ORIGINAL RESEARCH

Tai Chi for Well-being of Breast Cancer Survivors With Aromatase Inhibitor-associated Arthralgias: A Feasibility Study

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ABSTRACT

Context • Arthralgia is common and debilitating for a significant proportion of breast cancer survivors (BCSs) and leads to poor adherence to aromatase inhibitors (AIs). Despite increased recognition of the negative impact of arthralgia on function and the poor adherence that results, very few interventions have been developed to target this side effect.

Objective • This study aimed to determine the feasibility of tai chi to improve well-being for women experiencing AI-associated arthralgias (AIAAs).

Design • The study was a pilot to (1) demonstrate the feasibility of recruitment and retention for a tai chi trial, (2) determine the safety of tai chi, and (3) identify the outcomes (function, pain, and quality of life[QOL]) that tai chi may impact.

Setting • The study took place at the Gilda's Club South Jersey in Linwood, NJ, USA.

Participants • Postmenopausal women with a history of stage I-III breast cancer reporting AIAA were enrolled.

Intervention • Group tai chi was practiced for 1 h 2 ×/wk for 8 wks.

Outcome Measures • Functional outcomes included (1) sit-and-reach (SR), (2) functional reach (FR), (3) the Berg Balance Scale (BBS), and (4) timed up-and-go (TUG). The following patient-reported outcomes (PROs) were evaluated pre- and postintervention: (1) the Hospital Anxiety and Depression Scale (HADS), (2) the Functional Assessment of Cancer Therapy–Breast (FACT-B), (3) the Functional Assessment of Chronic Illness Therapy Fatigue (FACIT-Fatigue), (4) the Brief Pain Inventory (BPI), (5) the Functional Assessment of Cancer Therapy/Gynecologic Oncology Group–Neurotoxicity (FACT-GOG-Ntx), and (6) the Functional Assessment of Chronic Illness Therapy–Spiritual Well-being Scale (FACIT-Sp). Participants also recorded their tai chi experiences in a journal.

Results • For the 12 participants, adherence to the classes was 75%, with no adverse events reported. Participants experienced significant improvement from baseline to follow-up for the HADS anxiety ($P = .003$) and depression ($P = .020$) scales, the emotional well-being scale of the FACT-B ($P = .027$), the FACIT-Fatigue ($P = .030$), and the sit-and-teach test ($P = .016$). The BBS ($P = .090$), TUG ($P = .241$), BPI severity subscale ($P = .058$), and physical well-being subscale of the FACT-B ($P = .052$) showed no significant improvement. Participants reported increased relaxation, reduced stress, and enhanced sleep quality and duration. They valued the group's and the instructor's support.

Conclusion • The research team demonstrated the feasibility of a tai chi intervention for improving well-being for breast cancer patients with AIAA and identified measures that may be sensitive to the impact of a tai chi intervention in this population. (*Altern Ther Health Med.* 2013;19(6):38-44.)

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Aromatase-inhibitor associated arthralgia (AIAA) is a leading side effect experienced by breast cancer survivors (BCSs). Aromatase inhibitors (AIs) are a standard treatment used by postmenopausal women with hormone-receptor-positive breast cancer because the drug blocks the conversion of testosterone to estrogen. The arthralgias associated with the use of AI cause pain and decrease daily function, leading to premature discontinuation of the medication.[1] The prevalence of AIAA is increasing as AIs are being prescribed more often for postmenopausal BCSs, with nearly 25% to 50% of BCSs on AI reporting joint pain.[2,3] Despite increased recognition of the negative impact of arthralgia on function, with resulting poor adherence, very few interventions have been developed to target this side effect.[4]

The exact mechanism by which AIs cause arthralgias is unknown; however, research points to decreased estrogen levels that can cause bone loss,[5,6] decrease pain-level modulation in the central nervous system (CNS), and lower regulation of cytokines and immune cells involved with bone remodeling and resorption.[5,6] Pain and functional limitations resulting from AIAA can lead to low adherence to the medication, causing an increased risk for recurrence.[6] While the etiology of AIAA has been explored, little research has been done on nonpharmacologic approaches to the management of arthralgias.

