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The effects of graduated exposure, modeling, and contingent social attention on tolerance to skin care products with two children with autism

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Abstract

Children with autism may display unusual or fearful responses to common stimuli, such as skin care products. Parents of children with autism have often reported that their children will not allow the application of these types of substances to their skin and if the parent persists, the children become extremely upset and anxious. Such responding can interfere with adaptive functioning. The purpose of this study was to evaluate the effects of a treatment package involving graduated exposure to steps in an avoidance hierarchy, modeling, and social attention on the responding of two children with autism who displayed fearful responses to skin care products. Both avoidance and acceptance responses to skin care products were measured. Both changing criteria and multiple baseline experimental designs were employed to assess the effects of the intervention package. The results suggest that the package was successful in teaching tolerance of skin products for both children.

Keywords: Skin care products; Graduated exposure; Autism; Modeling

Although childhood fears are a part of normal development they have the potential to interfere with daily functioning (King & Ollendick, 1997), and this interference can be particularly detrimental when fearful responses interfere with adaptive functioning of children with developmental disabilities (Matson, 1981). Avoidance behaviors, such as screaming, crying,

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and running away are some of the behaviors that are included in definitions of fearful or avoidance responding.

An unusual responsiveness to the sensory environment is one of the behavioral characteristics of children with autism (American Psychiatric Association, 1994). For example, children may display extreme distress at going barefoot, it may severely agitate them to have their face touched, they may become upset if their hands get dirty, or show pronounced irritation if someone applies cream to any body part. This class of unusual responding has been called tactile defensiveness (TD) (Baranek & Berkson, 1994; Case-Smith, 1991; Royeen, 1986).

Quite often the parents of children with autism and TD report that their children will not allow the application of certain substances to their skin (Hatch-Rasmussen, 1995). If the parent persists, the children become extremely upset. This is of concern for several reasons. If a child has a cut, parents are not able to apply an antibiotic cream. If a child has eczema, parents are not able to apply lotion. If a child is at school and the kids are making mud pies, the child will be unlikely to participate. More often than not, children with autism behave very differently from their peers and are avoided by other children. In addition to health considerations unusual reactions can interfere with socialization. Love, Matson, and West (1990) reported that mothers stated that improvements in their child's phobic behavior eliminated a major impediment to their child's overall adjustment.

Children with TD often are excluded from new learning opportunities due to avoidance of everyday stimulation. The ability to tolerate tactile stimuli could be considered a behavioral cusp. A cusp is simply a change in behavior that has consequences for the child that go beyond that change itself. It can reveal new environments as well as new reinforcers and communities to the child (Rosales-Ruiz & Baer, 1997). Being able to wear sunscreen or tolerate dirty hands can make new environments available to the child, thereby providing the opportunity to develop new skills and reinforcers such as outdoor swimming, going on field trips, bike riding, or making mud pies with friends. Therefore, TD in children with autism appears to fit the definition of a socially significant problem (Baer, Wolf, & Risley, 1968) worthy of attention.

Although only a few studies specifically have addressed TD in children with autism, interventions designed to treat fearful responses to everyday events have been investigated with numerous populations. Treatments have generally involved counterconditioning, modeling, or flooding. A common counterconditioning procedure used with children is in vivo desensitization (Morris & Kratochwill, 1998). In this procedure fearful/rejecting responses are extinguished while approach/acceptance responses are reinforced as the child is gradually exposed to increasing proximity, intensity or amounts of the feared stimulus (Morris & Kratochwill, 1998).

In modeling, the therapist or caretaker demonstrates non-fearful behavior in the presence of the anxiety-provoking situation. Although the ability to imitate is a common deficit in many children with autism (Miller, 1997) it is almost always an early goal of intervention programs (Rappaport, 1996; Taylor & McDonough, 1996). Because of this, many children with autism who have been in treatment have acquired the skill of imitating their teachers and caretakers. Therefore, modeling can also be a useful technique with children in later stages of treatment programs (Davis & Russell, 1990). Reinforcing the modeled performance has been found to increase imitation (Bandura & Kupers, 1964; Bandura, Ross, & Ross, 1963a, 1963b).

Love et al. (1990) used in vivo desensitization with two children with autism. One child avoided going outside and the other avoided running water in the bathroom. The children were gradually exposed to the respective fearful situations with the mothers serving as therapists. Both children completed the desensitization hierarchy in fewer than 23 steps, and in fewer than 36 sessions. Fearful responses remained low (one or fewer per session) at 5 month and 1-year follow-ups. Luscre and Center (1996) reduced fearful responses in three male children with autism, between

the ages of 6 and 10, who exhibited fearful responses (described as aggression, persistent vocal resistance, and escape behaviors) during dental exams. The treatment package included desensitization with guided mastery, video peer modeling and reinforcement.

