

Review

# Effects of Tai Chi for Patients with Knee Osteoarthritis: A Systematic Review

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**Abstract.** [Purpose] The aim of the present study was to seek evidence for the effectiveness of Tai Chi for patients with knee osteoarthritis (KOA). [Subjects and Methods] Systematic searches were conducted of the China Journals Full-text Database, Pubmed, Medline, Science Direct-Online Journals and CINAHL for studies published between 2000 and 2012. Studies were evaluated based on following inclusion criteria: 1) design: randomized control, clinical trial; 2) subjects: patients with a knee osteoarthritis diagnosis; 3) intervention: exercise involving Tai Chi; 4) studies published in English or Chinese. [Results] Six randomized control studies involving Tai Chi and knee osteoarthritis were found. [Conclusion] Tai Chi was an effective way of relieving pain and improving physical function. Further randomized controlled trials with large sample sizes and long training period are needed to compare groups who perform Tai Chi training with other groups who undergo other forms of physical exercise in order to confirm the efficacy of Tai Chi.

**Key words:** Tai Chi, Knee osteoarthritis, Degenerative arthritis

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## INTRODUCTION

Osteoarthritis (OA) is one of the most common joint diseases seen in the elderly. Its prevalence associates with aging and gender. According to the World Health Organization, OA is commonly regarded as the largest cause of functioning disability, and about 80% of people aged over 65 years show radiological symptoms of OA<sup>1, 2)</sup>. Researchers have reported that the knee joint is frequently prone to be affected, and the trend of knee osteoarthritis (KOA) is upward<sup>3)</sup>. In 2001, about 10% people older than 55 years showed clinical symptoms and approximately 25% of them had severe disability<sup>4)</sup>. The pathology of KOA is multifaceted and there is no known cure for KOA. The current main objectives of KOA management are to relieve pain, educate the patients about their disease, restore function, slow down the progression of the disease, and maintain health-related quality of life<sup>5)</sup>. Treatments can be classified into the following four categories: pharmacological, non-pharmacological, surgical, and combination treatments<sup>6)</sup>. Recent studies reported that exercise is recommended for management of KOA<sup>7, 8)</sup>. Recently, researchers have discovered that psychophysiological intervention, a kind of alternative therapy, might alleviate the symptoms of KOA through increasing

endorphin and enkephalin levels.

Tai Chi (TC), a kind of psychophysiological intervention, is an ancient Chinese martial art and exercise that has been practiced for many centuries. It combines deep diaphragmatic breathing and relaxation with many basic postures that slowly and smoothly move from one to another gesture in a circular movement. TC focuses on a combination of imagination and reality, and serenity and action, seeking serenity in action and action in serenity<sup>9)</sup>. The intrinsic characteristics of TC involve a gentle, continuous movement, combining muscle strength and balance training, and they provide a good non-pharmacological therapy for patients with KOA<sup>10)</sup>. It has been reported that TC relieves pain, increases the range of motion and flexibility, promotes balance and mental health, and improves the cardio-vascular and respiratory functions for a variety of subjects including KOA patients, and few patients have complained of the side-effects after receiving TC training<sup>11, 12)</sup>.

Previous systematic reviews have investigated the effects of psychophysiological intervention on KOA<sup>13, 14)</sup>. However, they did not focus on TC and RCTs. The present review is different from previous ones in that it focused on the effects of TC, narrowed the scope to KOA, and included RCTs up to December 2012. This review aimed to seek evidence for the effectiveness of Tai Chi for patients with KOA, based on the data from RCTs.

## SUBJECTS AND METHODS

Searches were carried out of the China Journals Full-text Database, Pubmed, Medline, Science Direct-Online Journals and CINAHL for studies published from Janu-

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ary 2001 to December 2012 using the keywords: Tai Chi, osteoarthritis, and degenerative arthritis. All synonymous terms were grouped together with the “OR” operator. The reference sections of relevant articles were also reviewed by the authors. Studies identified were evaluated based on following inclusion criteria (1) studies published between January 2001 and December 2012 in English or Chinese; (2) randomized controlled clinical trials; (3) diagnosis the by criteria of the American Rheumatism Association (ARA) or the American College of Rheumatology (ACR) or radiographic evidence on the Kellgren/Lawrence Scale grade; (4) patients aged over 50 years old; (5) control group with different interventions or no intervention; (6) outcome measures focused on clinical symptoms caused by KOA. Exclusion criteria were: (1) not true experimental designs; (2) disorders other than KOA.

Two reviewers (Ye and Cai) independently evaluated the abstracts identified by our research.

