Tai Chi and Rheumatic Diseases

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Tai chi, a traditional Chinese mind-body exercise, has recently grown in popularity in the United States. According to the 2007 National Health Interview Survey, around 2.5 million Americans have practiced tai chi for health and this number is increasing. Furthermore, individuals with musculoskeletal conditions are more likely to practice tai chi. It is clear that patients with rheumatic disease are interested in seeking this type of complementary and alternative treatment. Thus, it is important to examine evidence-based tai chi mind-body medicine to provide clinicians with an overview of these new sources of knowledge for the best care of rheumatic patients.

As an original Chinese martial art, tai chi has been practiced in China for many centuries. It combines deep diaphragmatic breathing and relaxation with many fundamental postures that flow imperceptibly and smoothly from one to the other through slow, gentle, graceful movements. It has been considered a complex multicomponent intervention integrating physical, psychosocial, emotional, spiritual, and behavioral elements and promoting the mind-body interaction. Tai chi evolved into many different styles during its development, including Chen style, Wu style, Sun style, Yang style (classical long form style of 108 postures or simplified style of 24 postures), and other modified styles. Tai chi can be practiced in almost any setting because it requires no equipment and a minimal amount of space.

In the past 2 decades, the potential therapeutic benefits of tai chi for chronic conditions have been consistently recognized in the literature. Significant improvement has
been reported in balance, strength, flexibility, cardiovascular and respiratory function, mood, depression and anxiety, self-efficacy, pain reduction, and health-related quality of life in diverse eastern and western populations. Several recent reviews have further suggested that tai chi seems to improve a variety of medical conditions.

This article encompasses scientific evidence on the therapeutic benefits of tai chi for several major rheumatic disorders such as osteoarthritis (OA), rheumatoid arthritis (RA), and fibromyalgia (FM). The role of tai chi on associated conditions including neuromuscular abnormalities, cardiovascular disease, osteoporosis, depression, and sleep disturbance is also briefly reviewed.

**TAI CHI AND OA**

OA, the most prevalent joint disorder, is an increasing problem in the elderly, resulting in chronic pain, functional limitation, reduced quality of life, and substantial health care costs worldwide. The pathophysiological basis of OA is multifaceted and includes impaired muscle function, reduced proprioceptive acuity, and the psychological traits of chronic pain. Symptomatic OA is the most frequent cause of dependency in lower limb tasks, with substantial physical and psychosocial disability. Few effective disease-modifying remedies for OA currently exist. Nonsteroidal antiinflammatory drugs (NSAIDs) and acetaminophen, the most widely used therapeutic agents, relieve pain levels by about 20% and carry a hidden cost of serious adverse events in the elderly. Furthermore, recent evidence indicates that arthroscopic surgery for knee OA provides no additional benefits over optimized physical and medical therapy. Recommended core treatments for OA include physical therapy, such as aerobic and muscle strengthening exercises, but current data suggest that these treatments have modest benefits for pain and physical function, have substantial costs, and may not affect psychological outcomes. In addition, reduced activity levels caused by OA result in poor aerobic capacity and increased risk for cardiovascular disease, obesity, and other inactivity-related conditions.

As a complementary mind-body approach, tai chi may be an especially applicable treatment of older adults with OA. The physical component provides exercise consistent with current recommendations for OA (muscle strength, balance, flexibility, and aerobic cardiovascular exercise), and the mental component could address the chronic pain state through effects on psychological well-being, life satisfaction, and perceptions of health. These effects may reduce pain, improve function, and retard disease progression and disability associated with OA.

Several randomized controlled studies have examined the effects of tai chi on symptomatic OA. Hartman and colleagues were among the first to conduct a prospective randomized controlled clinical trial to test the efficacy of practicing 12 weeks of tai chi in patients with OA. A total of 35 community-dwelling participants were randomly assigned to receive either two 1-hour tai chi classes per week for 12 weeks (a 9 form Yang style) or a control group that received usual physical activities and routine care. The results of tai chi training significantly improved arthritis symptoms, arthritis self-efficacy, level of tension, and satisfaction with general health status. In another study, Song and colleagues reported that among 72 patients with OA, patients performing 12 forms of Sun-style tai chi over 12 weeks perceived significantly less pain and stiffness than patients receiving routine treatment. In addition, physical functioning, balance, and abdominal muscle strength were significantly improved in the tai chi group.

