Effect of Behavioral Activation Treatment on Chronic Fibromyalgia Pain: Replication and Extension

Duane A. Lundervold, Chris Talley & Michael Buermann

Abstract

A multiple-baseline-across two behavior sets and positions (reclined, upright) was used to experimentally examine the effect of Behavioral Activation Treatment for Pain (BAT-P) on pain-related behavior of a 44-year-old woman with a 22-year history of fibromyalgia (FM). BAT-P, based on the matching law, is comprised of Behavioral Relaxation Training (BRT), scheduled relaxation-activity cycles, daily relaxation practice, shaping performance of valued activities, visual feedback of performance and descriptive praise. Visual feedback was provided for pain interference rating, performance of relaxation skills, and self-rated depression. A behavioral contract was implemented to increase maintenance of intervention effects. Percent-relaxed behavior was functionally related to BRT with limited generalization from reclined to upright positions or across behavior sets. BAT-P resulted in clinically significant decreases in self-reported pain interference, pain anxiety, and depression and medication usage. Pain anxiety cognition declined without direct cognitive restructuring. Results were maintained at three- and six-month follow up. Findings replicate results of BAT-P for FM pain interference and pain anxiety cognition. Use of systematic maintenance procedures extends past research on BAT-P. Results provide further support for the utility of "pure" behavior analytic interventions for FM and the benefit of such procedures for pain anxiety cognition.
Keywords: Behavioral Activation Treatment for Pain (BAT-P), Fibromyalgia (FM), Behavioral Relaxation Training (BRT)

Fibromyalgia (FM), one of the most common disorders treated in rheumatology clinics in North America, consists of numerous physical symptoms including chronic, diffuse musculoskeletal pain, "tender points" at various bodily locations, fatigue and sleep disturbance (Wolfe, Smythe, Yunus, et al., 1990). Depression, memory deficits and confusion are often reported (Baumstark & Buckelew, 1992). Over three times as many women suffer from FM than men (White, Speechley, Harth, & Ostbye, 1999).

Etiology of FM is unclear; however, physiological mechanisms including dysregulated pain modulation within the central nervous system, alteration of brainwave patterns affecting sleep, and a hyperalgesic response to nociception have been implicated (Kosek, Ekholm & Hannson, 1996; Okifuji, Turk, & Marcus, 1999). Dysregulation of the autonomic nervous system stress hormone regulatory system has also been reported (Crofford, Engleberg, & Demitrack, 1996; Bennett, Clark, Campbell & Burckhardt, 1992). Environmental insults such as flu-like illness, physical trauma, stress, and emotional distress also have been linked to the onset of FM (Clauw & Chrousos, 1997; Turk, Okifuji, Starz, & Sinclair, 1996).

At present, there is no definitive medical or psychological intervention for FM. "Pure" behavior analytic and cognitive behavioral interventions have been shown to be effective in decreasing pain and disability (Rossy, Buckelew, Dorr et al., 1999; Thieme, Gromnica-Ihle, & Flor, 2003). Despite demonstrated effectiveness of operant conditioning interventions for chronic pain, (Fordyce, 1976; 2000; Sanders, 2003) it has been argued that cognitive behavioral intervention is necessary. According to Turk and Okifuji (1997), physical, cognitive and affective factors explain more variance in pain behavior and disability than do environmental (operant) factors. Unfortunately, results were based entirely on patient self-report. Pain-related fear has been found to be one of the most important predictors of chronic pain and associated disability among chronic pain patients (Vlaeyye & Linton, 2000).

Pain anxiety is comprised of four components: cognition, fear, escape/avoidance and physiological sensations (McCracken & Gross, 1992). From a behavior analytic perspective, pain anxiety cognition (e.g., catastrophic thinking) is verbal behavior that has discriminative or evocative functions (Malott, 1989; Malott & Garcia, 1991). Discriminative functions serve as a contingency specifying stimulus or a rule setting the occasion for behavior (Poppen, 1989; Skinner, 1969). As an establishing operation (EO), the verbal behavior alters the strength of consequences affecting pain behavior. For example, "My pain will get worse if I sweep the floor" increases the relative strength of the negative reinforcer (nociception) for avoidance behavior (recumbent behavior). The function of rule-governed behavior is most closely associated with depression and cognitive therapy (Beck, 1979). Chronic pain and depression share similar response characteristics in that each is clinically defined as a covert behavior, verbal behavior (e.g., pain anxiety cognition, catastrophic thinking in depression) is seen as the central feature affecting treatment outcome, with behavioral avoidance secondarily involved (Beck 1979; McCracken et al., 1998; Turk & Okifuji, 1997). Importance of overt behavioral performance (i.e., behavioral activation) is minimized.

