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Original Article **15-00607R1**

Effects of a Short-Term Dance Movement Therapy Program on Symptoms and Stress in Patients with Breast Cancer Undergoing Radiotherapy: A Randomized, Controlled, Single-Blind Trial

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Abstract

Context. Integrated interventions with combined elements of body movement and psychotherapy on treatment-related symptoms in cancer patients are relatively scarce.

Objectives. The present study aimed to study the effectiveness of dance movement therapy (DMT) on improving treatment-related symptoms in a randomized controlled trial.

Methods. A total of 139 Chinese patients with breast cancer awaiting adjuvant radiotherapy (RT) were randomized to DMT or control group. The intervention included six 1.5-hour DMT sessions provided twice a week over the course of RT. Self-report measures on perceived stress, anxiety, depression, fatigue, pain, sleep disturbance, and quality of life were completed before and after the three-week program.

Results. DMT showed significant effects on buffering the deterioration in perceived stress, pain severity, and pain interference (Cohen d = 0.34 to 0.36, $P < 0.05$). No significant intervention effects were found on anxiety, depression, fatigue, sleep disturbance, and quality of life (Cohen d = 0.01 to 0.20, $P > 0.05$).

Conclusion. The short-term DMT program can counter the anticipated worsening of stress and pain in women with breast cancer during radiotherapy.

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Key Words: breast cancer, dance/movement therapy, pain, perceived stress, randomized controlled trials

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Introduction

Adjuvant radiotherapy (RT) is used to reduce the risk of loco-regional recurrence in women with breast cancer (1, 2). Patients undergoing RT often experience multiple distressing symptoms including pain, fatigue, heightened stress, and sleep disturbance, with reported occurrence rates of over 60% near the end of RT (3-5). Although these symptoms may appear as inevitable, short-term side effects of RT, a significant proportion of patients with breast cancer continue to experience them long after treatment completion (6-8). These symptoms have been associated with poorer quality of life (9). Their high prevalence and tendency to co-occur warrant intervention (10). Because of their multiple causes and concerns over interactions with concurrent RT, symptom treatment during active RT is a challenging task.

A large volume of research has investigated the use of non-pharmacological interventions to alleviate treatment-related symptoms in cancer patients. Research evidence supports the use of physical movement to relieve fatigue (11) and psychotherapy for pain control (12), with the latter encompassing a wide range of therapies including cognitive therapy, behavioral therapy, and hypnosis. However, multiple remedies for various symptoms may necessitate frequent travel entailed by daily RT treatment and add to the patients' burden. An integrated intervention with combined elements of movement and psychotherapy could be more effective. Yet, research in this area is relatively scarce.

Dance movement therapy (DMT) is a movement-based psychosocial intervention that incorporates the therapeutic components of dance movement and group psychotherapy (13). As defined by the American Dance Therapy Association, DMT uses guided and self-initiated movements to further the emotional, cognitive, physical and social integration of the individual (14). DMT emphasizes the interconnection between the body and mind such that one can express his mind through body movements (15). It enables the patients to enhance self-expression, accept and reconnect with their bodies, cope with feelings of depression and fear, rebuild self-confidence, and to strengthen personal resources (16). The group approach allows them to share their emotions, concerns, and coping strategies with others who are undergoing similar experiences and establish mutual social support (17).

Previous research studies have reported positive results on the use of DMT on cancer patients (17-21). The majority of these studies are, however, not randomized controlled trials (RCT) and only have small sample size with relatively low statistical power. Bradt and colleagues (16) recently reviewed two RCT studies on the therapeutic effects of DMT on cancer patients. Their Cochrane review suggests DMT to have a beneficial effect on quality of life, somatization, and vigor but not on anxiety, depression, fatigue, stress, and body image. It remains unclear whether these findings are due to ineffectiveness of the treatment, unsuitable outcome measures, or limited number of RCT studies. To our knowledge, the effects of DMT on

patients receiving active cancer treatment have yet to be studied. More RCT studies are needed to elucidate the effects of DMT on physical and psychological outcomes in cancer patients.