In a 3-armed randomized clinical trial of 152 older patients with chronic symptomatic hip and knee OA, Fransen and colleagues found that when compared with a waiting list control group, both 12-week tai chi and hydrotherapy classes provided
large and sustained improvements in physical function. All significant improvements were sustained at 24 weeks. In a study by Brismee and colleagues, a 6-week group tai chi program followed by 6 weeks of home tai chi training showed significant improvement in knee pain and physical function compared with an attention control in 41 elderly patients with knee OA; however, the benefits for knee pain (visual analog scale) and the Western Ontario and McMaster Universities (WOMAC) OA overall scores were not sustained throughout the follow-up detraining period (weeks 13–18).

The author’s research group has recently conducted a single-blind randomized controlled trial testing the effectiveness of tai chi training in the treatment of knee OA symptoms in the elderly. Forty eligible individuals (aged 55 years or more; with body mass index [calculated as the weight in kilograms divided by height in meters squared] ≤40 kg/m²; with knee pain visual analog scale >40 [range, 0–100]; fulfillment of the American College of Rheumatology [ACR] criteria for knee OA; with radiographic Kellgren and Lawrence grade ≥2) were randomly assigned to 60 minutes of tai chi training (10 modified forms from classical Yang style) or an attention control (stretching and wellness education) twice weekly for 12 weeks. The outcomes of the WOMAC OA pain score, WOMAC function, patient and physician global assessments, timed chair stand, depression index, self-efficacy scale, and health-related quality of life were assessed at baseline, 12, 24, and 48 weeks. The results showed that participants in the tai chi arm exhibited significantly greater improvements in pain, physical function, depression, self-efficacy, and health status compared with the controls. Patients who continued tai chi practice after 12 weeks reported durable benefits in pain and function.

Another recent randomized controlled trial of 82 women with OA suggested that 6 months of 31 forms of Sun-style tai chi with qigong breathing exercise significantly improved knee extensor endurance and bone mineral density (BMD) and decreased patients’ fear of falling when compared with a self-help education program. Similar positive findings of short- and long-term tai chi have been well documented on balance control, flexibility, muscular strength, and endurance in the elderly, which have important benefits for patients with symptomatic OA.

Neurologic deficits, especially quadriceps sensory dysfunction (ie, decreased proprioceptive acuity) may precede clinically evident OA and are proposed to be a factor in its pathogenesis and progression. Studies examining the effect of knee joint proprioception and neuromuscular activities have largely focused on older adults with long-term tai chi practice. Tsang and Hui-Chan reported a longitudinal study comparing the knee joint proprioception of 21 elderly individuals who practiced tai chi for at least 3 years compared with 21 non–tai chi practicing controls. Using the passive knee joint repositioning test, the tai chi practitioners had better knee joint proprioceptive acuity (less absolute angle errors than controls). This research group further examined knee joint proprioception in 68 elderly subjects who practiced tai chi regularly for at least 4 years, long-term swimming-running exercisers, and sedentary controls. The tai chi practitioners showed significantly better knee joint proprioception than the other 2 groups. In addition, the threshold for detection of passive motion improved in knee flexion and extension in the tai chi group. Moreover, in a cross-sectional study of 61 elderly individuals consisting of long-term tai chi practitioners, regular joggers, and sedentary counterparts, Xu and colleagues found that when compared with a sedentary control, tai chi and jogging groups had significant improvements in the neuromuscular reaction. Despite limited observational evidence, these results generally support that long-term tai chi practice leads to better knee joint proprioceptive acuity and neuromuscular activities in the older population.