A series of case studies and randomized controlled trials have demonstrated that Behavioral Activation Treatment for Depression (BAT-D), based on the matching law (Herrnstein, 1961; Noll, 1995), is effective in the treating depression (Hopko, Lejuez, Ruggier, & Eifert, 2003; Hopko, Lejuez, & Hopko 2004). Using BAT-D, overt behaviors targeted for intervention increase in frequency while the frequency of non-targeted covert dysfunctional verbal behavior decreases. The goal of BAT-D is to have patients make contact with valued activities and life goals. BAT-D can be discriminated from merely attempting to increase pleasant events based on two critical features: (a) idiographic (functional) assessment of valued activities and goals that serve as reinforcers for behavioral action, and (b) direct intervention for decreasing behavioral avoidance.

Because of the similarities between depression and chronic pain, a behavior analytic intervention based on BAT principles may be especially valuable (Hopko et al., 2003). Lundervold, Talley and Buermann (2006), employed BAT for pain (BAT-P) with a 43-year-old woman with an extensive history of chronic FM pain. BAT-P resulted in decreased pain interference, depression and pain anxiety cognition. Pain anxiety cognition declined without direct intervention. Medication usage also declined from baseline to end-of-treatment but rose again at three-month follow up. Results of BAT-P replicated findings change in depression and cognition following BAT (Hopko et al., 2003) and behavior analytic interventions for FM (Thieme et al., 2003). Unfortunately, a clear functional relationship between BAT-P and pain-related dependent variables was not demonstrated due to experimental design limitations. The purpose of the present investigation was to: (a) replicate the effect of BAT-P for FM pain, and (b) extend past research through systematic use of a behavioral contract for maintenance of pain management skills.

Method

Participant

Janet was 44-years-old, Caucasian, employed, and married. She had an extensive history of chronic pain including FM, lower and upper back, and migraine and abdominal pain. (See Table 1). She was a frequent user of anxyiolytic, antidepressant, analgesic and narcotic pain medications. Five years earlier Janet took received surgery to fuse her cervical vertebrae. Current lower back pain complaints were due to bulging disks secondary to congenital degeneration of the spine and vertebrae.

Dependent variables

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) to record occurrence of 10 behaviors during successive one-minute intervals. During the first 30-seconds of each interval, number of breaths is observed and recorded; in the next 15-seconds the remaining nine behaviors are observed and then recorded in the final 15-seconds. 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 and decreased motor disability (Lundervold & Poppen, 2004; Poppen, 1998; Schilling & Poppen, 1983).

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).

Geriatric Depression Scale 15 (GDS-15). Self-reported depression was assessed using the GDS-15. The GDS-15 is suggested when assessing depression with comorbid medical conditions. GDS-15 has been validated with younger adults and is strongly correlated with the original GDS-Long Form (Ferraro & Chelminski, 1996; Lesher & Berryhill, 1994). A cut off score of > 6 suggests major depression.

Pain Anxiety Symptom Questionnaire (PASS). The 40-item PASS (McCracken & Gross, 1992) was used to assess pain anxiety: fear (F), escape/avoidance (E/A), cognition (C), and physiological (P). A six-point Likert scale was 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). The MI score was calculated based on daily self-recording of type and dosing schedule of medication (Blanchard & Andrasik; 1985). Mean daily MI was calculated by summing the products of the number of doses of a drug multiplied by its potency scale value divided by the total number of doses per day.

