Effect of Behavioral Activation Treatment on Fibromyalgia-Related Pain Anxiety Cognition

Duane A. Lundervold, Chris Talley & Michael Buermann

Abstract

Effects of Behavioral Activation Treatment (BAT) on pain anxiety, depression, and pain interference on a 43-year-old female with an 11-year history of chronic fibromyalgia pain are described. Analgesic, anxyiolytic, and antidepressant medications were stabilized prior to participation. Dependent measures were the Behavioral Relaxation Scale, a direct observation measure of relaxed behavior, and self-report measures of depression, pain anxiety and pain interference. A within session pre-post training assessment, embedded in a multiple-baseline-across-relaxed-positions single-subject experimental design, was used. BAT, based on the matching law, was comprised of behavioral relaxation training (BRT), activity-relaxation cycles, engaging in valued activities, and visual feedback of functioning. BRT resulted in an immediate increase in reclined relaxed behaviors with generalization to the upright relaxed position. A 100% improvement from baseline pain interference ratings was obtained following BAT. All four dimensions of pain anxiety declined to normative levels following BAT. Pain anxiety cognition declined without direct intervention. Depression declined to normative levels. Medication usage decreased from beginning to end-of-intervention but rose at follow up. Results were maintained at three-month follow up. Pain anxiety cognition was conceptualized verbal behavior that functioned as an establishing operation (EO) affecting consequences of overt and visceral (emotional) pain behavior. Altering contingencies related to overt healthy behavior delimits the effectiveness of the EO. Further research on BAT and pain anxiety cognition EOs is needed with chronic pain patients with fibromyalgia.
Keywords: Behavioral Relaxation Training (BRT), fibromyalgia, chronic pain patients. pain anxiety.

Introduction

Fibromyalgia (FM) is a rheumatic disorder characterized by a constellation of physical symptoms including chronic, diffuse musculoskeletal pain, “tender points” at various bodily locations, fatigue and sleep disturbance (Wolfe, Smythe, Yunus, et al., 1990). Behavioral complaints include depression, memory deficits and “fibro fog” (Baumstark & Buckelew, 1992). According to White, Speechley, Harth, and Ostbye (1995), FM is one of the most common disorders treated in rheumatology clinics in North America. It is estimated that 5% of women and 1.6% of men suffer from FM (White, Speechley, Harth, & Ostbye, 1999). In addition, FM patients are high utilizers of health care (Bombardier & Buchwald, 1996; Penrod et al., 2004). Unfortunately, there is no definitive physical pathology regarding FM; however, evidence suggests a number of physiological mechanisms including dysregulated pain modulation within the central nervous system, alteration of brainwave patterns affecting sleep, and a hyperalgesic response to nociception (Kosek, Ekholm & Hannson, 1996; Okifuji, Turk, & Marcus, 1999). Environmental causes of altered physiologic function include flu-like illness, physical trauma, for example, automobile accident, or emotional distress (Clauw & Chrousos, 1997; Turk, Okifuji, Starz, & Sinclair, 1996). Stress has been reported to exacerbate FM symptoms. Dysregulation of the autonomic nervous system and hypothalamic-pituitary-adrenal axis has been reported (Crofford, Engleberg, & Demitrack, 1996; Bennett, Clark, Campbell & Burckhardt, 1992).

Current psychological conceptualizations of chronic pain include consideration of bioenvironmental variables and their effect on motor, emotional, verbal behavior of pain patients and their social relationships. At present, there is no definitive psychological intervention for FM. Current research indicates that cognitive behavioral and “pure” operant procedures are effective in decreasing pain and disability (Rossy, Buckelew, Dorr et al., 1999; Thieme, Gromnica-Ihle, & Flor, 2003). Further research is needed in this area.

Fordyce's (1976; 2000) pioneering work was instrumental in the development and evaluation of effective behavior analytic treatment programs for chronic low back pain (Sanders, 2003; Turner & Clancy, 1988; Tuner, Clancy, McQuade, & Cardenas, 1990; Thieme, Gromnica-Ehl & Flor, 2003). Nonetheless, it has been argued that intervention targeting only overt behavior is inadequate. Turk and Okifuji (1997) reported that physical, cognitive and affective factors explained more variance in pain behavior and disability than did environmental (operant) factors. However, their results were based entirely on patient self-report. Nonetheless, greater emphasis has been placed on cognitive factors related to pain treatment models, emphasizing the need for cognitive restructuring. (See Turk & Gatchel, 2002).