In summary, the pathophysiological basis of OA is complex and multifaceted, and symptomatic OA is diverse and heterogeneous. Tai chi exercise, as a multicomponent...
mind-body intervention, may modulate complex factors and improve health outcomes in OA. The evidence reviewed in this article are promising and suggest that tai chi training may provide an ideal form of exercise for older individuals with OA, suffering from pain and poor function. As a form of physical exercise, tai chi may enhance cardiovascular function, muscular strengthening, proprioceptive acuity, neuromuscular activities, and integration of the mind and body, thereby reducing pain. Stronger muscles and better balance coordination can also improve the stability of joints and physical function. Increased periarticular muscle strength may protect joints from traumatic impacts. Improving self-efficacy, social function, and depression can help people build confidence, get support, and overcome fears of pain, leading to improved physical, psychological, and psychosocial well-being and overall quality of life.40–42

TAI CHI AND RA

Treatment of RA, a systemic, diverse, and dynamic disorder, has made major progress over the past few decades. Early active treatment with disease-modifying antirheumatic drugs and biologic agents can be highly beneficial for controlling inflammatory activity and preventing disability in many patients.43 However, the most effective new drugs can be too expensive and many patients with RA continue to suffer from pain, restricted mobility, reduced muscle strength, and low endurance. In addition, it is increasingly recognized that comorbid conditions play a pivotal role in RA outcomes. For example, cardiovascular complications are the leading contributor to mortality in RA,44 accounting for approximately one half of all deaths,45 and osteoporosis resulting in bone fractures represents a major source of morbidity in RA.46 Indeed, lifestyle behavioral modification is considered to be critical in preventing RA-associated comorbidities and their complications.47 Tai chi exercise may be beneficial to patients with RA because of its effects on muscle strength, stress reduction, and cardiovascular and bone health, as well as improved health-related quality of life.

One early publication by Kirsteins and colleagues48 reported on 2 nonrandomized controlled trials of 47 and 28 patients with RA with 10 weeks of tai chi training. Disease activity (joint tenderness, number of swollen joints), time taken to walk 50 ft, handgrip strength and a written functional assessment, and exacerbation of joint symptoms were measured. The studies showed that tai chi seems to be safe for patients with RA and may serve as a suitable weight-bearing exercise with the additional potential advantages of stimulating bone growth and strengthening connective tissue.

A Korean randomized controlled study of 31 patients reported by Lee49 showed that when compared with a usual care group, 6-week tai chi training significantly improved mood and sleep disturbance. Another Korean randomized controlled trial of 61 patients showed that 50 minutes per week of tai chi training for 12 weeks significantly decreased pain and fatigue compared with usual care controls.50

To obtain preliminary data on the effects of tai chi on RA, the author’s research group conducted a pilot randomized controlled trial.51 Twenty patients with functional class I or II RA and mean disease duration of 14.5 years were randomly assigned to tai chi or attention control in twice-weekly sessions for 12 weeks. Patients continued to intake routine medications such as NSAIDS, corticosteroids, and disease-modifying antirheumatic drugs and maintained treatment visits with their primary care physician and rheumatologist throughout the conduct of the study. The ACR20 response criterion, functional capacity, health-related quality of life, and the depression index were assessed. At 12 weeks, 5 of 10 patients (50%) randomized to tai chi achieved an ACR 20% response compared with none (0%) in the control (P = .03). Tai chi had greater improvement in the disability index (P = .01), vitality subscale of the
36-Item Short Form Health Survey (SF-36) \( (P = .01) \), and the depression index \( (P = .003) \). Similar trends to improvement were also observed for disease activity, functional capacity, and health-related quality of life. No adverse events were observed and no patients withdrew from the study, suggesting that tai chi is safe and may be beneficial for functional class I or II RA.