The current study aims to explore the changes in treatment-related symptoms (fatigue, anxiety, depression, pain, perceived stress, and sleep disturbance) and quality of life in a sample of Chinese patients with breast cancer during the course of RT. We have reported the qualitative outcomes of the study elsewhere (22), where DMT was found to provide benefits in terms of coping with cancer, treatment, and physical symptoms and improving mental well-being, attention, and appreciation for the self and body. In this quantitative analysis, we investigate the effectiveness of DMT in symptoms relief in patients with breast cancer . Previous research showed that fatigue or pain levels typically increase during RT, but their patterns over treatment vary by studies (23). It was hypothesized that a brief DMT intervention over the course of RT would benefit the patients by buffering their treatment-related symptoms while the symptoms would worsen in women who did not receive DMT.

Methods

Study Design

This was a randomized controlled single-blind trial. Simple randomization was carried out with computer generated random numbers to randomize participants into either intervention (DMT) group or waitlist control group. Allocation concealment was carried out by research

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assistants using sequentially numbered, opaque, sealed envelopes. Only the participants were blinded to the group allocation. The treatment group received DMT program during the first week of RT and the DMT program continued for three weeks. The waitlist control group received standard care during the course of RT and the same DMT program after collection of follow-up data three weeks later.

The procedures of this study were in accordance with the ethical standards of the Institutional Review Board of the University of Hong Kong and Hong Kong Hospital Authority (Reference number: UW 10-118). Ethical approval was obtained from the institutional review board of the University of Hong Kong prior to start of the study. The trial was registered with the Clinical Trials Centre of the University of Hong Kong (HKCTR-1077). Written informed consent was obtained from all participants in the study.

Participants

Patients with breast cancer awaiting the initiation of RT or during the first week of adjuvant RT were recruited from two public hospitals and three community cancer support centers in Hong Kong between December 2011 and February 2013. RT for breast cancer patients in Hong Kong was carried out over an average span of 25 - 30 days that lasted around 5 – 6 weeks, depending on the type of surgery. Women who were ethnic Chinese aged 18 years or above with stage 0 to III primary breast cancer were eligible if they did not have any of the

following conditions: recurrent breast cancer, history of other cancers, history of psychiatric illness or physical disabilities that rendered them incapable of joining the DMT program. Calculation for sample size and power was performed for the regression of change in outcome variables on the treatment condition using Monte Carlo simulations (24). According to prior pilot studies (17, 21), we anticipated a medium effect size (Coden d = 0.63). Under the 0.05 significance level and an assumed attrition rate of 7.1%, a sample size of n = 140 was found to provide a statistical power of 80.0% for the medium effect size.

The flow of the study is presented in Fig. 1. A total of 317 eligible women were referred by the oncologists or medical social workers at the recruitment sites and subsequently contacted by a research assistant. Each potential participant received an invitation letter with details of the study. A hundred and seventy women declined to participate, mostly due to a lack of time or other personal reasons (response rate of 46%). Eight women withdrew after randomization (5% drop-out) due to personal reasons such as tight schedule, having previous engagement, not being able to commit to data collection etc., leaving 69 participants in the DMT group and 70 in the waitlist control group (total *n* = 139) for the analysis.

Intervention

The DMT program used for this study originated from the West and was modified by the first author to suit the Chinese culture, which values modesty, emotional control, and respect for

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authority. It has been used in local populations with good outcomes and acceptance (17, 25). The program consisted of six 1.5-hour DMT sessions held twice a week for three consecutive weeks over the course of RT. The program was specially tailored to meet the needs of patients with breast cancer, including stretching, relaxation exercises, movement games and rhythmic body movement to exercise the upper extremities, improvisational dance and movement to explore positive emotions. Interactions, emotional expressions and communications were encouraged among the group members in the sessions. Simple group dances and group sharing were carried out to relate the movement process to participants' personal experiences of breast cancer and cancer treatment. The sessions took place in the hospital, the community cancer support center, and the University of Hong Kong. Each group comprised 6-10 women, and women in the same groups went through the six sessions together. All sessions were led by a qualified dance movement therapist. The waitlist control group did not participate in the intervention program but received radiotherapy and standard nursing care in the hospitals.