The purpose of the present study was to evaluate the effects of a treatment package having three components: graduated exposure to steps in an avoidance hierarchy, modeling and social attention (praise, hugs, smiles, tickles, etc.) delivered contingent on step completion. The behavior of interest was the acceptance/avoidance of skin care products.

1. Method

1.1. Participants

The participants were two young children with autism, independently diagnosed using the Childhood Autism Rating Scale (CARS) (Schopler, Reichler, DeVellis, & Daly, 1980). Four-year-old Duke had a CARS score in the mild to moderate range (33) and was also diagnosed as having a ''severe language disorder''. He was intolerant to skin lotion and his mother requested assistance in applying lotion to prevent severe dry skin. She usually attempted to apply lotion after his bath in the evening. She reported, and the experimenter observed, that he hit, screamed, cried, hid his hands behind his back, and pushed away the bottle and the person holding the bottle. His face contorted in a grimace, he whined ''No, I don't want it'' and other verbalizations in a tone that was usually a precursor to crying.

The second child, 4-year old Sam, had a CARS score in the moderate to severe range (37). He displayed intolerance to three skin care products: suntan lotion, antibiotic cream, and baby lotion. His mother reported, and the experimenter observed, that he cried and screamed and struggled to get away from the person who had the products. He pulled his arms or legs away if anyone tried to apply any of these products to him. He also whined while he said things like ''No, no lotion'', ''I don't want it'', usually accompanied by crying. In addition to the experimenter, Sam's mother functioned as a change agent who implemented generalization probes throughout the study.

1.2. Settings and materials

All sessions were conducted in the homes of participants, starting in a room with children's furniture and toys and eventually moving to other areas of the home. All sessions were video recorded and lasted between 30 and 60 min. Materials included a variety of games and toys as well as the targeted skin care products. For Duke, the targeted product was skin lotion and for Sam, the targeted products were suntan lotion, antibiotic cream, and baby lotion.

1.3. Dependent variables

1.3.1. Duke

Viewing the videotaped sessions, the experimenter recorded the frequency of each of the following avoidance, or ''rejecting'', responses: verbal protests, whines, and facial grimaces. Verbal protests included words spoken by the child that conveyed dislike/discomfort, for example, saying, ''Stop it'' or ''This feels icky''. Whines included noises that were neither full cries nor normal speech tone, and facial grimaces included facial contortions such as nostrils flared, and eyebrows scrunched down. Completion or failure to complete each of the graduated exposure steps was also documented.

1.3.2. Sam

As with Duke, data were collected on ''rejecting'' and ''accepting'' responses viewed in the videotaped sessions. The experimenter recorded the frequency of the verbal, vocal, facial and physical responses. Examples distinguishing rejecting from accepting responses included: ''I want lotion'', or ''Put on tummy'' as accepting and ''no'' or ''I don't want'' as rejecting; laughing or smiling as accepting and whining as rejecting; smiling as accepting and grimacing as rejecting; and picking up product as accepting and pushing away product as rejecting. Completion or failure to complete each of the graduated exposure steps was also documented.

Each occurrence of a response that was contextually related to the treatment was recorded by placing tick marks in the appropriate boxes on an observation form. For example, if during the session, the child was playing with a car and pushed it away, that was not counted as a physical rejecting response. On the other hand, if the child threw the bottle of lotion and screamed ''Help'' that was counted as one physical rejection response and one verbal rejecting response.

A second observer, another graduate student, was trained to record session data from the same tapes in order to assess interobserver agreement (IOA). Training continued until IOA met a criterion of 90% for data collecting during three consecutive steps in the treatment hierarchy. When proficiency was achieved, both experimenter and observer recorded data simultaneously and independently from footage of treatment steps. No IOA assessment was done for Duke.

Reliability of the scoring was determined for baseline and treatment sessions by calculating the percent agreement between two scorers. Percentage agreement was calculated by dividing the number of agreements per session divided by the number of agreements plus disagreements, and multiplying by 100.

Social validity was assessed with a questionnaire (Poling, Methot, & LeSage, 1995). The parents of both children were asked to rate the importance of the goal and method of this treatment package, using a 5-point Likert Scale. The parents were also asked to rate their satisfaction of the method and outcome of this study, from one to five. Finally, the questionnaire also included three open-ended questions. The first two addressed the significance of the outcomes for their family and for their child, and the third question requested suggestions for improvement of the intervention program.

1.4. Independent variables

The three independent variables were graduated steps of exposure to skin care products, modeling of appropriate responses to these products and social attention (praise, tickles, etc.) contingent on step completion. The hierarchy of graduated steps for Duke is shown in Table 1 and for Sam in Table 2. For both children, the experimenter recorded each step of the exposure hierarchy completed or attempted but not completed.