Pain anxiety has been found to accompany chronic pain and influence treatment outcomes (McCracken & Gross, 1998). Pain anxiety is a complex response class comprised of fear (emotional response), cognition (verbal behavior), physiological anxiety (sensations), and escape/avoidance behavior (McCracken, Zaylor & Gross, 1992). These behaviors have both respondent and operant functions (Davey, 1997; Kehoe & Macrae, 1998; Morgan & Riccio, 1998; Pear, 2001; Schwartz, Wasserman, & Robbins, 2002). The operant aspects of pain anxiety cognition may include: discriminative, motivational, reinforcing and aversive functions (Malott, 1989; Malott & Garcia, 1991). As a discriminative function, verbal behavior may serve as a contingency specifying stimulus or a rule setting the occasion for the occurrence of overt behavior (Poppen, 1989; Skinner, 1969). As an establishing operation (EO), the VB alters the relative strength of consequences affecting learning and performance related to a specific behavior. For example, the verbal response "My pain will get worse if I sweep the floor" will increase the relative strength of the negative reinforcer (nociception) for avoidance behavior (recumbent behavior). Cognitive restructuring interventions for pain management attempt to change the evocative influence of pain anxiety cognition as a covert EO. In contrast, behavior analytic interventions for pain management rearrange contingencies to activate and reinforce healthy overt behavior and teach overt pain management skills. Doing so alters the relative density of reinforcement for two concurrent operant response classes: adaptive, healthy behavior and maladaptive pain behavior. Behavioral Activation Treatment (BAT), based on the matching law, applied to depressed populations has been found to increase the frequency of targeted adaptive overt behavior and decrease non-targeted covert dysfunctional cognition (Jacobson et al 1996; Hopko, Lejuez, Ruggier., & Eifert, 2003; Hopko, Lejuez, & Hopko 2004). Given the similarities between depression and chronic pain, a purely behavior analytic intervention would seem to have merit. The purpose of this pilot study was to examine the effect of BAT on pain anxiety cognition with a fibromyalgia chronic pain patient.

Method

Participant

ZB, a 43-year-old female, with an 11-year history of chronic pain, received treatment. ZB was married and receiving disability payments due to chronic pain. Medical diagnoses included fibromyalgia, post-traumatic migraine headache, essential tremor, and sub-clinical irritable bowel syndrome. DSM-IV-TR diagnoses included major depression, pain disorder, and social anxiety. ZB was severely depressed (Geriatric Depression Scale-15 score = 14). In 1993, ZB suffered a rear-end automobile collision and subsequently developed neuromuscular and neurological symptoms. Depression pre-dated the collision but was exacerbated by the event. Neurosurgery was performed in 1996 to fuse cervical vertebrae and remove cranial bone and dura mater in the occipitalis area. Migraine headache frequency lessened following surgery but still occurred once per week for approximately 48 hours per episode. Current medication regimen was Vicodin 375 mg twice per day; Ibuprofen 800 mg four to six times a day, and Xanex 10 mg prn. Abortive migraine headache medication had been discontinued due to lack of benefit. Based on medical records, no medication changes had occurred for two months prior to taking part. Informed consent and consent to release of information was obtained prior to assessment and intervention.

Dependent variables

Pain interference rating (PIR). A 10 cm visual analogue scale (VAS) was used to measure pain interference each day. VAS measures of pain are recommended for use with younger adults and are valid, reliable and sensitive to treatment effects (Jensen, Turner, Romano, & Fisher, 1999; Turner, 1982).

Geriatric Depression Scale 15 (GDS-15). Self-reported depression was assessed using the GDS-15. It has been suggested that the GDS-15 be used when assessing depression with comorbid medical conditions. GDS-15 has been validated with younger adults and found to be strongly correlated with the original GDS-Long Form (Ferraro & Chelminski, 1996; Lesher & Berryhill, 1994; Meara, Mitchelmore, & Hobson, 1999). A cut off score of ≥ 6 suggests major depression.