Data Collection

Outcome data were collected via self-administered questionnaires before the start of the DMT program (pre-RT) and at 3-week follow up upon the completion of the program (end-RT). The self-report questionnaires were completed at home and returned to the research team by post. The self-report questionnaire included validated measurement scales on the following outcomes:

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perceived stress, anxiety, depression, fatigue, pain, sleep disturbance, and quality of life. Clinical and demographic data were also collected at pre-RT. In the DMT group, over 90% of the participants attended five or more sessions. In addition, in the last DMT session, qualitative feedback was sought from the participants on whether and how the program helped them during the RT. Over 93% of the participants provided data at end-RT, with attrition rates of 4.3% and 8.6% for the treatment and control groups, respectively.

Outcome Measures

The Perceived Stress Scale is a 10-item, 5-point measurement scale that measures respondents' subjective global experience of stress (26). The total score ranges from 0 to 40 and higher scores indicate higher levels of perceived stress. The Hospital Anxiety and Depression Scale is a 14-item, 4-point scale used to measure depression and anxiety symptoms (27). The total scores for anxiety (7 items) and depression (7 items) range from 0 to 21, with higher scores indicating worse mental health status. The Brief Fatigue Inventory is a 9-item, 11-point assessment scale of fatigue severity and its interference with daily functioning (10). The total scores for fatigue severity (3 items) and fatigue interference (6 items) range from 0 to 10, with higher scores indicating more severe fatigue.

The Brief Pain Inventory is a 11-item, 11-point measurement scale of pain severity and its interference with daily functioning (28). The total scores for pain severity (4 items) and

interference (7 items) range from 0 to 10, with higher scores indicating more severe pain. The Pittsburgh Sleep Quality Index is a 7-component, 4-point measurement scale of sleep disturbance (29). The seven component scores are summed to produce a global measure of sleep disturbance, with higher scores denoting poorer sleep quality (range = 0 – 21). The Functional Assessment of Cancer Therapy – Breast scale is a 36-item, 5-point instrument that assesses quality of life of the patients in physical, social, emotional, functional, and breast cancer specific domains (30). The total score for quality of life ranges from 0 to 144, with higher scores denoting better quality of life. All of the Chinese version of the measurement scales showed good reliability ($\alpha > 0.75$) in the current study.

Statistical Analysis

Independent samples *t*-tests and Chi-square tests were conducted using SPSS 20 to compare the demographics and baseline characteristics of the two groups. Attrition analysis was performed to compare the profiles of the study dropouts ($n = 9$) and the completers ($n = 130$). Traditional analytic techniques such as analysis of variance (ANOVA) adopt listwise deletion or substitution methods (31) and may not yield precise estimates in the presence of missing data. In this randomized trial, latent growth modeling was used to evaluate the intervention effects via maximum likelihood estimation in Mplus 7 (32). This technique analyzes changes in outcome variables over time and achieves intent-to-treat analyses by including all available data in the

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model via full information maximum likelihood (33). The change trajectories of the outcome variables were examined in the overall sample via unconditional growth modeling. All statistical tests were two-sided.

A linear trend was fitted on each outcome variable and the growth models were identified by fixing the residual variances of the repeated measure at zero. For the analysis of DMT effect, we regressed the changes in outcome variables on the treatment condition via conditional growth modeling. In the conditional model, age was included as a control variable to increase the statistical power of detecting treatment effects. Model fit was evaluated using the following criteria for the fit indices: insignificant chi-square (χ^2), comparative fit index (CFI) ≥ 0.95, Tucker-Lewis index (TLI) ≥ 0.95, root mean square error of approximation (RMSEA) ≤ 0.06, and standardized root mean square residual (SRMR) ≤ 0.08 (34). Cohen's d reflects the standardized between-group slope difference, with values of 0.2, 0.5 and 0.8 denoting small, medium and large effect sizes, respectively (35).