As each child progressed through the hierarchy, the experimenter paired praise with events previously identified as high preference for every attempt of a trial. During modeling, the experimenter demonstrated appropriate verbalizations and/or actions that typically accompany the use of the targeted stimuli or a combination of both. A verbal model included spoken words like ''Oh my gosh, that's a lot'' or ''Hey look, it's all gone''. A physical model included smiling and physical movements like rubbing in lotion. A combination of both included rubbing lotion while the experimenter smiled, laughed and said ''Hey it disappeared''. Modeling was used if the child failed to respond to the stimuli in a manner similar to typical peer responses. No model was delivered if the child was already responding appropriately.

Table 1
Hierarchy of steps for Duke

Dry skin lotion
1. Hold bottle of lotion
2. Child puts lotion in therapist's palm
3. Child puts lotion on therapist's nose using therapist's finger
4. Child puts swirls lotion on back of therapist's hand using therapist's finger
5. Dab of lotion on back of child's hand, count to 3 therapist wipes off with tissue
6. Dab of lotion on back of child's hand, count to 5 child wipes off with tissue
7. Dab of lotion on back of child's hand, count to 5, child wipes off with 1 in. off of tissue
8. Used old tissue from Step 7 (some lotion already on tissue)
9. Dab of lotion on back of child's hand, count to 10, child wipes off with 1/2 of tissue
10. Dab of lotion on back of child's hand, count to 5, child wipes off with very small piece of tissue (too big, step dropped)
11. Touch product
12. Very small dab on hand of child and on therapist, with therapist's instruction "rub it in" both rubbed lotion into hands simultaneously
13. Dab of lotion on back of child's hand, therapist states "uh-oh, no tissues, rub it in make it go away like magic"
14. ... then in palm
15. ... palm and elbow
16. Child applied lotion to himself
17. Therapist instructs "you do it all by yourself, do elbows too"
18. ... knees, elbows and cheeks
19. ... knees, elbows, cheeks and neck
20. Generalize lotion application to bathroom where application of lotion typically occurs
Criterion "Do you want some (lotion)?"

1.5. Experimental design

A changing criterion design was used in both treatments. For Duke, only one skin care product was targeted and the effects of the intervention were evaluated within a changing criterion design. For Sam, the effects of the intervention on the first of the three skin care products were evaluated within a changing criterion design. Additionally, generalization and intervention effects were assessed within a multiple baseline across two additional products and probes with a Sam's mother.

1.6. Experimental conditions

During baseline, all targeted stimuli were presented at criteria for each child. After repeated failure to complete the criterion step (answering "yes" to the question "do you want some lotion", accepting the application of the skin care product on his person, and allowing the substances to remain on his skin), the treatment began for one of the targeted stimuli. During the treatment phase, they were exposed to the targeted stimuli in a series of treatment steps that brought him into even closer contact with the feared stimulus. Table 3 shows typical session training sequence. For Sam, responses to remaining products were probed about halfway through the first treatment hierarchy. During post treatment, conducted to test for lasting treatment changes, the experimenter presented the criterion step as in baseline. Generalization was assessed throughout treatment for Sam. His mother participated in baseline (or pretreatment) and post treatment (or follow-up). Furthermore, she conducted at least six probe trials during treatment. She conducted these trials in the same manner as the experimenter.

Table 2
Hierarchy of steps for Sam

Suntan lotion, antibiotic cream, dry skin cream
1. Look at and touch bottle
2. Smell product with cap off bottle
3. Pick up off floor, give to therapist
4. Hold bottle 5 s
5. Hold bottle 15 s
6. Dab on back of therapist's hand, child wiped off with tissue
7. Child wiped off therapist's nose with tissue
8. Child pushed therapist's hand to therapist's nose, with product on therapist's index finger, and wiped off with tissue
9. Child pushed therapist's hand to therapist's nose, with product on therapist's index finger, and wiped off with tissue (as in previous step) and puts product back of therapist's hand and wiped off with tissue
10. Rubbed product into therapist's hand with finger of therapist's other hand, with child manipulating therapist's hand
11. Pretended to do previous step (rubbed product into therapist's hand with finger of therapist's other hand, with child manipulating therapist's hand), therapist "accidentally" got product on child, therapist wiped off immediately with a tissue
12. Therapists applied dab of product from therapist's finger, on back of child's hand, wiped off immediately with a tissue
13. Therapists applied dab of product from therapist's finger, on back of child's hand, counted to 3 out loud, wiped off with a tissue
14. From bottle, put dab on back of child's hand, counted to 3, wiped immediately (step dropped)
15. Therapists applied dab of product from therapist's finger, on back of child's hand, counted to 5 out loud, wiped off with a tissue
16. Therapists applied dab of product from bottle onto back of child's hand, counted to 5 out loud, wiped off with a tissue
17. Therapists applied dab of product from bottle onto back of child's hand, counted to 10 out loud, wiped off with a tissue
18. Pretended to do previous step (dab of product from bottle onto back of child's hand, counted to 10 out loud, wiped off with a tissue), when therapist got to "10", said "uh-oh, no more tissues. Rub it in."
19. Child applied product to therapist in one of three possible settings[a]
20. Child rubbed in product, on hands, without any counting in one of three possible settings[a]
21. Child applied to own body in one of three possible settings[a]
22. Therapist applied to child's body in one of three possible settings[a]
Criterion: "Do you want some (product)?" in one of three possible settings[a]

[a] One of three settings included living room, outside, or school.