Experimental design

A multiple-baseline-design-across behavior sets and positions (reclined, upright) was used to demonstrate a functional relationship between BAT-P and dependent variables (Bloom, Fischer & Orme, 2006). Two behavior sets, comprised of five behaviors each, for reclined and upright positions, respectively, were formed following baseline observation. Behavioral Relaxation Training (BRT) was first implemented in the reclined position for Behavior Set 1 with time-lagged implementation for Behavior Set 2, followed by upright BRT for Behavior Set 1 and 2.

Procedure

A 1 (baseline 1). Four baseline observations of reclined relaxed behavior were conducted. Consent to take part and release of information was obtained. One observation of upright relaxed behavior was conducted (session 4). During each of these sessions self-report measures of pain anxiety and depression were obtained. A rationale for multimodal behavioral assessment was provided. Self-report questionnaires for depression and pain anxiety were completed. A structured chronic pain behavioral interview was conducted. A five-minute adaptation period for observation was conducted (session one only) followed by a five-minute observation of relaxed behavior. Behavioral skill training was used to teach Janet to record daily pain interference, behavioral activities and medication usage. Homework (self-recording) was reviewed at each session and contingent praise and feedback provided. At the last baseline session for Behavior Set 1, the participant was given the Valued Behavioral Activity Checklist (Lejuez et al., 2001) for completion as a homework assignment.

Surgery. Unexpected surgical intervention for bulging vertebral disks occurred and resulted in an 11-week hiatus.

A 2 (baseline 2). Upon the participant's return a second baseline was conducted. Between two and four reclined baseline observations were obtained. Three to six baseline observations of upright relaxed behavior were obtained. Self-reported depression and pain anxiety was obtained on each baseline observation. Self-recording of PIR, activities and medication usage was conducted on a daily basis as before.

B (BAT-P). BAT-P consists of visual feedback (i.e., graphical depiction of performance data), Behavioral Relaxation Training (BRT), activity-relaxation cycles, shaping performance of valued behavioral activities, and descriptive praise. Visual performance feedback was provided each session in relation to PIR, depression and relaxation skills. Activity-relaxation cycles were employed to maintain a dense schedule of negative reinforcement for muscle tension-pain cycles. Daily at-home 15-minute relaxation sessions were also included. No visual feedback was provided for pain anxiety. No direct cognitive restructuring was conducted (Turk, Meichenbaum, & Genest, 1983). Fourteen sessions of BAT-P were conducted.

At session one, 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 depression. Self-management of pain rather than its elimination was emphasized. 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 and reach life goals. Increasing contact with valued activities was described in the context of improving quality of life and mood. An expectation of treatment benefit regarding decreased pain interference and improved mood was presented. No expectation regarding change in pain anxiety was presented. After the first post-training observation, the Valued Behavioral Activity Checklist (Lejuez et al., 2001) was reviewed and items rank ordered from 1-15 (easy to difficult to complete).

Following the conceptualization and rationale for BAT-P, BRT was conducted. Reclined relaxed behaviors were trained first. Reclined Behavior Set 1 was comprised of: Breathing, Shoulders, Hands, Feet, and Head. Behavior Set 2 consisted of Quiet, Body, Eyes, Mouth, and Throat. BRT (Poppen, 1998) was conducted for approximately 15-20 minutes each session. A five-minute post training observation was conducted immediately after training. A forward chaining procedure was used to teach the relaxed behavior.

The behavior was first labeled and examples and non-examples of relaxed behavior modeled. The participant was then instructed to imitate the relaxed behavior. Praise and descriptive feedback were presented contingent on meeting a 30-second acquisition criterion for each behavior. If the behavior was unrelaxed at anytime during the 30-second period, contingent feedback was provided and followed by the instruction "relax your (behavior)." If the correct response was not performed, manual guidance was provided, as appropriate and the instruction given again. Contingent on meeting the 30-second acquisition criterion, the next behavior was introduced to training. After instruction and modeling of the new behavior the participant was instructed to relax the newly trained behavior and all previously trained relaxed behaviors. All relaxed behaviors had to meet the 30-second acquisition criterion before a new relaxed behavior was introduced to training. Chaining continued until all five behaviors in the behavior set were acquired at the 30-second training criterion.