Results

Demographic and Clinical Characteristics

Table 1 presents the demographic and clinical characteristics of the participants by treatment group. The mean age of the participants was 48.9 years (*SD* = 8.2) and they on average received 9.5 (*SD* = 8.2) days of radiotherapy sessions at the start of the study. The majority of the

participants attained secondary educational level (65%), were married (63%), and had undergone breast conserving surgery (59%) and chemotherapy (80%). The two groups did not differ significantly in the demographic and clinical characteristics.

The descriptive statistics of outcome variables by treatment group are shown in Table 2. No significant difference ($P > 0.05$) was found in the outcome variables at pre-RT across the two groups. Comparisons on the profiles of the study dropouts ($n = 9$) and the completers ($n = 130$) showed that at pre-RT the dropouts were significantly younger (M = 42.1 vs. 49.3, $P < 0.05$) and had significantly lower sleep disturbance (M = 5.2 vs. 7.5, $P < 0.05$) and better quality of life (M = 114.0 vs. 96.3, $P < 0.01$). In a descriptive sense, participants in the DMT group had slight improvement in all measures except anxiety and depression. For the control group, participants showed slight decreases in depression, fatigue severity, fatigue interference and quality of life but increases in perceived stress, pain severity, pain interference, and sleep disturbance.

Analysis of Treatment Effects

The unconditional growth models fitted the data well with insignificant χ^2, CFI and TLI > 0.97, RMSEA < 0.06, and SRMR < 0.08. The overall sample reported significant decreases in fatigue severity ($\triangle$ = -0.39, SE = 0.20, $P < 0.05$) and fatigue interference ($\triangle$ = -0.52, SE = 0.17, $P < 0.01$). There were no significant changes in perceived stress ($\triangle$ = -0.58, SE = 0.34, P = 0.08), quality of life ($\triangle$ = 1.93, SE = 1.03, P = 0.06), anxiety ($\triangle$ = -0.07, SE = 0.20, P= 0.72),

depression (△ = -0.32, *SE* = 0.27, *P*= 0.22), pain severity (△ = 0.19, *SE* = 0.18, *P*= 0.30), pain interference (△ = 0.12, *SE* = 0.18, *P* = 0.53), and sleep disturbance (△ = -0.26, *SE* = 0.22, *P*= 0.25).

The conditional growth model provided an adequate fit to the data with insignificant χ^2, CFI and TLI > 0.96, RMSEA and SRMR < 0.06. As shown in Table 3, there were significant DMT effects on perceived stress, pain severity, and pain interference but not on anxiety, depression, fatigue severity, fatigue interference, sleep disturbance, and quality of life. The model estimated trajectories for perceived stress, pain severity, and pain interference are shown in Fig. 2. There was a decrease in these outcome variables in the DMT group in contrast to an increase in the control group. The effect sizes of the DMT treatment were of small to medium magnitude (Cohen *d* = 0.33 - 0.36) on the outcome variables.

Discussion

In the present study, latent growth modeling analyses demonstrated significant effects of DMT on stress, pain severity and pain interference compared to control condition. Consistent with previous findings (3-5), the control group showed an increase in perceived stress, pain severity, and pain interference over the course of RT. In contrast to Dibbell-Hope's study (18), the only other RCT study that examined the effects of DMT on our outcomes, our study showed small but significant improvements in perceived stress for DMT over RT. The use of spontaneous

movement and rhythmic action in DMT enables participants to relax and express their feelings nonverbally and freely (16), thereby allowing them to release their psychological tension. The group psychotherapy component of DMT likely provides social support to the participants and helps them overcome their isolation through rhythmic sharing. These could, in turn, contribute lower levels of perceived stress.