A subsequent study of tai chi in patients with RA by Uhlig and colleagues,\(^5,2\) however, produced inconsistent results. In a before and after comparison study involving 15 female patients with RA aged 40 to 70 years, participating in an 8-week tai chi training, no improvements were seen in disease activity, muscle strength, flexibility, balance, and health status despite the fact that the study suggested that tai chi was a safe and feasible exercise for RA. The same group of investigators using the similar study design for another 15 patients found that a 12-week tai chi program improved lower limb muscle function and endurance at the end of 12 weeks.\(^5,3\) A Cochrane review examined the evidence of 4 clinical trials in 206 participants, and only 2 of them exclusively included tai chi from nonrandomized controlled trials by Kirsteins and colleagues.\(^4,8\) The other 2 trials were using multicomponent programs that include combinations of exercise and tai chi.\(^5,4,5,5\) The review suggested that tai chi does not exacerbate symptoms of RA and has statistically significant benefits on lower extremity range of motion for people with RA, with ankle range of motion in particular.\(^5,6\)

As a chronic disorder characterized by inflammation leading to joint destruction, RA has clinically important comorbidities, including cardiovascular complications and osteoporosis. Numerous studies have evaluated the effects of tai chi on cardiovascular and respiratory function.\(^5,7,6,1\) Since 1979, results related to the effect of tai chi on cardiovascular and pulmonary function have been reported in 43 eastern and western publications.\(^4,8,6,2\) Among them, one study\(^6,3\) reported that the metabolic intensity of the activity seems insufficient to improve cardiorespiratory fitness in healthy young adults. Yet, other studies suggested that regular tai chi practice may preserve cardiorespiratory function in older individuals and may be prescribed as a suitable exercise for older adults. Recent systematic reviews of the literature have shown that tai chi can reduce blood pressure and increase cardiovascular exercise capacity.\(^8,6,2\) Thus, encouraging evidence suggests that tai chi may be a safe and beneficial adjunctive therapy to conventional care for patients with RA-associated cardiovascular disease and RA complications. Several large ongoing trials studying tai chi for patients with cardiac conditions will provide more information on the role of tai chi’s benefits and mechanisms in the prevention and management of cardiovascular disease.

Evidence from several recent randomized controlled trials and observational studies have evaluated the potential beneficial effects of tai chi for osteoporosis, another common RA-associated comorbidity. In a recent randomized trial comparing 3 times per week tai chi or resistance exercise with a no-intervention control in 180 community-living elders, Woo and colleagues\(^6,4\) reported that both tai chi and resistance exercise had less BMD loss at total hip after 12 months than the no-intervention controls. In a second randomized trial among 28 sedentary elderly adults, Shen and colleagues\(^6,5\) compared the effects of tai chi and resistance training and found that treatment with 3 sessions per week of 24-week tai chi increased serum bone-specific alkaline phosphatase and parathyroid hormone levels compared with resistance training after 6 or 12 weeks. Results also revealed a reduction of the urinary calcium level with tai chi at 24 weeks and suggested that tai chi is beneficial for increased bone formation in the elderly. A longitudinal randomized prospective trial also showed that 12 months of 108 form tai chi slowed bone loss in weight-bearing bones in 132 healthy
postmenopausal women compared with sedentary controls. Among early postmeno-
opausal Chinese women in Hong Kong, Qin and colleagues demonstrated that tai chi practitioners with more than 4 years experience had significantly higher BMD in the lumbar spine, proximal femur, and distal tibia than sedentary controls. They also demonstrated that regular long-term tai chi practice was associated with higher BMD and better neuromuscular function.

In summary, as a complex immunologically mediated disorder, RA is still a therapeutically challenging chronic condition to control. Emerging evidence from clinical trials reviewed in this article support the concept that the development of better lifestyle-modifying strategies, such as tai chi, could affect the progression of disease and decrease morbidity among individuals with RA. Although existing evidence regarding tai chi on RA remain limited and inconclusive, these promising results suggest that tai chi may be a safe adjunctive therapy for RA and warrants further investigation.

TAI CHI AND FM

FM is a complex disorder characterized by widespread musculoskeletal pain, sleep disturbances, functional limitations, and poor quality of life that can be best managed with multidisciplinary therapies. Pharmacologic therapies that are currently available for the treatment of FM are associated with numerous limitations, including side effects and addiction and tolerance issues, and patients are often left with unrelieved pain. Nonpharmacologic approaches, including educational and exercise programs, have a role in pain management, but data from clinical trials on the use of these treatment modalities and knowledge of how to best incorporate them into the clinical care of patients are limited.