Because complementary and alternative medicine (CAM) use is high among BCSs,[7-10] evaluation of a CAM intervention for symptom management is particularly relevant for this population. Approaches to mind-body movement therapy have shown promise for modifying various side effects of treatment for breast cancer patients.[11,12] Tai chi, a weight-bearing, mind-body movement therapy, has been shown not only to improve balance and strength but also to increase bone formation and decrease bone resorption in cancer survivors.[13] Tai chi involves deep breathing exercises and slow movement to unite the physical, emotional, and mental states of an individual into a healthier being.[14,15] These studies make plausible the idea that tai chi may have numerous benefits for improving well-being among BCSs with AIAA.

To inform the appropriate design of an adequately powered, randomized controlled trial (RCT) of tai chi for creating well-being among individuals with AIAA, the research team conducted a feasibility study to explore the impact and safety of tai chi for this population. The specific aims of the current study were to (1) demonstrate the feasibility of recruitment and retention for a tai chi trial, (2) determine the safety of tai chi, and (3) identify the outcomes—function, pain, and quality of life (QOL)—that tai chi may impact for this population.

MATERIALS AND METHODS

Participants

Participants enrolled in this study included women who (1) had a history of stage I, II, or III breast cancer; (2) had visited an oncologist within the previous 3-month period and were free of the disease by clinical examination and history; (3) were postmenopausal, as defined by cessation of menses for at least 1 year or FSH > 40 mIU/mL; (4) currently were receiving AIs—anastrozole, letrozole, or exemestane; (5) were able to understand written English; (6) had had at least 15 days with pain in the preceding 30 days; (7) had joint pain for at least 3 months; (8) had joint pain attributed to the use of AIs; and (8) were willing to adhere to all of the study's procedures. Women were excluded from the study if they (1) had metastatic breast cancer (stage IV); (2) had completed chemotherapy or radiation therapy fewer than 4 weeks prior to enrollment; (3) had joint pain attributed to inflammatory arthritis, such as rheumatoid arthritis, gout, or pseudogout; (4) were having severe pain or noninflammatory arthralgia prior to AI initiation, based on history; or (5) had surgery or a joint injection involving the treatment joint within the prior 3 months. Each participant was fully informed of the study requirements and procedures and signed an informed consent. The study was approved by the Institutional Review Board (IRB) at The Richard Stockton College of New Jersey (Galloway, NJ, USA) and of the AtlantiCare Regional Medical Center (Galloway, NJ, USA), and the study was conducted at the Gilda's Club South Jersey (Linwood, NJ, USA).

Tai Chi Intervention

For this study, the research team developed a protocol by examining previous tai chi studies for BCSs[14,16,17] and through consultation with an expert trained in tai chi (Table 1). Participants met twice per week for 8 weeks for 1 hour in a group program under the supervision of a tai chi master. This program included a gentle, low-impact form of tai chi that focused on body awareness, deep breathing, and weight bearing to address the symptoms that BCSs experienced. Each session began with relaxation exercises that included the breath, the body, and the mind. Following the relaxation session, the instructor reviewed the previously-learned techniques and introduced new movements. Each woman was given a tai chi handout for home practice that included elements of relaxation, meditation, and the White Crane form.

Outcome Measures

Demographics were collected from each participant, and the research team collected the following patient-reported and functional outcomes at baseline and the end of 8 weeks

Participant-reported Outcomes. Participants' self-reported outcomes (PROs) that were used to measure intervention effects included the (1) Functional Assessment of Cancer Therapy–Breast (FACT-B), (2) Brief Pain Inventory (BPI) to assess pain intensity and severity,[18] (3) Hospital Anxiety and Depression Scale (HADS), and (4) Functional Assessment of Chronic Illness Therapy–Fatigue (FACIT-Fatigue). These outcome measures had been used in a similar study, with the exception of the FACIT-Fatigue, performed by Galantino et al in 2008.[19] For the current study, the FACT-B was used as a disease-specific questionnaire for the BCS population; the survey measures health-related QOL.[20] The BPI was used as a multidimensional pain scale to measure pain severity and interference with function.[21] The HADS was administered to quantify the anxiety and depres-