The DMT group reported significant improvements in pain severity and pain interference over RT, with proportional improvements in comparison to the control group exceeding 25%. These results resemble similar findings on the beneficial effects of body movement on pain among cancer patients receiving chemotherapy (36). The body-oriented approach of DMT could improve range of arm motion and shoulder function, release muscular tension (13, 37), and promote patients' self-awareness of their own body. These might foster a greater internal focus of control and provide relief from the symptoms by shifting the focus away from the unpleasant and painful RT experiences (15). These elements could contribute to effective pain control. Given the potential clinical value of DMT in pain reduction, DMT could be incorporated as part of an integrative cancer care treatment for prophylactic pain control at the onset of RT to facilitate early intervention.

Though Sandel and colleagues (19) reported a large treatment effect of DMT on quality of life, our DMT group showed no significant improvements on sleep disturbance and quality of

life. The lack of significant findings could be attributed to the short duration (3 weeks) between the pre and post assessments. Given the time constraint in relation to the radiotherapy treatment duration for the intervention, dramatic changes in quality of life were not expected. Consistent with Dibbell-Hope's study (18), no significant effects were found for the DMT program in anxiety, depression, and fatigue in the present study. Interestingly, fatigue severity and interference decreased for both DMT and waitlist control groups over RT. Though such declines in fatigue stood in contrast with the expected worsening of fatigue during RT, previous studies (3, 38, 39) have reported a lessening of cancer-related fatigue.

In the present study, the majority of the participants had received chemotherapy before RT. Fatigue associated with chemotherapy has been documented to be more intense than with RT (40). Prior chemotherapy experience could shift in patients' standard in judging the symptom severity such that fatigue induced by RT was judged to be milder. Participants might plausibly feel less fatigued over time after the completion of chemotherapy. Smets et al. (41) noted that patients might gradually cope better with treatment-related demands such as daily trips to the clinic and meeting social obligations over the course of RT, making the patients feel less fatigued. Besides, we did not ask the participants in the control group to refrain from engaging in symptom relief measures during the study. It is possible that participants in the control group might have performed exercise on their own during the study period, leading to a decrease in

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their fatigue levels.

There were several study limitations. Since the study sample included only ambulatory patients, our findings cannot be generalized to those who are less mobile. Patients who were in severe fatigue or pain might lack the stamina or motivation to join the program. This may lead to sampling bias and response bias and underestimation of the severity of the symptoms in the sample. An interesting finding is that participants who dropped out of the study were significantly younger and displayed better sleep quality and quality of life. This may suggest that these participants were already accessing social support and the intervention was felt to be of less use to them. Future studies should explore the effects of DMT on patients who are more impaired by fatigue or pain.

Besides, the time constraint of RT treatment limited the duration of the intervention and the data collection interval. This might potentially hamper bigger changes to be observed in outcomes. Nevertheless, the DMT intervention had a high completion rate and was well received by most participants. No participants reported any adverse effects of DMT throughout the study. The modest effect sizes of DMT found in this study could be explained by brevity of the intervention period. A prospective study with a longer DMT program that covers the post-treatment period and a longer follow-up period would elucidate the potential benefits and sustainability of DMT. Future studies should examine optimal treatment dose and duration for

DMT interventions on cancer patients.

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Figure Legends

Fig. 1. CONSORT flowchart of the study.

Fig. 2. Estimated trajectories of perceived stress and pain symptoms over RT.

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Table 1 Demographic and clinical characteristics of study participants at baseline

	DMT (*n* = 69)	Control (*n* = 70)		
	n (%)	*n* (%)	χ^2	*p*
Education level				
Secondary or below	43 (62)	47 (67)	0.35	.55
Tertiary	26 (38)	23 (33)		
Marital status				
Single	22 (32)	30 (43)	1.79	.18
Married	47 (68)	40 (57)		
Cancer stage				
0	5 (8)	4 (6)	0.68	.88
I	17 (25)	18 (26)		
II	27 (40)	31 (46)		
III	18 (27)	15 (22)		
Surgery type				
Mastectomy	27 (39)	30 (43)	0.20	.66
Lumpectomy	42 (61)	40 (57)		
Chemotherapy				
No	13 (19)	16 (23)	0.34	.56
Yes	56 (81)	54 (77)		
	M (SD)	*M (SD)*	*t*	*p*
Age (in years)	48.6 (7.7)	49.1 (8.7)	-0.40	.69
Days of RT received	9.2 (8.0)	9.7 (8.4)	-0.40	.69

Note. DMT = Dance movement therapy.