The Physiotherapy Evidence Database (PEDro) scale was applied to rate the quality of each trial<sup>15, 16</sup>. The cut-off score was set to 6, to make sure that the studies included in the review had reached a certain evidence threshold. A censor score was used after a discussion if there were disagreements between the two reviewers.

## RESULTS

A total of 74 potential relevant articles were yielded based on the initial search, but 57 of them did not meet the inclusion criteria, and 11 of them did not meet the exclusion criteria. Thus, 6 studies involving 314 subjects were identified for further analysis (Fig. 1 and Table 1) and were included in the review. All articles were prospective randomized controlled clinical trials (RCTs) with comparison between a TC group and a control group<sup>17–23</sup>. A variety of outcome variables were measured across the different studies, including physical symptoms (pain, stiffness), physical function or activities of daily living, physical fitness (balance, ROM, flexibility, strength) and performance, quality of life, psychological functioning, using either self-reported

instruments (e.g. questionnaire) or physical methods (walking distance, stair time) (Table 2).

## DISCUSSION

The overall findings of this systematic review suggest that TC has some effect on reducing pain and improving physical function and performance in KOA. Studies seldom reported adverse events. Although the mechanism is still unknown, the following three aspects would help to explain it. First of all, TC is a kind of psycho-physiological intervention which affects the endocrine system, resulting in the release of beneficial products, such as endorphin and enkephalin<sup>24</sup>. Moreover, TC is a form of physical exercise, which affects muscular systems, improving endurance, reducing pain and developing physical functioning, if performed regularly. Last but not the least, the synergy between physical and mental components plays a vital role.

Recent findings suggest that balance is significantly improved by practicing TC<sup>18, 19</sup>. As mentioned above, TC is a kind of physical exercise, and it consists of a sequence of low-intensity exercises. Constant forward and backward movements result in the gravity shifts from foot to foot, which might contribute to the improvement of balance.

With regards to the long-term effects of TC on patients with KOA, two studies conducted a follow-up investigation, but the improvement was not durable after detraining<sup>19, 21</sup>, suggesting that TC should be practiced regularly in order to maintain its effectiveness.

There was little evidence that TC improves flexibility<sup>22</sup>.

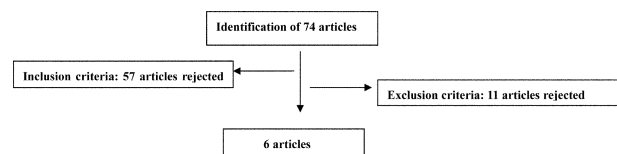


Fig. 1. Flowchart of literature search and recruitment process

Table 1. PEDro quality assessment results

Study (first author, year)	N G, 2010 <sup>17</sup>	Song R, 2010 <sup>18</sup>	Wang C, 2009 <sup>19</sup>	Lee HJ, 2009 <sup>20</sup>	Brismee JM, 2007 <sup>21</sup>	Song R, 2003 <sup>22</sup>
1 Randomized allocation	1	1	1	1	1	1
2 Concealed allocation	1	0	1	1	0	0
3 Similar prognosis	1	1	1	1	1	1
4 Blinded subjects	0	0	0	0	0	0
5 Blinded therapists	0	0	0	0	0	0
6 Blinded assessors	1	1	1	1	1	1
7 Key outcomes	0	0	1	1	0	0
8 Intention to treatment	1	1	1	1	1	1
9 Comparison between groups	1	1	1	1	1	1
10 Precision and variability	1	1	1	1	1	1
Total	7/10	6/10	8/10	8/10	6/10	6/10