Upon mastery of the acquisition criterion, BRT proficiency training was conducted. Janet was instructed to demonstrate the relaxed behaviors with contingent descriptive praise, feedback and manual guidance provided. During alternate one-minute intervals (i.e., 1, 3, 5 etc), the trainer provided instructions to “notice the sensations while you relax your (the behavior) in the (relaxed position).” During opposing one-minute intervals contingent descriptive praise and feedback was provided. At the end of the BRT session, Janet was instructed to “relax on your own for the next few minutes” and a post training observation was conducted. Both reclined and upright relaxed behaviors were trained using forward chaining procedures. Upright Behavior Set 1 was consisted of Breathing, Quiet, Body, Head, and Eyes. Behavior Set 2 in the upright position was Mouth, Throat, Shoulders, Hands, and Feet.

Homework consisted of instructions to conduct self-managed BRT sessions every two hours for approximately 15-minutes, implement activity-relaxation cycles, engage in assigned valued activities, and record daily rating PIR and medication usage. Level 1 valued activities were first assigned as homework. Higher-level valued activities were assigned as homework contingent on mastery of previous levels. Duration of activity-relaxation cycles was determined by pinpointing the maximum duration of activity performed up to the onset of pain. Activity duration was then decreased with instructions to conduct 5-minute mini- BRT sessions at the end of the activity and then resume activity.

A behavioral contract was implemented at the second to last session that described the benefits of continued use of the skills acquired. The contract stated the participant would continue practicing the skills as scheduled and completing the Chronic Pain Daily Record (used to record PIR, activities etc.) for the first seven weeks following end of intervention. Each week self-recorded data would be mailed to the investigator. A follow up phone call was conducted at the end of week one and two to prompt and reinforce self-recording, mailing of data, and problem solve difficulties related to maintenance.

Follow up. Three- and six-month follow up was conducted as in baseline. Assessment of depression, pain anxiety and reclined and upright relaxed behavior was conducted. One week of daily PIR, medication usage and activities was obtained and mailed to the investigator.

Results

Interobserver agreement of relaxed behavior was obtained on 22% of sessions (Mean 96%, range 85-98%). Agreement was calculated by dividing the number of relaxed behaviors by the number of relaxed and unrelaxed behaviors multiplied by 100. Percent-relaxed behavior in the reclined position was low and deteriorating for Behavior Set 1 during A1. (See Figure 1). Behavior Set 2 showed more variability with an upward trend. Upright BRS scores for Behavior Set 1 and 2 were low and stable. At A2, reclined BRS scores increased and then declined to previous levels for Behavior Set 1; however, percent-relaxed behavior remained stable for reclined Behavior Set 2. While some generalization had occurred, upright BRS scores were below the standard training criterion of 80%. (Poppen, 1998).