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Table 2 Descriptive statistics of outcome variables by treatment group

	DMT group			Control group		
	Baseline	Follow up	Change	Baseline	Follow up	Change
Outcome	(n = 69)	(n =66)	%	(n = 70)	(n = 64)	%
	M (SD)	*M (SD)*		*M (SD)*	*M (SD)*	
Perceived stress	19.4 (4.3)	18.4 (4.6)	-5.2%	19.2 (4.8)	19.5 (4.0)	+1.6%
Anxiety	6.2 (3.1)	6.3 (3.8)	+1.6%	5.7 (3.3)	5.7 (3.0)	-
Depression	5.5 (3.4)	5.5 (3.7)	-	5.8 (4.0)	5.5 (3.4)	-5.0%
Fatigue severity	5.3 (2.3)	4.9 (1.9)	-7.6%	4.9 (2.2)	4.6 (2.3)	-6.0%
Fatigue interference	3.9 (2.2)	3.4 (2.2)	-12.8%	3.8 (2.2)	3.4 (2.4)	-10.5%
Pain Severity	3.0 (2.1)	2.9 (2.0)	-3.7%	2.5 (2.3)	3.1 (2.2)	+24.0%
Pain interference	2.7 (2.2)	2.6 (2.2)	-3.7%	2.1 (2.1)	2.6 (2.3)	+23.8%
Sleep disturbance	7.5 (3.9)	7.1 (3.9)	-5.3%	7.3 (4.2)	7.5 (4.2)	+2.7%
Quality of life	97.1 (18.8)	98.9 (20.0)	+2.0%	97.9 (18.1)	97.8 (18.4)	-0.1%