Table 1. Procedure for Tai Chi Sessions

Phase	Description
Relaxation	Involves relaxing the breath through slow abdominal breathing, relaxing the body with visualization and relaxation techniques designed to release physical tension, and relaxing the mind by focusing on mantras or phrases—*I am calm and relaxed*—coordinated with breathing.
Standing Meditation	Releases impure energy and tension through awareness, relaxation, and settling of the body as the impure energy flows back into the earth like compost. After the impure energy is released, healthy energy will build and flow through the body. The practice is akin to first dumping out a glass of dirty water and then filling the glass with pure water.
Coiling Silk *Qigong*	Includes specific qigong—energy healing—movements designed to keep the joints of the body loose and lubricated, while it circulates *qi*—life force energy—through the body; many participants had mentioned stiffness of the joints from the medication.
Tibetan White Crane Tai Chi	Is a temple form of tai chi as opposed to the family style such as *yang* or *chen*. As the name implies, it is generally taught in the temples directly by word of mouth from the master to the disciple. The Tibetan White Crane form in tai chi emphasizes the white crane's movements of balance and gracefulness, while it increases the movement of or circulates the qi or internal energy.

sion level of the participants while the FACIT-Fatigue was implemented to measure the fatigue of participants. Additional outcome measures included the Functional Assessment of Cancer Therapy/Gynecologic Oncology Group–Neurotoxicity (FACT-GOG-Ntx) to assess neurotoxicity[29] and the Functional Assessment of Chronic Illness Therapy–Spiritual Well-being Scale (FACIT-Sp) to assess spiritual well-being.[30]

Participants' Functional Outcomes. Researchers who were trained physical therapists evaluated participants using the functional reach (FR) and sit-and-reach (SR) tests. The FR and SR have been used previously in clinical trials of yoga for osteoarthritis[22] and breast cancer[11,23] and were sensitive to functional changes over time. In the current study, the FR and SR were used to quantify balance and flexibility, respectively. The FR has been shown to possess predictive validity for falls[24] and has demonstrated strong reliability and validity for measuring postural control in reaching forward during standing.[25]

The research team also examined participants' functional abilities with several other tests. The Berg Balance Scale (BBS) is considered the standard of functional balance tests.[26] It measures a person's balance during given activities of daily living and can provide a prediction for a fall risk.[27] The timed up-and-go (TUG) is a standardized test that measures physical function with the person being measured changing from sitting to standing, walking a specified distance, and returning to a seated position.[28] Both tests can be used to track changes in balance performance over time.

Qualitative Data Collection and Analyses. Participants were given a notebook with five guiding questions and various tai chi home-practice options. Participants completed journal entries after each tai chi session and home exercise program, and the research team collected them at the end of the study. The five questions that the current study used had been employed in previous yoga research[11] and were established by two qualitative researchers. They requested that participants (1) identify the greatest benefit from the tai chi session; (2) indicate the greatest challenge from the session; (3) describe the way in which joint pain/stiffness had changed—improved or worsened—since the last session; (4) describe the benefits of the home tai chi program; and (5) indicate the driving force that brought them to each session.

Participants were encouraged to maintain the normal activities of daily living, refrain from other types of exercise for the duration of the study, and contact the researchers if any questions or problems arose. Weekly phone calls were made by members of the research team to ensure consistency of attendance and to address any issues that might have emerged in the course of the interventions. Each researcher was assigned to a participant to establish a relationship and maintain continuity throughout the 8-week intervention. Journals were read by each of four researchers, and they assigned codes to relevant portions of the text. The process was iterative, and code categories were revised, expanded, and created as research progressed. Thus, the qualitative data recorded from the weekly phone calls was entered into a standard form. After all members of the research team had read the journals in detail twice, they identified, coded, and triangulated the main themes. Quotations corresponding to the main themes were entered into Microsoft Excel (Microsoft Inc, Redmond, WA, USA) to create tables identifying the themes.