Table 2. Summary of characteristics of included studies

References	Participants	Study design	Intervention group	Control group	Main outcomes	Results
Ni et al., 2010, China <sup>17)</sup>	35 clients with KOA ACR clinical criteria Age: 62.89 y (IG) 63.47 y (CG) 100% Female	RCT Single-blinded Computer-generated blocked randomization Sample size (allocated/completed): 35/29 RCT	TC group (n=18) 24-form simplified Yang style TC 24-week program Three 8-week sessions gradually increasing frequency (2 d/w, 3 d/w, 4 d/w) 30 min/d	Attention controlled (n=17): Wellness education & stretching Once a week 45 min/d Attention controlled group (n=20)	Physical function WOMAC total WOMAC pain WOMAC stiffness WOMAC function	p=0.000 p=0.001 p=0.043 p=0.000 p=0.001
Wang et al., 2009, USA <sup>19)</sup>	35 clients with KOA ACR clinical criteria Radiographic K/L scale grade $\geq 2$ Age: 63 y (IG) 68 y (CG) M/F: 1/3	Single-blinded Computer-generated blocked randomization Sample size (allocated/completed): 40/40	TC group (n=20) 10 forms from Yang style TC 12-week program Twice a week 60 min/session	Wellness education & stretching 12-week program Twice a week 60 min/session	Stair climb time 6-min walk distance (Assessed at 0 w, 24 w) WOMAC Pain Physical function Patient VAS Physician VAS Chair stand time CES-D SF 36-PCS	p=0.003 At 12 week: p=0.0005 p=0.001 p=0.01 p=0.002 p=0.00005 p=0.009 p=0.004
Brismee et al., 2007, USA <sup>20)</sup>	41 clients with KOA ARA classification criteria Age: 70.8 y (IG) 68.8 y (CG) M/F: 86.4% female (IG) 78.9% female (CG)	RCT Single-blinded A random table Sample size (allocated/completed): 41/31	TC group (n=22): 24-form simplified Yang style TC 6-week instructed group class + 6-week home practice 3 times/week 40 min/session Setting: hospital/home	Health related lecture (n=19): Lectures+ Discussion 6-week program 3 times/week 40 min/session	Pain (VAS) Maximum Minimum Overall Physical function (WOMAC) Pain Stiffness Physical function Overall Knee ROM (Assessed at 0 w, 3 w, 6 w, 12 w, 15 w, 18 w)	Between group (p<0.05) at 9 weeks: Overall & maximum pain, WOMAC overall, pain & physical function subscale at 12 weeks: Overall pain, WOMAC physical function subscale at 6 weeks: Maximum pain Within group (p<0.05) at 9 weeks: Overall & maximum pain, WOMAC overall, pain, stiffness, & physical function subscale at 12 weeks: Overall & maximum pain, WOMAC overall, stiffness, & physical function subscale at 6 weeks: WOMAC stiffness subscale Detraining effects: knee ROM

**Table 2.** Continue

Refer-ences	Participants	Study design	Intervention group	Control group	Main outcomes	Results
Song et al., 2010, Korea <sup>(18)</sup>	82 clients with KOA ACR clinical criteria Radiographic K/L scale grade≥2 Age: 63.03 y (IG) 61.20 y (CG) 100% female	RCT Single-blinded computer-generated random number Sample size (allocated/completed): 82/65	TC group (n=41): 31 forms of Sun-style TC with qigong breathing exercise 6-month program 2 session/week for 3 weeks Once a week 55-65 min/session ≥20 min/d at home Instructed by certified TC masters	Self-help education (n=41): self-management skills & knowledge 6-month program Once a month 2 hours/session	Knee muscle strength extensor flexor Knee muscle endurance Ward's triangle trochanter (Korean version of the survey of activities and fear of falling in the elderly) (Pre- and Post-test)	p= 0.0137 (w13-18) p= 0.0296 (w12, 18) p= 0.01 p< 0.01 p= 0.02 p< 0.01 p= 0.01
Lee et al., 2009, Korea <sup>(20)</sup>	44 clients with KOA Radiographic K/L scale grade≥2 Age: 70.2 y (IG) 66.9 y (CG) M/F: 93.1% (IG) 93.3% (CG)	RCT Single-blinded Computer-generated balanced block randomization Sample size (allocated/completed): 44/41	TC Qigong (n=29) 18 TC movements incorporating intention of movement, enhancing awareness of breathing 8-week program Twice a week 60 min/session	Waiting list (n=15)	Quality of life SF-36 Physical function WOMAC pain Physical performance 6-min walk test	p= 0.024 p= 0.030 p= 0.001
Song et al., 2003, Korea <sup>(22)</sup>	72 clients with KOA ACR clinical criteria Radiographic K/L scale grade≥2 Age: 64.8 y (IG) 62.5 y (CG) (fe-male)	RCT Single-blinded A random table Sample size (allocated/completed): 72/43	TC group (n=22) 12 movements in Sun style TC 12-week program 3 times/w for 2 weeks 1 time/w for 10 weeks 2 min/set, 10-15 sets/session, 3-5 times for warm-up & cool-down 20 min/d at home	Routine treatment (n=21)	K-WOMAC pain stiffness physical Physiological measures Balance Abdominal muscle strength	p= 0.034 p= 0.039 p= 0.008 p= 0.002 p= 0.009

This systematic review had some limitations. First, not all relevant RCTs were covered in this review because of language restriction. Also, a meta analysis was not conducted.

In conclusion, there was some strong evidence to suggest that TC is effective for pain control and improvement of physical function for patients with KOA. Also, evidence was provided that TC can improve balance, BMI, muscle strength, and knee ROM. Our recommendation for future work is that RCTs involving larger sample sizes and an appropriate comparison group for longer treatment periods should be conducted.

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