1.6.1. Duke

The product for Duke was lotion for dry skin. The treatment included graduated exposure, modeling and contingent attention. A token system that was employed during his home treatment program was also used during the step procedure. Visual prompts were used to indicate how many trials were to be completed. For instance, if the experimenter wanted to present five trials, she put out five blocks and a dump truck. Following each trial, the child put a block in a bed of the dump truck and when all the blocks were gone, he could go play. Similarly, the experimenter put out ten pieces of granola bar and after each trial the child ate one. When they were all gone, he could go play. This was standard procedure for this child during his daily therapy sessions and proved to be effective as well as enjoyable for the child.

After each trial, Duke received some form of social attention (praise, smiles, tickles, etc.). The child was never forced to complete a step. If two types of rejection occurred on any trial, the

Table 3
Typical training session sequence

A. Therapist arrives
1. Therapist speaks with parent
2. Therapist gathers materials

B. Therapist plays highly preferred activity with child

C. Desensitization trial begins (video camera turned on)
1. Therapist takes out bottle of lotion and asks the child if he wants some
2. The child hides his hands and shakes his head (this step is broken down)
3. Therapist puts the bottle on the table next to the child and talks about its funny shape
4. The child makes a comment and the therapist tickles the child (this is fun for him) and moves the bottle closer (this is another next step)
5. The child decides to pick up the bottle to show the therapist something on the bottle (this is another next step)
6. The therapist tickles the child and says "Ya', that's cool!" can I hold it? (modeling)
7. The therapist looks at the bottle and finds something else interesting on it and offers the child the bottle again
8. The child takes the bottle and the therapist tickles the child again and the therapist tries to make the bottle stand upside down (modeling)
9. The child takes the bottle and tries to make it stand upside down (the child has now mastered a step and the therapist will progress to another step)
10. Video camera turned off

D. Therapist plays highly preferred activity with child

E. Desensitization trial begin (video camera turned on)
1. Therapist takes out bottle of lotion and asks the child if he wants some
2. The child hides his hands and shakes his head (here this step will be broken down again)
3. The therapist opens the bottle and applies it to herself and says "This stuff smells like suntan lotion, mmmm" (modeling)
4. Therapist asks again if the child would like to try lotion
5. The child hides his hands and shakes his head (step is still too difficult)
6. The therapist puts a dot of lotion on the back of her hand and the child takes her other hand and swirls the therapist's finger in it and the laugh at the design it made (modeling and new step)
7. The therapist puts another dot of lotion on the back of her hand and the child takes her other hand and swirls the therapist's finger in it and the child tries to make another shape on the therapist's hand. They laugh at the design it made (modeling)
8. The therapist puts another dot of lotion on the back of her hand and the child takes her other hand and swirls the therapist's finger in it and the child tries to make another shape on the therapist's hand. The therapist tells the child to keep swirling it until it disappears. "Cool, it's like magic!" (The child has now mastered a step and the therapist will progress to another step)
9. Video camera turned off

F. Play highly preferred activity with child and says good-bye to the child
G. Therapist meets with parent for a few minutes and leaves

experimenter stopped and presented an "easier" step. If only one type of negative response occurred, the experimenter remained on that step for another trial. If no rejections occurred, then the experimenter moved on to the next step in the hierarchy. At times, the experimenter remained on a step for two or three more sessions if that step was particularly difficult or qualitatively different from the previous step, or if the previous step had produced a lot negative responding. Throughout all sessions, the experimenter made every attempt to make sessions enjoyable for the child.

1.6.2. Sam

The products for Sam were suntan lotion, antibiotic cream, and baby lotion. Similar to Duke, the procedure included graduated exposure, modeling and contingent attention. Following baseline, the training phase was introduced on one product at a time. Since Sam had three target stimuli, probes for the remaining products were conducted periodically, with both the experimenter as well as the mother. When products were tolerated in an appropriate manner for the targeted stimulus, the next product was introduced, beginning with experimenter-conducted trials. No tokens or other visual prompts were used to indicate how many trials were remaining.