STATISTICAL ANALYSES

SPSS version 19.0 (SPSS Inc, Chicago, IL, USA) was used to analyze descriptive and paired *t* test statistics for patient-reported outcomes (PROs) and functional measures. Trends and standard deviations were included to ascertain small changes over time. *Last observation carried forward* was implemented for three participants who experienced changes

Table 2. Demographic and Clinical Information (N = 12)

Characteristic	Participants
Median Age, y, minimum–maximum	59 (49-76)
Race, n (%)	
White	11 (91.6%)
Black	1 (8.4%)
Employment, n (%)	
Full-time	4 (33.33%)
Part-time	2 (16.67%)
Currently unemployed	6 (50%)
Education, n (%)	
High school or less	1 (8.33%)
Some college	7 (58.33%)
College degree	1 (8.33%)
Graduate/postprofessional	3 (25%)
Tobacco History, n (%)	
Never smoked	6 (50%)
Quit <10 y ago	3 (25%)
Quit >10 y ago	2 (16.67%)
Current smoker	1 (8.33%)
Breast Cancer Diagnosis, n (%)	
Stage I	6 (50%)
Stage II	3 (25%)
Stage III	1 (8.33%)
Not available	2 (16.67%)
Chemotherapy Rx, n (%)	
Yes	8 (66.67%)
No	4 (33.33%)
Radiation Rx, n (%)	
Yes	10 (83.33%)
No	2 (16.67%)
Surgical Intervention, n (%)	
Mastectomy	1 (8.33%)
+Axillary/sentinel node	3 (25%)
Lumpectomy	2 (16.67%)
+Axillary/sentinel node	6 (50%)
Reconstructive Surgery, n (%)	
Yes	3 (25%)
No	9 (75%)

in health status that precluded them from continuing in the study's final week.

RESULTS

Feasibility of Recruitment and Retention

Local advertisements and referrals from cancer centers yielded 20 interested BCSs. Eight women were ineligible because they had (1) a primary diagnosis of osteoarthritis, (2) recently discontinued AI, or (3) previous orthopedic complications related to the lower back or to a lower extremity with a recent knee injection. Twelve women met the criteria and enrolled. Demographic and clinical outcome data are noted in Table 2.

The women ranged from age 49 to 76, with a mean age of 59. Eleven of the women were non-Hispanic white (91.6%) and one was black (8.4%). Four were working full-time (33.33%) and two part-time (16.67%). All but one woman (8.33%) had attended at least some college. Out of the 16 tai chi sessions, seven women attended 75% to 100% of the sessions; one woman attended 50% to 74% of the sessions; three women attended 25% to 49% of the sessions; and one woman attended 24% of the sessions. Nine of the 12 enrolled women finished the full 8-week study, and all 12 women were included in the analysis.

Preliminary Safety

No woman experienced an adverse event as a result of the tai chi intervention. However, two events did complicate full participation in the study. During week 8 of the study, one woman with a prior history of a meniscus tear experienced another tear outside of the study during her activities of daily living. Another participant experienced a recurrence of cancer that led to her withdrawal from the study. It is important to note that four participants with lymphedema experienced no exacerbation of their symptoms during the group or home-based tai chi, per the participants' reports and the research team's observations.

Quantitative Findings

PROs revealed a significant reduction in anxiety, from 8.00 to 5.67 ($P = .003$), and depression, from 5.17 to 2.42 ($P = .020$). The emotional well-being subscale of the FACT-B also improved significantly, from 18.42 to 20.88 ($P = .027$), and perceived fatigue showed a significant decrease, from 30.92 to 37.33 ($P = .030$). A significant improvement also occurred in the functional outcome of SR ($P = .016$). While not statistically significant, the following PROs and functional measures showed positive trends: (1) pain severity ($P = .058$), (2) the physical well-being subscale of the FACT-B ($P = .052$), (3) the meaning/peace subscale of the FACIT-Sp ($P = .074$), (4) the BBS ($P = .090$), and (5) TUG ($P = .241$). See Table 3.