Behavioral Relaxation Scale (BRS). The BRS is an objective, quantitative measure of relaxed behavior that employs a partial-interval direct observation measurement procedure (Poppen, 1998). Ten behaviors are observed and scored as relaxed or unrelaxed during successive one minute intervals. During the first 30 seconds of each interval, number of breaths is observed and recorded; during the next 15-seconds the remaining nine behaviors are observed and during the final 15-seconds the behaviors are recorded. Percent relaxed behavior is obtained by dividing the number of relaxed behaviors by the total number of observations multiplied by 100. The BRS has been found to be a reliable and valid measure of relaxed behavior, associated with reduced electromyographic activity, decreased motor disability, and increases in relaxation states of Physical Relaxation, Joy, Mental Quiet, Peace and Disengagement (Lundervold & Poppen, 2004; Poppen, 1998; Poppen & Schilling, 1983; Riefesel, Buermann, Talley, & Lundervold, 2005; Smith, 2001).

Pain Anxiety Symptom Questionnaire (PASS). The 40-item PASS (McCracken, Zaylor & Gross, 1992) was used to assess four domains of pain related anxiety: fear (F), escape/avoidance (E/A), cognition (C), and physiological (P). A six-item Likert scale is used to rate the magnitude of pain anxiety. The PASS has good reliability and validity with preliminary normative data with chronic pain patients.

Medication index (MI). Following the procedure described by Blanchard and Andrasik (1985), an MI score was calculated based on daily self-recording of type and dosing schedule of medication. An average daily MI was calculated by summing the products of the number of doses of a drug multiplied by its potency scale value.

Experimental Design

In certain conditions, an extended baseline phase may be inappropriate when the participant does not have the skill in the repertoire or there is no opportunity to respond (Cuvo, 1978). A third condition for delimiting baseline length is risk or immediate need for treatment. Severe depression meets condition number three. Given these conditions, we employed a mixed single subject research design comprised of a repeated pre-post training assessment design and non-concurrent multiple baseline design across relaxed positions to evaluate the immediate effect of intervention and assess generalization of relaxed behavior to the upright position (Bloom, Fisher, & Orme, 2006; Watson & Workman, 1981).

Step-like change in the dependent variable from pre- to post-training within and between sessions suggests a functional relation between dependent and independent variable. A primary limitation of the repeated pre-post training design is limited number of true baseline observations. By including time lagged observation of behavior across relaxed positions (reclined, upright), this weakness was lessened and allowed assessment of generalization.

Procedure

Diagnostic and Behavioral Interview A rationale for multimodal assessment was provided. Two sessions were devoted to interview assessment. A semi-structured diagnostic interview was conducted by the first author (DAL) was followed by a structured chronic pain behavioral interview. Self-report questionnaires for depression and pain anxiety were completed. ZB also received instruction in recording pain interference, behavioral activities and medication.

Pre-training assessment At the second session, baseline assessment of relaxed behaviors occurred. A five-minute adaptation condition was conducted prior to assessment of relaxed behaviors in the reclined position and ZB was then instructed to “relax on her own”. A 5-minute pre-training observation of relaxed behavior was conducted. In later sessions, observation of both reclined and upright relaxation was conducted.

Behavioral Activation Treatment (BAT) BAT, a treatment package based on the matching law (Herrnstein, 1961), is a comprised of Behavioral Relaxation Training (BRT), visual feedback (i.e., graphical depiction of performance data), shaping performance of valued behavioral activities, and praise. BAT aims to increase the relative ratio of reinforcement for healthy, overt behavior while concurrently decreasing the density of reinforcement for unhealthy behavior (Noll, 1995). For example, engaging in relaxed behavior decreases the aversive experience of pain (i.e., increased density of negative reinforcement for healthy behavior). Through identification and scheduling of valued behavioral activities, the ratio of positively reinforcing events is increased. Activity-relaxation cycles also were employed to maintain a dense schedule of negative reinforcement and prevent over-activity. Visual performance feedback was provided each session in relation to PIR, depression and BRS scores. No visual feedback was provided for pain anxiety. No direct cognitive restructuring was conducted (Turk, Meichenbaum, & Genest, 1983).

In the first treatment session, a biobehavioral conceptualization of chronic pain was provided, describing gate control theory (Melzak & Wall, 1965; Melzack, 1999), deconditioning, loss of valued activities, and their relationship to mood. Similarly, emphasis was placed on self-management of pain rather than its elimination. BRT was presented as a means to “close the pain gate,” a self-management procedure to be employed as needed and as a means to improve quality of life. BRT was trained according to Poppen (1998) with each BRT session lasting approximately 15-20 minutes. Immediately after BRT a post-training assessment was conducted in the same manner as the pre-training assessment. Upon completion of the post-training assessment, other components of BAT were implemented. Both reclined and upright BRT were eventually trained in the same session. Twelve sessions of reclined and upright BRT were provided.