As with Duke, after each trial, some form of social attention was delivered. The child was never forced to complete any step. If two or more types of negative responses occurred, the experimenter stopped and returned to a previously mastered step. If only one type of negative response occurred, the experimenter remained on that step, if doing so seemed appropriate. If no negative responses occurred, then the experimenter moved on to the next step in the hierarchy. The experimenter stayed on a step for two or three more sessions if that step was particularly difficult or qualitatively different from the last step, or if the previous step had produced a lot negative responding. As with Duke, throughout all sessions, the experimenter made every attempt to make sessions fun for the child (Table 2).

Additionally, generalization probes were conducted for Sam. During pretreatment, the mother conducted trials at criterion Step 22 as did the experimenter. During treatment, the mother conducted trials at various steps within the exposure hierarchy. Finally, during post treatment, the mother presented the criterion step in the same manner as the experimenter. This procedure was followed for all three skin care products. The mother did not complete the full training package that included all steps and models. She did, however, provide social attention on those steps she probed and that Sam completed.

2. Results

Interobserver agreement on all measures of Sam's behavior Sam ranged between 75 and 100%. Baseline IOA for rejecting responses was 97%, for accepting responses was 91%, and for steps completed was 100%. Scores for rejecting responses in all treatment sessions scored ranged between 75 and 100%. Scores for positive responses in all treatment sessions scored ranged between 86 and 100%. IOA for steps completed during sessions was 100%.

2.1.1. Duke

The results for Duke are presented in Fig. 1. The upper graph displays Duke's progression through the hierarchy of steps shown on the ordinate and the trials conducted in each of the 10 sessions on the abscissa. White boxes depict presentation of a step that was not completed. Black boxes depict a step that was completed. An ''X'' depicts a step that was presented, dropped, and never returned to again. The lower graph shows the total number of rejecting responses for each session. The data point for each session appears above the session number on the lower graph.

Baseline consisted of the first two trials in the first session, during which the child cried, hid his hands and pulled away. Treatment began in Session 1 on Trial 3. In Trial 4, a criterion probe trial was conducted during which several rejection responses occurred. Trials 6 and 7 were attempts at Step 11. This step was too difficult for Duke. After the second attempt at this step (Trial 7), Step 3 was introduced. The experimenter remained at Step 4 (hand over hand prompting, child's hand on experimenter's, swirling lotion into a circle on the back of

experimenter's hand) for three trials (Trials 9, 10 and 11). This was done for two reasons. The first reason was that in the previous trial, the jump to Step 11 had been too big and he was not successful. It is important with graduated exposure that a history of successful contact with the stimuli be established. Furthermore, it was important that the procedures not be associated with aversive stimulation. The second reason was that during this step, it appeared that the child was having fun swirling the lotion and the experimenter determined that repeating this step would enhance future tolerance.

Moving on to Step 5 in Trial 12 entailed putting lotion on the back of the child's hand and counting to three, after which the experimenter wiped off the lotion with a tissue. This was the first successful direct skin contact with lotion. The experimenter remained at this step for three trials because it was deemed important to ensure continuing acceptance and to allow the child to succeed in repeatedly using lotion before the experimenter increased exposure.

In Session 2, the experimenter dropped a step from the hierarchy. Step 10 (using a piece of tissue roughly 2 in square to wipe off lotion after counting to five) was attempted in Trials 16 and 17 and dropped because it produced many rejecting responses during two presentations. The experimenter dropped back to Step 7 and ended the session there so that the child's last response was successful and included no rejecting responses.

In Session 3, Trials 19 and 20 were probes conducted at criterion and resulted in several rejecting responses. Treatment resumed with Step 7 on Trial 21. No rejecting responses occurred. The experimenter ended the session there so that the session ended with the child succeeding and an absence of rejecting responses.

Session 4 began with Step 8. This step resulted in more than one type of negative response, so the experimenter returned to Step 7. Step 8, was then presented again and there were no rejecting responses. In Step 9, two "failed" presentations involved only one type of rejecting response, so

