during baseline. On the first day of training, two accidents were noted. One or no accidents occurred until day 13, after which no more accidents occurred. On day 10, two independent requests to use the bathroom were noted. By day 17 of the plan spontaneous requests occurred on a daily basis. Toileting gains generalized to the home setting. Six-month and 1-year follow-up interviews with Tommy’s parents and teacher indicate that all toileting gains have maintained over time.

Intervention procedures were systematically faded. All three participants had been returned to their normal classroom setting by the end of training.

4. Discussion

The results of this study indicate that for all three students, self-initiated, requests to use the toilet in the absence of toileting accidents was achieved within 7–11 training days. A urination accident criterion of zero is more stringent than is often cited in the research literature. For example, a 90% decrease in accidents was achieved by Azrin and Foxx (1971). Barton (1975) reported significant progress, however, no participant met the criterion of complete dryness. Smith et al. (1975) reported an 80% reduction in urination accidents. Although the data reported in the present study reflect only 18–20 days of training, anecdotal follow-up reports indicated that accidents maintained at zero over time. This preliminary evidence indicates that the present procedure is at least as effective, if not more effective, than established toilet training methods.

Another issue raised in the current investigation involves the speed of skill acquisition. Original report by Azrin and Foxx (1971) indicated a median duration of training of 4 days. As stated in Smith and Smith (1987), this rapidity of skill acquisition has not been replicated by other researchers using the Azrin/Foxx procedure. The data in the present study show slightly slower rates of acquisition than Azrin and Foxx: all participants mastered toilet training within 11 days. This rate can be considered rapid when compared to toilet training acquisition rates reported by other researchers (Barton, 1975; Pfadt & Sullivan, 1981; Smith et al., 1975). It is also important to note that the present training procedure was only implemented during the participants’ school day (approximately 5.5 hr). Foxx and Azrin (1973) recommend an 8-hr training day for maximum effectiveness.

The present approach to toilet training is a combination of a structured, operant toilet training program based on that designed by Azrin and Foxx (1971) in combination with a forward prompting procedure based on that by Van Wagenen et al. (1969). The results of the three case studies described in the present report indicate that the combination procedure used in this study is an effective and rapid method of toilet training children with autism to request the need to use the bathroom based solely on internal cues.

The forward chaining error correction procedure was included to take the place of the overcorrection/full cleanliness training consequence used by Azrin and Foxx. For reasons noted before, the implementation of the consequence procedure may be the major contributor to the perceived reluctance to carry out intensive toilet training programs today. Additionally, by placing an emphasis on communication training, the current procedure teaches the individual to request the need to use the toilet instead of self-initiating, a skill that is well suited to educational and community settings. It is also interesting to note that all three participants generalized toileting skills to the home environment even though a specific generalization plan was not implemented.

The current intervention may be seen as acceptable by both parents and service providers due to the proactive teaching philosophy on which it is based. Although the intervention removes the punishment component of the Azrin/Foxx procedure, it retains the emphasis on structure, operant reinforcement for success, clear goals, systematic prompting procedures and intense staffing ratios upon which the Azrin/Foxx program is based. This acceptance might lead to an increase in the provision of toilet training interventions with individuals with developmental disabilities, which in turn will increase the independence of these individuals.

There are several limitations to the present report. First, the simple AB design that was used can be seen as having some inherent threats to internal validity that a more experimental design (i.e., multiple baseline across participants, comparison to a control or alternate treatment group) would not have had. It is the opinion of the authors, however, that the clarity and rapidity with which toileting skills were attained, once training was initiated, is evidence of the link between the current intervention and behavioral change. Second, objective data were not formally collected on generalization to home environments or alternate settings. Reported generalization and maintenance gains were based on accounts from parent and teacher interviews. Third, all three case studies involved children under the age of 7 years, diagnosed with autistic disorder. It is unknown whether this "non-punishment" based approach would show success with older individuals or with individuals with other developmental disorders. In addition, some resear
may argue that it is inappropriate to compare skill acquisition and error reduction rates between studies in which the participants were not equated according to functioning level. The current authors do not argue that level of functioning can have a definite impact on rate of acquisition and error reduction across consumers, however, the data in the present study indicate the effectiveness of the intervention package with participants of a similar profile to those included in the study.

Future investigators can address these limitations by using a larger scale, experimentally rigorous study with a more diverse population. Other areas for future research include investigating the effects of a training package including parental involvement and comparing different methods of staff training. It would also be important to conduct an investigation of the social validity of the procedures and the outcomes they accomplish.

References