Increasing contact with valued activities also was described in the context of improving quality of life and mood. An expectation of treatment benefit regarding decreased pain interference and improved depression was presented. No expectation regarding change in pain anxiety was presented. To increase behavioral activation, the Valued Behavioral Activity Checklist was completed and rank ordered from 1-15 (easy to difficult to complete). Initially, homework for behavioral activation targeted the easiest tasks. After successful mastery of those activities and managing pain, the next set of five activities was introduced. Homework consisted of engaging in BRT every two hours, activity-relaxation cycles, recording performance of assigned valued behavioral activities, daily rating of PIR and medication usage.

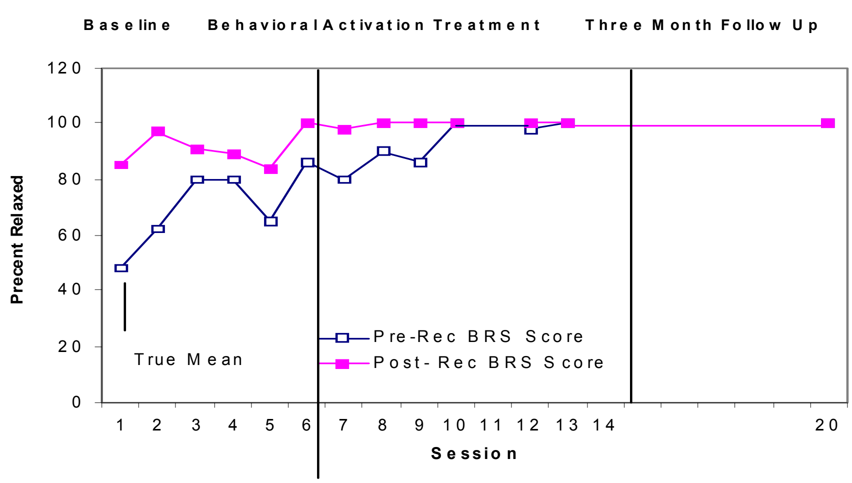
Post training assessment At the end of instruction in BRT, a 5-minute post-training assessment was conducted. ZB was instructed to “relax on your own” and direct observation of relaxed behaviors was conducted as in pre-training assessment.

Follow up A three month follow was conducted. Assessment of reclined and upright relaxed behavior, daily PIR, depression and pain anxiety were obtained.

Results

Independent observers assessed reliability of BRS observations on 28% of observations of relaxed behavior (range 74%-90%; mean 84%). Reliability was calculated by dividing the number of agreements by the number of agreements and disagreements multiplied by 100.

Reclined BRS scores systematically improved following training. (See Figure 1). At the initial pre-training assessment (true baseline) reclined BRS was 48 % relaxed. Following reclined BRT an immediate increase in the post-training assessment BRS score (82%) was observed. Systematic step-like increases from pre- to post-training assessments within and between sessions was observed, lending support to the interpretation that change in BRS scores were functionally related to the intervention. Baseline assessment of upright relaxation indicated generalization from reclined to upright position, though suboptimal optimal performance (70% relaxed). With implementation of upright BRT, performance increased above baseline. While rate of acquisition was slower, step-like changes in pre-post-training assessment BRS scores were again observed. Relaxation skills were maintained at follow up (86% upright; 100% reclined).



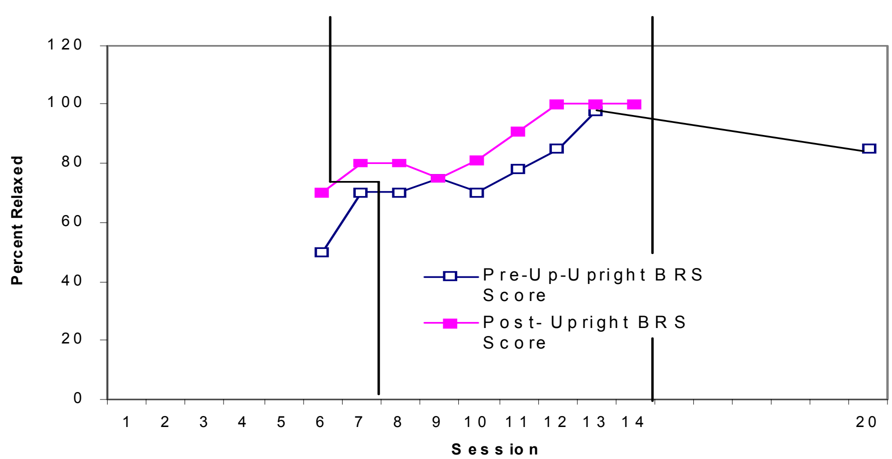


Figure 1: Percent relaxed behavior in reclined and upright positions.