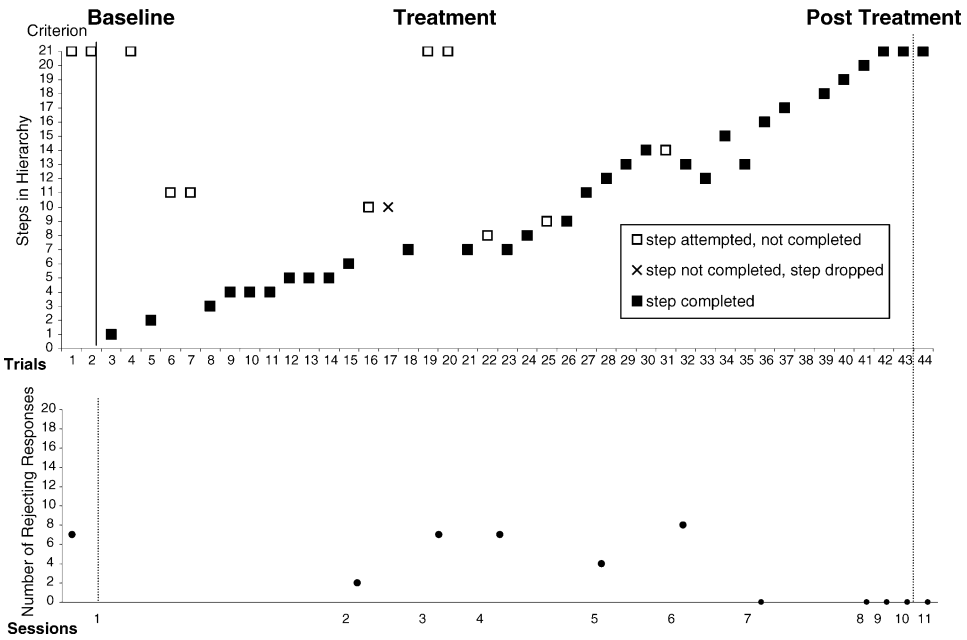

Fig. 1. Duke's progression of steps and rejecting responses.

the experimenter stayed at this step. The child succeeded in mastering the step on the third presentation and there were no rejecting responses.

Session 5, Trial 28 began with Step 11 which was one of the steps the child previously had trouble with. There were no rejecting responses, so the experimenter moved on through Steps 12 and 13. In Session 6, the experimenter proceeded to Step 14 in Trial 32. There were several rejecting responses so the experimenter returned to Step 13. Although this resulted in no rejecting responses and the experimenter could have returned to Step 14, she decided to move down one more to Step 12. Step 12 involved the experimenter rubbing in lotion on the back of her own hand simultaneously with the child. This was an attempt to avoid moving too quickly and to capitalize on modeling. Step 14 was not revisited but the behavior in Step 14 (putting lotion into the child's hand) was included in subsequent steps and accepted.

Session 7 started with Step 15, in which Duke not only rubbed the lotion into his hands, but also then applied it to his elbows at the experimenter's suggestion. There were no rejections from Session 7 on. The target behavior was achieved in 43 trials during nine treatment sessions. Five months later, Duke used lotion without protest on each of three post-treatment trials.

2.1.2. Sam

Figs. 2 and 3 show Sam's results in a multiple baseline across treatment targets. Fig. 2 shows the treatment steps to criterion for suntan lotion in the top panel, for antibiotic cream in the center

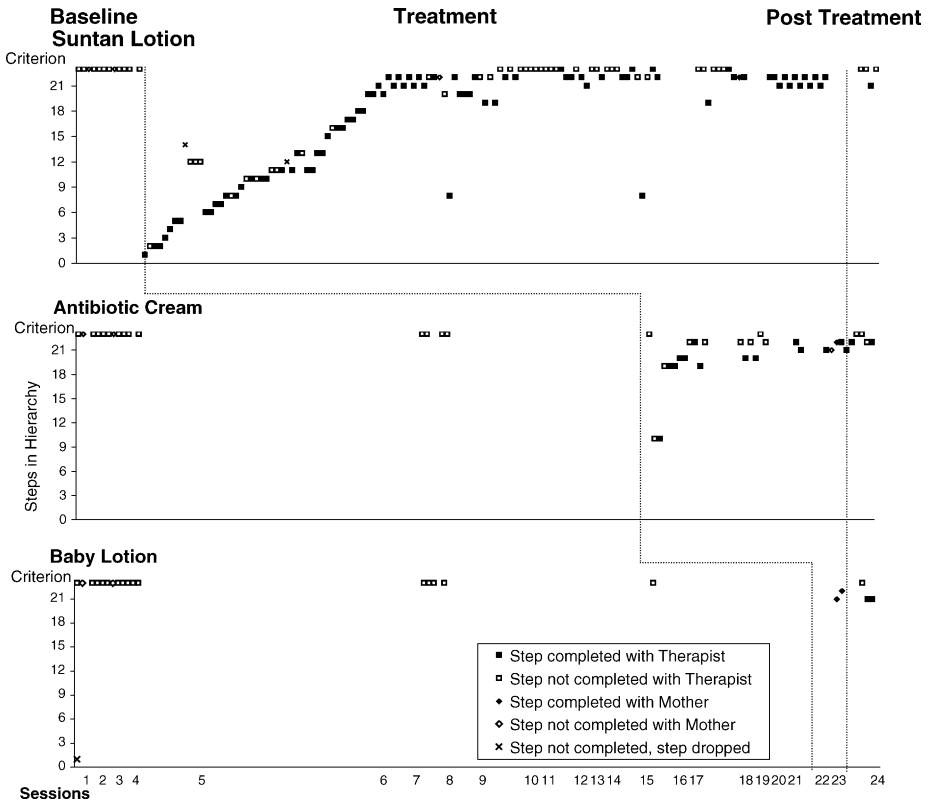

Fig. 2. Sam's progression of steps in hierarchy across three products.