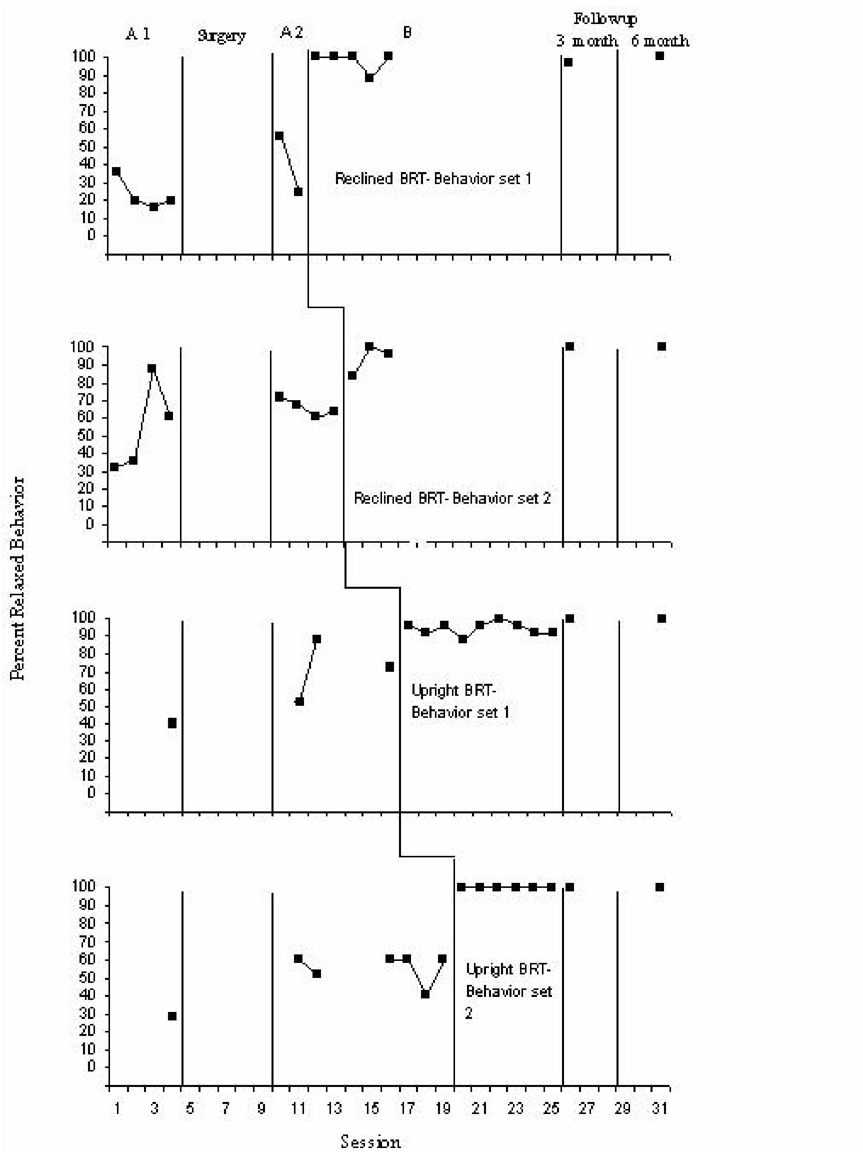

Figure 1. Percent-relaxed behavior across behavior sets, relaxed positions and experimental conditions.

A large, immediate increase in reclined BRS scores was obtained for Behavior Set 1 following BRT while BRS scores for Behavior Set 2. With implementation of BRT for reclined Behavior Set 2, the effect of BRT was replicated. BRS scores for each Behavior Set ranged from 85-100% relaxed during training. No improvement in upright BRS scores was during reclined BRT. Follow up assessment at three and six months indicated 100% relaxed for reclined Behavior Set 1 and 2.

The effect of BRT was replicated in the upright position for Behavior Set 1 and 2. Large, immediate increases in BRS scores for each Behavior Set was systematically observed following implementation of upright BRT with sustained performance over of the training period. Results were maintained at three and six month follow up.

Figure 2 displays PIR. Considerable variability during A 1 was observed (range 2.75-10.000 cm). Following surgery, PIR returned to extremely high levels (range 1.75-10.00 cm), which were sustained during baseline 2.