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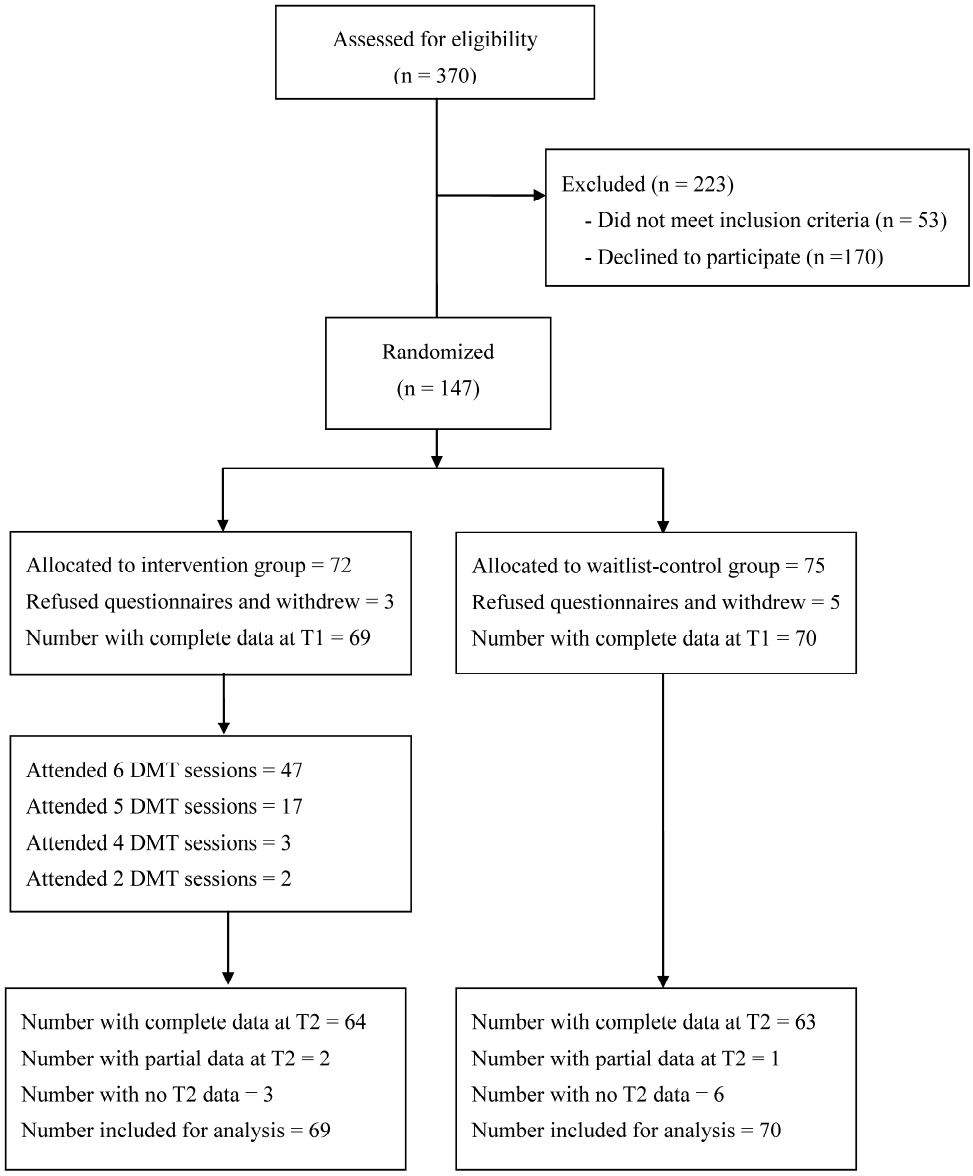
Table 3 Estimates of DMT effects on outcome variables

Change in outcome	β	*SE*	*z*	*p*	*d*
Perceived stress	-0.167	0.081	-2.07	.039*	0.33
Anxiety	0.039	0.085	0.45	.65	0.08
Depression	0.057	0.090	0.63	.53	0.11
Fatigue severity	0.003	0.092	0.03	.98	0.01
Fatigue interference	-0.071	0.090	-0.79	.43	0.14
Pain severity	-0.181	0.086	-2.11	.035*	0.36
Pain interference	-0.173	0.087	-1.98	.048*	0.35
Sleep disturbance	-0.098	0.084	-1.17	.24	0.20
Quality of life	0.048	0.087	0.55	.58	0.10

Note. β = standardized regression estimates; *SE* = standard error; *d* = effect size on between-group difference in change; * $p < .05$.



T1 = before RT

T2 = end of RT

DMT − Dance movement therapy

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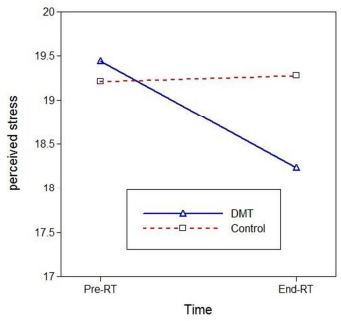

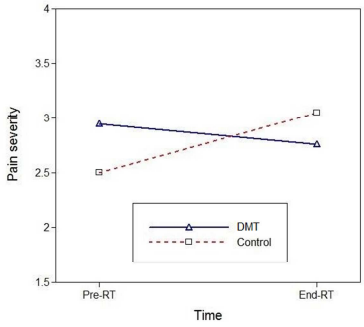

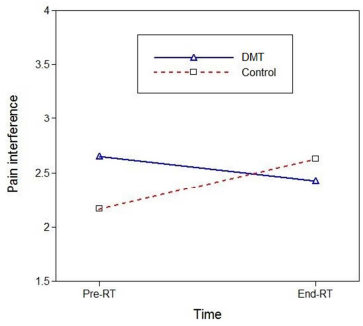

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