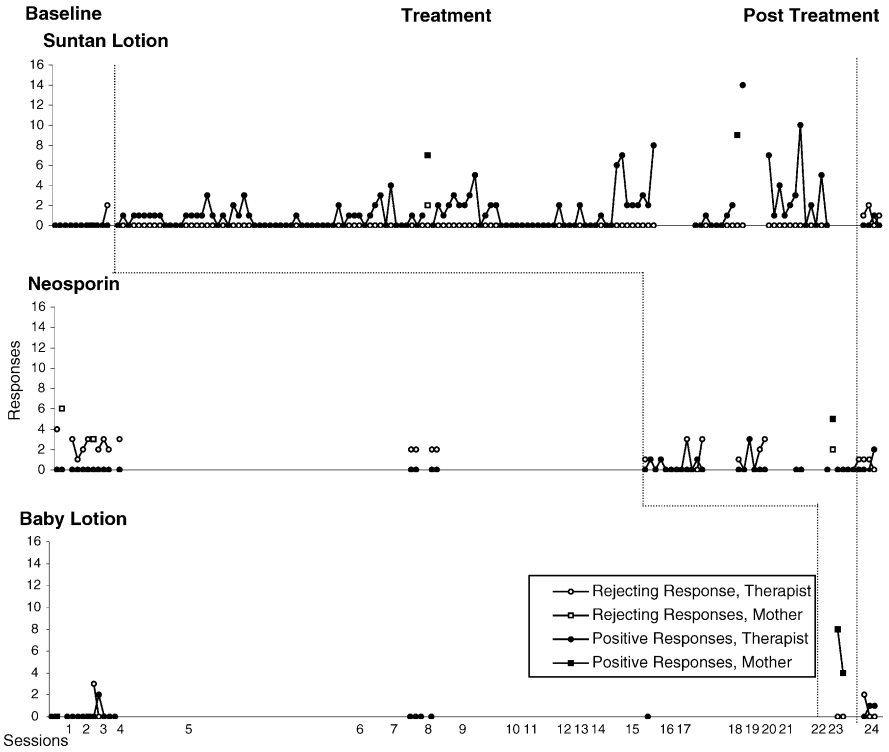

Fig. 3. Sam's accepting and rejecting responses across three products with mother and therapist.

panel and for baby lotion in the bottom panel. The comparable panels in Fig. 3 shows Sam's accepting and rejecting responses, respectively.

Baseline trials, conducted in the first four sessions, resulted in Sam's crying, throwing each product and pulling away from the setting. Open squares in Fig. 3 pretreatment baseline show Sam failed to achieve criterion (''Do you want some (product)?'') in all probes. Fig. 4 shows there were no accepting responses during pretreatment baseline and Fig. 5 shows a number of rejecting responses.

Treatment began in Session 4. The experimenter proceeded through the treatment hierarchy, as with Duke, again finding that gradual progression through the steps was necessary. The jump from Step 6 to Step 12 in Session 4 resulted in failure to achieve Step 12 as well as an increase in the frequency of rejecting responses. Sam progressed steadily through the steps until reaching Step 21 in Session 6. The experimenter remained at Steps 21 and 22 from Session 6 on because the child did not say ''yes'' when asked if he wanted suntan lotion. Although he said ''no'' more than half of those trials, he tolerated application of lotion and emitted accepting responses of various kinds. It should be noted that Sessions 2 through 6 were conducted in the child's bedroom. Session 7 probed for generalization outdoors by the pool. All trials in Sessions 8, 10, 11 and 17 were conducted at Sam's preschool and Sessions 9, 12–16, 18–20 and were conducted at his home in the living room.

The bottom two panels of Fig. 2 show that Sam failed to meet criterion Step 22 in all baseline trials and that probes conducted during Sessions 7 and 8 also resulted in failure to meet criterion

Step 22. However, when treatment using antibiotic cream began in Session 14 (middle panel), Sam mastered Step 9 in two trials and quickly progressed to Step 21, whereupon he responded as he did with respect to suntan lotion.

A probe of Sam's responses to the final target product, baby lotion, occurred in Session 15, showing failure to master criterion Step 22. Treatment for baby lotion began in Session 23, when Sam was reliably achieving Step 21 for antibiotic cream. The experimenter started training for baby lotion at Step 20, which was achieved in one trial and followed by success at Step 21 on the next trial.