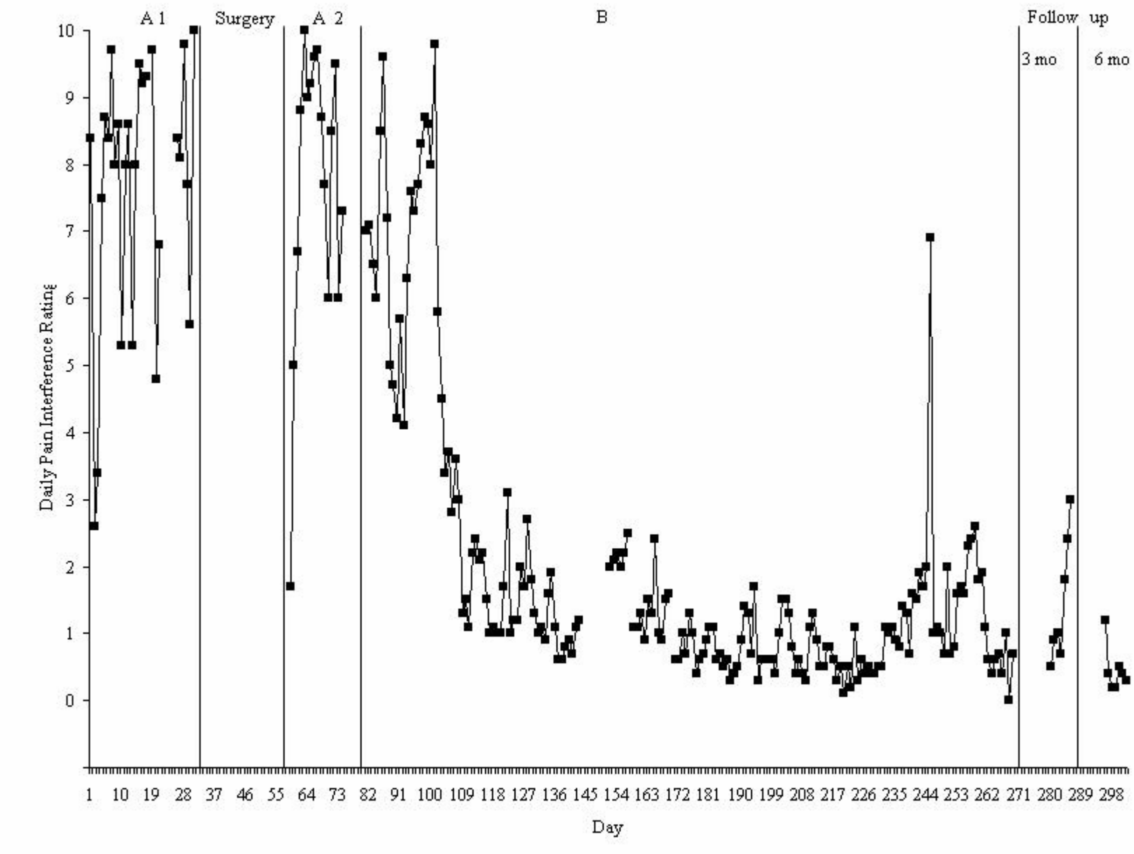

Figure 2. Daily pain interference rating (PIR) across experimental conditions.

During the first two weeks of BAT-P, PIR was variable and overlapping with A2. At week three, and corresponding with training in upright BRT, PIR rapidly declined to low levels and remained stable. With one exception, very low pain interference ratings were reported throughout the phase. Three month follow up showed a slight increase in PIR (range .5-3.00 cm). Six-month follow up indicated a decline in PIR (range .5-1.25 cm) below that obtained at end of intervention.

Pain anxiety scores are displayed in Figure 3. Cognitive and Physiological anxiety showed the greatest elevation, with scores above the norm, followed by Escape/avoidance and Fear. Cognitive and Physiological scores were above the norm. Following surgery, Cognitive anxiety substantially worsened and remained stable. No meaningful change in other pain anxiety subscale score was observed.