Qualitative Findings

The four members of the research team who had read the journals compared each code category to establish good intrarater reliability ($\kappa = 80\%$) within the recurring themes. No outliers or insignificant themes were found, and the group came to a consensus on each identified theme. The investigators' notes, taken during the weekly phone calls, were reviewed by the team for any additional relevant information and confirmatory statements. A member check was performed to enhance the internal validity of the results. The ability to triangulate with journals, weekly phone calls, and observations of the tai chi instructor and the research team further confirmed the findings.

Theme 1: Improved Relaxation and Stress Reduction. All participants found that they were more relaxed and calm throughout each session, with the change starting immediately after the first week of the intervention. Stress levels decreased and relaxation increased as a result of the deep-

Table 3. Change in Self-reported and Functional Performance Outcomes

Measure	Baseline Mean (SD)	Wk 8 Mean (SD)	*P* Value
BPI: Severity Subscale	4.19 (1.266)	3.15 (1.710)	.058
BPI: Intensity Subscale	3.46 (1.847)	2.58 (2.214)	.141
HADS: Anxiety Subscale	8.00 (3.247)	5.67 (3.576)	.003[a]
HADS: Depression Subscale	5.17 (3.215)	2.42 (1.730)	.020[a]
FACT-B: Physical Well-Being	17.42 (4.502)	20.48 (3.558)	.052
FACT-B: Social/Family Well-Being	24.42 (4.188)	24.92 (3.088)	.660
FACT-B: Emotional Well-Being	18.42 (4.719)	20.88 (2.490)	.027[a]
FACT-B: Functional Well-Being	20.67 (3.447)	21.83 (2.517)	.223
FACT-B: Breast Cancer Subscale	21.83 (7.506)	22.65 (5.218)	.713
FACT-B Total	102.75 (16.592)	110.76 (10.122)	.115
FACIT-Fatigue	30.92 (9.568)	37.33 (7.402)	.030[a]
FACIT-Sp: Meaning/Peace	25.75 (4.901)	28.67 (2.839)	.074
FACIT-Sp: Faith	13.58 (2.746)	13.58 (3.315)	1.000
SR	16.92 (11.87)	20.62 (9.08)	.016[a]
FR	12.63 (6.10)	14.44 (4.95)	.229
BBS	53.58 (4.32)	55.92 (0.28)	.090
TUG	8.90 (3.67)	7.72 (2.04)	.241

[a]Denotes significance at $P < .05$.

Abbreviations: BPI = Brief Pain Inventory; HADS = Hospital Anxiety and Depression Scale; FACT-B = Functional Assessment of Cancer Therapy–Breast; FACIT-Fatigue = Functional Assessment of Chronic Illness Therapy–Fatigue; FACIT-Sp = Functional Assessment of Chronic Illness Therapy–Spiritual Well-Being; TUG = timed up-and-go; SR = sit-and-reach; FR = functional reach; BBS = Berg Balance Scale.

breathing training taught in the sessions. Most participants felt calm following tai chi and noticed an overall increase in serenity with continued practice in learning the tai chi form. Their stress levels had decreased, and the motivation to participate in various daily activities increased.

Quotations: "(I'm) feeling peaceful from the first moment."; "I am breathing slowly in stressful situations."; "I feel calmer and energized."

Theme 2: Increased, Undisturbed Sleep. With the exception of two women, all participants reported an increase in the quantity and quality of their sleep. They found that their ability to sleep without the interruption of pain increased with continued attendance at the tai chi sessions. Notably, the participants who did not have a positive change in their sleeping habits were those who missed a few sessions and/or were not consistent with their home exercises.