Recent research testing tai chi mind-body interventions has found considerable benefits for patients with FM. One nonrandomized study of tai chi in 39 individuals with FM suggested that 6 weeks of 1-hour twice-weekly tai chi exercise led to statistically significant improvement in FM symptom management and health-related quality of life. The author’s group recently conducted a single-blind randomized controlled trial of classical Yang-style tai chi versus a control intervention consisting of wellness education and stretching for the treatment of FM (defined by the ACR 1990 criteria). Each session lasted 60 minutes and took place twice a week for 12 weeks for each of the study groups. The primary end point was a change in the FM impact questionnaire (FIQ) score (range, 0–100; with higher scores indicating more severe symptoms) at the end of 12 weeks. Secondary end points included patient and physician global assessments, sleep quality, 6-minute walk time, depression, chronic pain, self-efficacy, and summary scores on the physical and mental components of the Medical Outcomes Study SF-36. All assessments were repeated at 24 weeks to test the durability of the response. The study found that when compared with the control group, the 33 patients in the tai chi group had clinically important improvement in the FIQ score and in the measure used to assess pain, sleep quality, depression, and quality of life. Improvements were maintained at 24 weeks. No adverse events were reported in the study participants. Notably, more subjects had discontinued medication use for FM in the tai chi group than in the control group, although the difference was not significant (11 of 31 patients vs 4 of 26, respectively; P = .09). Both studies suggested that tai chi may be a useful treatment in the multidisciplinary management of this therapeutically challenging disorder. Similar positive findings were reported in several clinical trials supporting the benefits of other forms of mind-body practice or group exercise, such as qigong, for symptom management in FM.
Effect of Tai Chi on Psychological Health

Chronic pain in FM is commonly accompanied by psychosocial stress, anxiety, and depression. Therapeutic approaches with psychological and behavioral effects, such as tai chi mind-body therapy, could better patients’ emotional health outcomes. The author’s group systematically reviewed the evidence of the effects of tai chi on stress, anxiety, depression, and mood disturbance in various eastern and western populations. Specifically, the results of 33 randomized and nonrandomized trials suggest that regular tai chi practice is significantly associated with improvements in psychological well-being, including reduced stress (effect size, 0.66; 95% confidence interval [CI], 0.23–1.09), anxiety (effect size, 0.66; 95% CI, 0.29–1.03), depression (effect size, 0.56; 95% CI, 0.31–0.80), and mood disturbance (effect size, 0.45; 95% CI, 0.20–0.69) in healthy participants and patients with chronic conditions (Fig. 1).

Seven observational studies with relatively large sample sizes reinforced the beneficial association between tai chi practice and psychological health. Notably, the review found that tai chi tends to reduce depression compared with various controls among healthy adults; individuals with OA, RA, FM, depression disorders; sedentary obese women; and elderly participants with cardiovascular disease risk factors. This positive result was associated with improvement in symptoms and physical function in patients with OA, FM, RA, and multiple sclerosis. Interestingly, the benefits were also associated with an improvement in the immune response, with 50% improvement in varicella-zoster virus–specific cell-mediated immunity (T cell–dependent response) after 15 and 25 weeks of tai chi in healthy elderly Americans.

However, the vast majority of the studies have less rigorous designs and were conducted on healthy populations, with only 2 studies reporting results on participants diagnosed with clinical depression. Nevertheless, the potential mental health benefits of tai chi mind-body therapy support its inclusion as a key component of a multidisciplinary medical approach to promote psychological health, treat chronic pain, and better inform clinical decision making for FM.