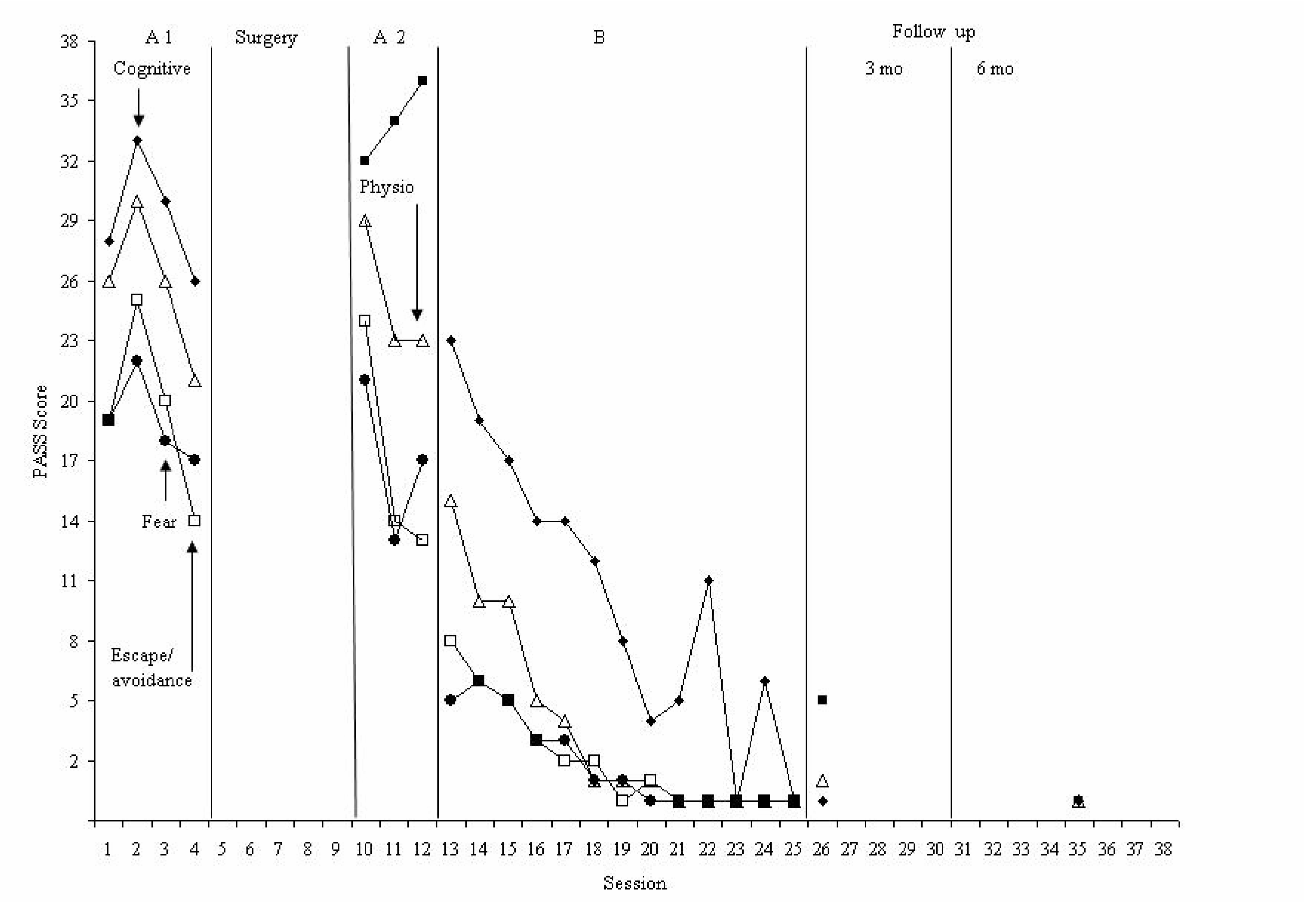

Figure 3. Pain anxiety symptom scale scores (PASS) across experimental conditions.

Immediately following BAT-P, each pain anxiety subscale scored dropped precipitously (e.g., 5-12 points) with a systematic downward trend in each. At the end of the BAT-P all pain anxiety scores were near or at zero. Results were maintained at three and six month follow up.

Self-reported depression declined during A1. Surgery did not alleviate depression. Depression ratings began trending downward during A2 with further decreases during BAT-P. Results were maintained at follow up.

Medication index (MI) score at A1 was 39.71 indicating a high usage of anxiolytic, antidepressant, and analgesic medications. MI score (64.57) for the second baseline was substantially greater despite surgery to relieve chronic back pain and an 11-week recuperative period. One week of BAT-P produced a significant decline in medication usage (37.00) from A2 End of BAT-P intervention resulted in an MI score of 23.62. At the three-month follow MI score had risen to (35.51) but was below both baseline levels. Medication usage at six-month follow up was marked reduced (13.00).