Quotations: " … (I) noticed I am sleeping through the night. I had been waking (up) with hip pain 3 to 4 times a night."; "I am sleeping better and dreaming, which I don't normally do."; "Tai chi has not only kept my joints flowing nicely, but I am sleeping better."

Theme 3: Value in Group and Instructor Support. All the women found the tai chi instructor to be patient and understanding. He took the time to explain each tai chi movement. The form was divided into movement parts, and he did not continue with the next part until he was sure everyone understood the previous forms. With the exception of one individual, camaraderie existed among the women. This solidarity enabled them to discuss their personal challenges with other BCSs who were enduring similar experiences and side effects from treatment. The woman who was the exception found the group dynamic intrusive because she preferred to come to sessions to forget her problems and not dwell on them. Overall, the bonding opportunity and uplifting atmosphere enlightened the journey these women experienced. Tai chi helped them find a connection, which improved QOL.

Quotations: "I really enjoy the calmness of the instructor and how gentle he is working with us."; "He never makes any of us feel less of ourselves."; "The bond has been built between him and all of us because we can all laugh together."; "The peace and relaxation and camaraderie of classmates (is helpful)."

Common journal themes focused on pain perspectives, sleep enhancement, stress-reduction levels, social camaraderie and support of the class, and overall improvement in QOL. Pain and stiffness improved in half of the study's participants while the other half noticed no perceived changes. A few cases of minor relapses of pain occurred, and this incidence typically occurred in the weeks when a woman missed at least one class or was not consistent in her home exercises. The inconsistencies transpired due to busy schedules, difficult days, and lack of energy. Due to the positive experiences of this cohort, most of the women continued taking tai chi after the 8-week commitment.

DISCUSSION

In the current study, the research team demonstrated the feasibility and preliminary safety of a tai chi intervention

for improving well-being among BCSs who experienced AIAA. The team found that tai chi could reduce anxiety/depression, decrease fatigue, and improve emotional well-being, and promising trends could be seen in functional outcomes. Qualitative findings indicated that relaxation, the experience of group support, and enhanced sleep could potentially have facilitated the quantitative change in outcomes seen in the study. Tai chi was well-tolerated, and no adverse events occurred as a result of the intervention.

The arthralgias associated with the use of AI can cause debilitating pain, which limits functional range of motion (ROM) and decreases QOL. With nearly 25% to 50.8% of BCSs on AI reporting joint pain,[2,3] the current study contributes to nonpharmacological options to improve QOL and decrease joint pain. A limited number of research studies with BCSs have shown improvements in balance[13] with tai chi, and the current study showed positive trends in this area, as measured by the BBS and the TUG tests. While tai chi has been shown to reduce knee pain and improve QOL for those with osteoarthritis, the current research team did not find a significant difference on the BPI, which may be due to a small sample size; however, the effect size in pain-severity reduction was modest (about 25%). The research team found a significantly improved PROs, including reduced anxiety, depression, and fatigue, which is consistent with other published studies with BCSs.[14,17] The difference between the current study and other published studies is that the current research team studied BCSs with specific joint pain while other studies worked with the general breast-cancer population. Lastly, the improved trends in functional outcomes may hold particular clinical relevance for this population because all women age in the context of profound estrogen deprivation.

A number of potential pathways exist by which tai chi could have a beneficial effect on BCSs experiencing AIAA. First, a recent Cochrane systematic review indicated that exercise and mind-body interventions for BCSs may have beneficial effects on QOL and certain PROs, including body image/self-esteem, emotional well-being, sexuality, sleep disturbance, social functioning, anxiety, fatigue, and pain at varying follow-up periods.[31] Another recent systematic review highlighted the methodological limitations of existing tai chi studies in the population of BCSs; they were poorly controlled and had heterogeneous outcomes and the risk of bias was high. Benefits were shown for improvements in QOL, fat mass, bone formation, aerobic capacity, shoulder ROM, and self-esteem. The three small, nonrandomized, controlled clinical trials included in this review did show favorable effects in psychological and physical outcomes. These results emphasize the need for future large, randomized, controlled studies to evaluate the effect of tai chi definitively in this population.