Figure 2 displays pain anxiety (PASS) scores. As can be seen, C and P were significantly elevated at baseline with E/A and F much less so. Following intervention P scores immediately dropped and continued to do so throughout BAT. Meaningful change in E/A and F occurred by the third BAT session with increasingly lower scores being obtained at nearly each session. The course of change for C corresponded most closely to E/A. Significant change in C occurred by the fourth session of BAT with further significant decreases occurring over the last four sessions. By the end of intervention, all pain anxiety scores were within normative levels for chronic pain patients (McCracken et al., 1992). Further decline in pain anxiety scores occurred at follow up.

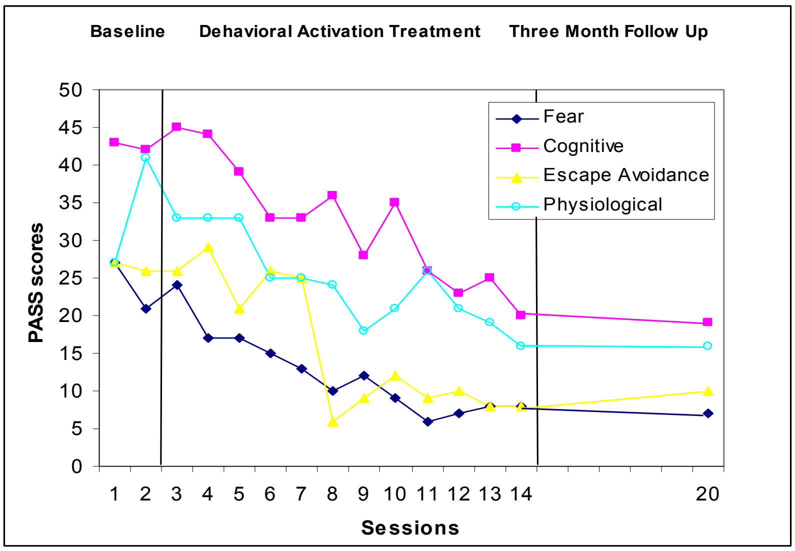


Figure 2: PASS subscale scores across phases.

PIR improved more than 100% from baseline levels (baseline mean = 6.4; end of treatment (last five observations = 2.08). (See Figure 3). Gradual improvement in PIR ratings occurred following exacerbation in pain due to migraine during the first nine days of intervention. Consistent improvement in PIR continued following this initial disruption. Results were maintained three months post intervention. Related to PIR is medication usage. MI was calculated based on week of data collected prior to implementation of BAT. Baseline, end-of-intervention, and follow up MI scores were 10.71, 8.42, and 20.1. Medication regimen was changed between end-of-intervention and follow up.

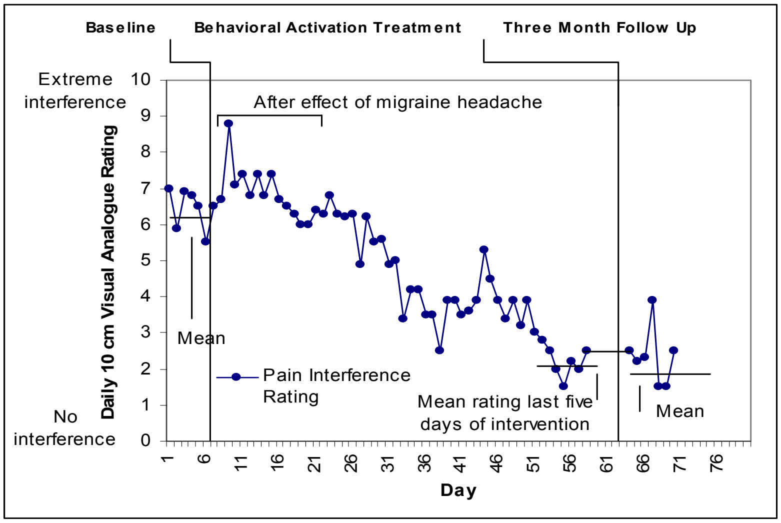


Figure 3: Daily pain interference rating (PIR) across phases.