Effect of Tai Chi on Sleep Quality

Sleep disturbances are common in FM, and patients may derive greater benefits from mind-body interventions to improve sleep quality and reduce pain and fatigue. Several randomized controlled studies have investigated the efficacy of tai chi interventions for sleep quality. Li and colleagues randomized 118 older people with moderate sleep disturbance into 1-hour thrice-weekly sessions of tai chi or low-impact exercise for 24 weeks. Tai chi participants reported significant improvements in Pittsburgh Sleep Quality Index global scores and subscores (sleep quality, sleep-onset latency, sleep duration, sleep efficiency, and sleep disturbances) in comparison with the low-impact exercise control group. The study concluded that tai chi seems to be effective as a nonpharmacologic approach for sleep-disturbed elderly individuals. A second randomized controlled trial was reported by Irwin and colleagues on 112 healthy older adults who were randomly assigned to 16 weeks of tai chi training or health education followed by practice and assessment 9 weeks later. The main outcome measure was sleep quality, as assessed by the Pittsburgh Sleep Quality Index. Among adults with moderate sleep disturbance, subjects in the tai chi group showed significant improvements in Pittsburgh Sleep Quality Index global score (P<.001), as well as habitual sleep efficiency (P<.05), sleep duration (P<.01), and sleep disturbance (P<.01). In addition, Yeh and colleagues assessed the effects of a 12-week tai chi exercise program on sleep using the sleep spectrogram in a randomized controlled trial of 18 patients with chronic stable heart failure. Compared with the usual care.
Fig. 1. Effects of tai chi on stress, anxiety, depression, and mood outcomes (A–D). The magnitude of the effect size (Hedges’ g) (clinical effects) is indicated as 0 to 0.19, negligible effect; 0.20 to 0.49, small effect; 0.50 to 0.79, moderate effect; and 0.80+, large effect. N, number of participants; NRS, nonrandomized comparison study (all the meta-analyzed NRS are self-comparison studies); RCT, randomized controlled trial. aMcCain 2008, included only tai chi versus waiting list control (n = 119); Fransen 2007, included only tai chi versus control group (n = 97); Chen and Sun 1997, included only participants in tai chi group as pretreatment and posttreatment (n = 18); Sattin 2005, included only clinically depressed participants in tai chi and control arms (n = 43). bDechamps 2009, compared an active control with tai chi. (Adapted from Wang C, Bannuru R, Ramel, et al. Tai chi on psychological well-being: systematic review and meta-analysis. BMC Complement Altern Med 2010;10:23. [According to BioMed Central policy, the article permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.])
group, the tai chi group had significant improvements in sleep stability. Similarly, one observational study of 145 subjects reported that 1 to 14 years of tai chi practice significantly improved sleep and mood disturbance in elderly Chinese participants.89

**Practicing Tai Chi for Chronic Rheumatic Conditions**

Overall, despite limited data, previous works have demonstrated that tai chi, a traditional Chinese mind-body exercise, may be highly suited to the management of symptoms of common chronic rheumatic conditions by reducing pain and improving physical and psychological health and well-being. Scientific research is under way to learn more about how tai chi affects rheumatic diseases and for which conditions it may be helpful. For patients who like to practice tai chi to improve their health and well-being, health care providers need to discuss complementary and alternative practices to help ensure coordinated and safe care. There is no evidence to support that tai chi can be a replacement for conventional care or can postpone visiting a doctor about a medical problem. Also, there is no current standard training for instructors; therefore, providing patients with access to experienced tai chi instructors is essential.

**SUMMARY**

OA, RA, and FM consist of complex interplay between psychological and biologic aspects. Many patients with these chronic rheumatic illnesses experience high levels of pain and psychological distress that are incompletely relieved by current pharmacologic or physical interventions. Tai chi, a complex multicomponent mind-body therapy, may be particularly applicable for promoting overall quality of life for patients with these chronic rheumatic conditions.

Over the past 2 decades, clinical trials and observational studies have provided encouraging evidence that tai chi, both short- and long-term, has great benefits for patients with a variety of chronic conditions. As a form of physical exercise, tai chi enhances cardiovascular fitness, muscular strength, balance, coordination, and physical function. In addition, tai chi seems to be associated with improvements in psychological well-being including reduced stress, anxiety, depression, and mood disturbance and increased self-esteem. Thus, despite the noted limitations in the evidence, and the need for further methodologically rigorous studies, tai chi mind-body exercise can be safely recommended to patients with OA and FM as a primary form of treatment or as an adjective therapy for RA and its comorbidities to promote both physical and psychological well-being. Further exploring the mechanisms of successful mind-body medicine is important to better inform clinical decision making for rheumatic patients.

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