Approaches to mind-body movement therapy have been shown to modify various side effects of treatment for BCSs,[11,12] including regulation of inflammatory responses and other biomarkers.[32] Physical activity, including tai chi, increases the amount of endorphins in the brain and improves neuropsychological functioning.[33] Tai chi produces invigorating effects on mental and physical energy that are similar to some of the effects of aerobic exercise and that thereby may improve sleep and fatigue[31] associated with pain. Because of the weight bearing, relaxing, and strengthening aspects of tai chi, it may have positive effects on QOL and, possibly, bone mineral density in menopausal women[34] and osteoporosis.[13,35] With improvements in these areas that are germane to BCSs, function may improve.

Second, studies have demonstrated that tai chi reduces stress[16] through mindfulness, movement, and breathing techniques, which have been found to be effective in increasing energy and decreasing pain.[36] The practice has positive effects on management of symptoms for BCSs,[14,17] including improved psychological well-being through reduction in anxiety, depression, and stress.[15,23,37] Previous studies have shown that activation of the mind-body relationship and group support increases QOL in BC survivors.[38] In the current study, the women found that the camaraderie was very helpful, which in turn reduced stress and increased the perception of a higher QOL. Furthermore, the qualitative results demonstrate the impact for BCSs of having an understanding and dedicated tai chi instructor who created a stress-free environment. The current tai chi study contributes to the findings of improved PROs by women living with AIAA symptoms from treatment of breast cancer.

Third, tai chi places an emphasis on body awareness and an enhanced sense of self and well-being. Active engagement between the mind and the body encourages the mind to focus on what is occurring in the body and where the body is in space. Both awareness and proprioception improve muscle strength and endurance, flexibility, and cardiopulmonary endurance. Tai chi fosters the body moving as a whole unit, and it is this consistent, whole-unit practice of dynamic stabilization that increases overall lissomness of the body. Practitioners perform many repetitive movements within this consistent practice. Research has shown that repetitious movement encourages serotonin neuron activity that has been linked to an improved mood, better sleep, and greater health.[39] Thus, the mind-body practice of tai chi in this pilot study show several parameters of improved QOL. Taken together, increases in relaxation, stress reduction, and improved flexibility and function allow tai chi to have a beneficial impact on survivors experiencing AIAA.

Limitations

The study had several limitations. A single-arm, mixed-methods study, it was conducted to evaluate issues that would be important in the design of a study to examine the effects of tai chi on AIAA. The sample size of this pilot study was not intended to provide an efficacy analysis but rather to obtain an estimate of the effect size and variance necessary to plan a definitive study to test and refine individual components of the tai chi protocol for AIAA and measurement tools.

The lack of a control group negates the ability to conclude that findings were due to placebo or regression to the

mean effect. Furthermore, the team did not measure long-term follow-up data beyond 8 weeks to determine the sustainability of the structured sessions and a home-based tai chi program. Long-term follow-up is important when considering the long-term use of AI and the management of musculoskeletal pain. Any number of the activities related to group interaction, which occurred in the tai chi class, may have played a role in the overall improvement of the participants through nonspecific effects. The research team recommended a daily dose of 10 to 20 minutes twice per day for the home exercise program that it provided to participants but did not measure the home programs' frequency or intensity, which could have had a direct impact on the treatment outcomes.

CONCLUSION

In summary, the current pilot study established the feasibility of using tai chi to improve symptoms, functions, and well-being among women with AI-related arthralgia. Because AIAA is a relatively new clinical phenomenon and very few intervention studies have been performed to address this clinical problem, the research team believes that its efforts are an important first step in demonstrating the feasibility of rigorous evaluation of tai chi for this indication. The qualitative data provided information on specific domains that may directly or indirectly impact AIAA. Future randomized controlled trials (RTCs) are needed to establish the comparative efficacy of tai chi to improve outcomes related to AIAA, a clinical problem affecting hundreds of thousands of BCSs.

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