Sam failed to achieve Step 22 in 2 of 3 post-treatment trials with suntan lotion but did show mastery when the experimenter tested his response to Step 20. Post-treatment responses to antibiotic cream failed at Step 22 and at Step 21 and then succeeded at Step 21 in the last trial. Post-treatment responses to baby lotion were similar to Sam's responses to antibiotic cream and suntan lotion.

Fig. 4 shows that rejecting responses were at 0 with the therapist in the last two treatment sessions and appeared infrequently during post treatment. On the contrary, accepting responses with the therapist and the mother (seen in Fig. 5) increased steadily during all treatment phases. They remained at low levels during post-treatment.

2.2. Social validity

Both parents reported that the goal and method of this treatment was ''very important'' (5 points) and they were both ''very satisfied'' (5 points) with the method and outcome. They both reported that their children are now able to be outdoors without health risks because they are able to tolerate the application of suntan lotion, thereby reducing the threat of sunburn and skin damage.

Duke's mother reported that acquiring this new skill allowed her son to experience new things. She stated that the decreased frequency and intensity of tantrums associated with application of skin products had improved their relationship. She suggested that future research expand the variety of products to be tolerated, and the treatment extended to different settings.

Sam's mother reported that her son's time outdoors playing with friends or swimming, is no longer severely limited. His parents can now apply an antibiotic cream to scrapes, which until this treatment, were easily infected. She reported that the family can now have more time to have fun instead of the parents ''fighting with (Sam) over the protection he needs''. She had no suggestions for future improvements to the procedure. She added that the treatment never placed Sam in a situation that upset him and the parents ''saw *very* quick results.

3. Discussion

The results of this study show that graduated exposure together with modeling and contingent social attention were successful in teaching tolerance of skin products for Duke and Sam. Not only did the children tolerate application of these products, but verbal and nonverbal accepting responses increased in frequency while rejecting responses decreased in frequency. For Duke, his mother reported 3 years later that he still had no problems with lotion or similar tactile stimuli. Follow up with Sam a month after post-treatment trials found that he was still tolerating the products. Long-term effects seem to be promising, although the small number of individuals treated limits conclusions regarding generality. Results of this study support previous studies showing the usefulness of in vivo desensitization, with modeling, to reduce fearful responding in children.

The findings reported here contribute to a meager supply of experimental research on the treatment of avoidance responses of children with autism to tactile stimuli. Avoidance and fearful responses interfere with socialization and they can affect children's health. If typical children at school include a child with autism in making mud pies, or going to an outdoor pool, the child with autism can participate only if his avoidance behavior can be successfully treated. As a result of participation in new activities and environments, opportunities may develop to expand the number and types of environments encountered by the child, thereby increasing events that function as reinforcers and new responses (Rosales-Ruiz & Baer, 1997). For example, making mud pies, going swimming outside, going on field trips, going for bike rides, and participating in a variety of other activities with peers seemed more likely to occur. Measurement, however, is necessary in order to demonstrate the relationship between successful intervention and increases in activities related to the type of tactile stimuli. Beyond the verbal reports of the parents, this study did not measure engagement in collateral activities outside of treatment.

A question arises as to whether these children were initially avoiding the application of lotion or whether the rejecting responses were serving some other function. An analysis may have been helpful in identifying the function of the avoidance behaviors, but the children did not exhibit avoidance behaviors under any other conditions and they engaged in appropriate responses to get attention and to escape demand in other circumstances. Furthermore, there are ethical concerns with using a functional analysis with this type of behavior. Repeated trials in the presence of a stimulus that provokes such fearful responding would be quite upsetting to the children, as well as to their parents and the experimenters. However, conducting a functional analysis may be helpful in those cases where a benign treatment, such as the one used herein, proves ineffective. It would also be helpful to collect data regarding other types of responses such as compliance to instructions and mands for attention in order to identify the function of the responses.

Another topic that bears consideration is the experimenter's minor adaptations of the treatment to the responses of each child as treatment progressed. The use of modeling varied throughout the course of treatment and decisions to change or stay on particular steps were based on the procedures outlined here as well as the experimenter's previous experience with these and other children. Perhaps future investigations will develop more standardized decision rules.

The cost to benefit ratio for this treatment is quite favorable. The risks to these children were very low. Safeguards and general concern for the children were ongoing. If at any time fearful responding was intense, the experimenter stopped what she was doing. In addition, much expensive professional time can be saved if parents, like Sam's mother, become active participants in their child's treatment. The benefits of this study far outweighed the costs.

This study utilized a treatment package. Conducting a component analysis may be necessary to determine the contributions of each component of the package. It is not clear if all components of the package were necessary or whether any component would be effective by itself in producing these results. Graduated exposure may be necessary, but modeling and praise and access to preferred toys may also be necessary and may make the process more enjoyable for the child. Having a treatment that is not only effective, but also enjoyable is an important consideration (van Dyck & Spinhoven, 1997).

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