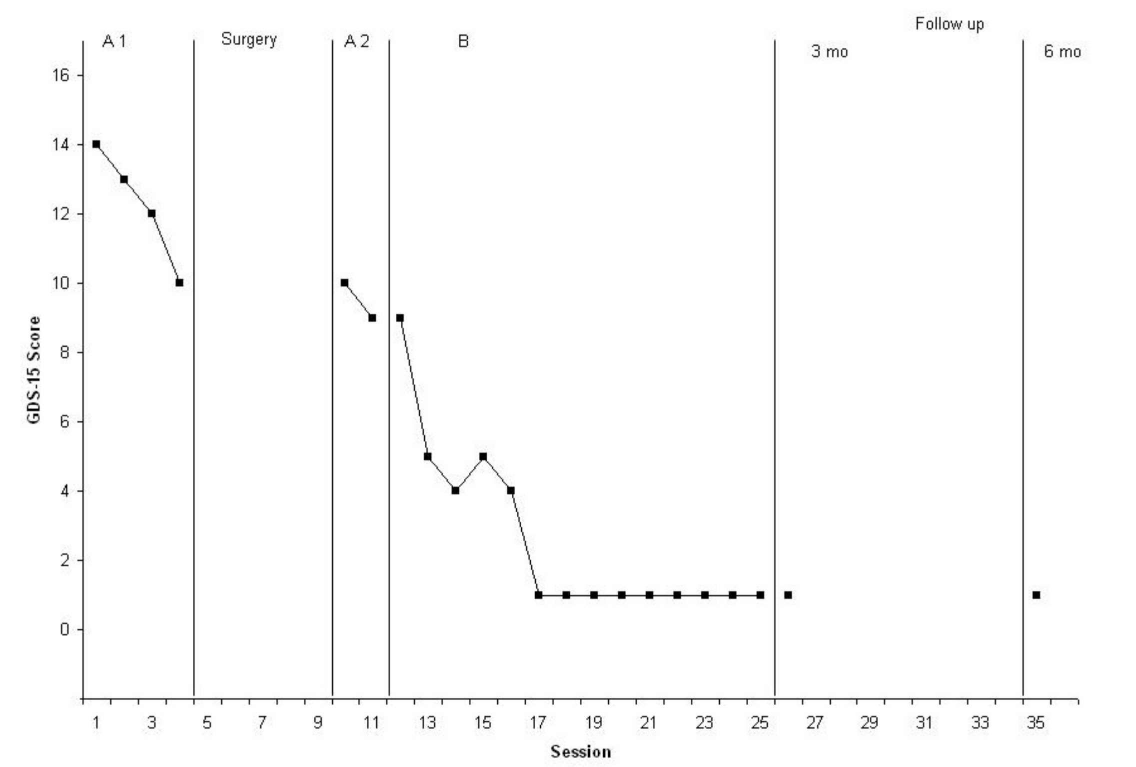

Figure 4. Geriatric Depression Scale-15 (GDS-15) scores across experimental conditions.

Discussion

Effects of BAT-P for FM pain interference and pain anxiety cognition were replicated and extended relative to Lundervold et al. (2006). Experimental control was demonstrated using a multiple-baseline-across-behavior sets and relaxed positions design. Clinically significant change in pain anxiety cognition occurred without direct cognitive intervention. Analgesic and anxiolytics medication usage markedly declined from baseline to end of intervention. Results were maintained at three and six-month follow up. Results support the use of behavior analytic interventions for FM pain and are consistent with findings reported by Theime et al with an in patient population. Use of a behavioral contract for enhancing maintenance has not been reported in the FM literature. Systematic evaluation of this component of BAT-P is needed. Limited generalization of relaxed behavior across behavior sets and relaxed positions clearly indicates that instruction of all behaviors is necessary and positions is necessary (Lundervold et al., 2006).

That BAT-P produced in indirect change in pain anxiety cognition without direct cognitive restructuring. Behavioral activation based on the use of functional activities and goals that create the conditions for reinforcing behavior incompatible to behavioral avoidance. The effect of approach behavior is a decrease in the strength of a dysfunctional verbal EO (pain anxiety cognition). Approach behavior is systematically reinforced through shaping of performance of valued activities and contact with life goals and visual feedback of performance.

Though behavior analysts are seldom concerned with psychiatric diagnosis, the lack of systematic diagnostic assessment in this report is a limitation. High scores on the GDS-15 and PASS suggested that Janet was not coping well with FM pain. Use pain assessment instruments that allow systematic discrimination of subtypes of pain patients who are coping poorly and those at risk of increased pain and suffering would be valuable in future BAT-P research. Though results are encouraging and consistent with those reported previously, replication is needed.

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Author Contact Information:

Duane A. Lundervold,
Department of Psychology,
Central Missouri State University.
Warrensburg, MO 64093.
E-mail: Lundervold@CMSU1.CMSU.edu.