Two consecutive baseline measures of depression using the GDS-15 were obtained with near maximal scores obtained on each observation. (See Figure 4). A slight decline in GDS-15 score immediately occurred following the first session of BAT. Larger systematic decrements in ratings of depression occurred over the course of intervention. The last four self-ratings of depression were within normal limits. Results were maintained at follow up.

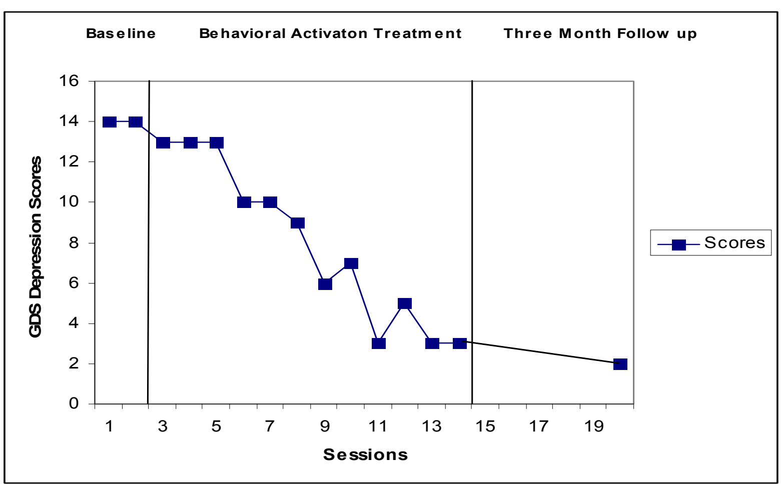


Figure 4: GDS-15 score across phases.

Discussion

A behavior analytic pain management intervention based on the matching law (Herrnstein, 1961) was found effective in decreasing pain anxiety cognition, pain interference, and depression. BAT targeted overt behavior with the aim of altering the relative ratio of reinforcement for healthy behavior versus unhealthy pain behavior. Pain anxiety cognition changed without direct cognitive restructuring intervention. Medication usage also declined from baseline levels. Unfortunately, a change in medication after end-of-intervention confounds interpretation of follow up results. Data reported are consistent with Hopko et al (2004) and Jacobson and colleagues (Jacobson et al., 1996) who reported BAT for depression was effective in altering dysfunctional depressive verbal behavior without direct intervention. Inspection of Figure 2 indicates that pain anxiety cognition covaried most closely with escape/avoidance behavior. These data lend support to the analysis that pain anxiety verbal behavior is an EO for pain avoidance behavior. Through direct contact with the contingencies the relative evocative strength of pain anxiety verbal behavior as an EO diminishes. While the matching law provided the theoretical basis for BAT, no direct assessment of response or reinforcement rate was obtained. Furthermore, the matching law was applied to response classes of differing topography and contingencies. Research is needed to systematically assess reinforcement rates for healthy behavior and pain behavior as they relate to applications of the matching law and BAT. Lack of a structured psychiatric diagnostic interview and reliability of diagnosis is problematic. While not a primary concern among behavior analysts, reliable psychiatric diagnosis is important among other behavioral health disciplines. Results of this pilot study are encouraging but further research using more rigorous assessment procedures and experimental designs is needed. Immediate step-like change in BRS scores suggests that BRT was responsible for change in relaxed behavior. Concurrent observation of upright relaxed behavior did not occur with all reclined observations; however, when observations were conducted concurrently upright BRS scores were stable and systematically increased following BRT in the upright position. Clinically meaningful decreases in PIR only occurred after implementation of upright BRT.

Few studies have assessed or reported generalization of relaxed behavior (Poppen, Hanson & Ip, 1988). In part, this may be due to the lack of objective measures of relaxed behavior or simple failure to assess generalization. From this perspective, the obtained results are important. The high degree of generalization in upright relaxed behavior may be due to the brief duration between pre-post observation intervals for reclined relaxed behavior. While significant generalization occurred performance was sub optimal. With implementation of upright BRT, substantial improvement in upright relaxed behavior occurred.

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