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Mind-Body Therapies and Osteoarthritis of the Knee

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Abstract

Osteoarthritis of the knee is a major cause of disability among adults worldwide. Important treatment options include nonpharmacologic therapies, and especially symptom management strategies in which patients take an active role. Among these, mind-body therapies may have particular promise for alleviating the distressful symptoms associated with osteoarthritis of the knee. However, systematic reviews are lacking. The objective of this paper is to review English-language articles describing clinical studies evaluating the effects of patient-driven mind-body therapies on symptoms of knee osteoarthritis. Eight studies, representing a total of 267 participants, met the inclusion criteria. Interventions included tai chi, qigong, and yoga. Collectively, these studies suggest that specific mind-body practices may help alleviate pain and enhance physical function in adults suffering from osteoarthritis of the knee. However, sample sizes are small, rigorous investigations are few, and the potential benefits of several mind-body therapies have not yet been systematically tested. Additional high-quality studies are needed to clarify the effects of specific mind-body therapies on standardized measures of pain, physical function, and related indices in persons with osteoarthritis of the knee, and to investigate possible underlying mechanisms.

Keywords

Osteoarthritis; knee; yoga; tai chi; qigong; mind-body

INTRODUCTION

Osteoarthritis (OA) is the most common form of arthritis, with an estimated 27 million U.S. adults having the condition, which most commonly affects the hip, knee, and hand joints [1]. 80% of those aged 65 years or older show radiographic signs of OA [2]. Globally, OA is the eighth leading cause of disability [3] with the joint most frequently associated with disability being the knee [4]. The prevalence of knee OA increases with age [4,5]; therefore, the impact of this disease will become even more substantial with the aging of the population.

Currently there is no cure for OA. The main emphasis of treatment involves managing the pain and dysfunction related to the disorder. The American College of Rheumatology (ACR) guidelines for the medical management of knee OA recommend nonpharmacologic therapies as a first line course of treatment [6]. More recent practice guidelines from the Osteoarthritis Research Society International (OARSI) place initial emphasis on self-help

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strategies and therapies that are patient-driven, as opposed to passive treatments provided by health-care professionals [7].

Mind-body therapies may offer particular promise for alleviating the symptoms associated with knee OA. There is growing evidence to suggest that the practice of patient-driven mind-body therapies such as meditative practices can decrease pain, reduce other distressful symptoms, and enhance both physical and physiological function in a broad range of populations [8,9]. Consistent with current OARSI recommendations, mind-body therapies stress the importance of active patient engagement in the management of his/her own health and well-being [10]; the gentle nature of these disciplines make them especially suitable to older adults with OA. However, systematic reviews regarding the effects of mind-body therapies on OA of the knee are lacking. The objective of this article is to review the clinical studies evaluating the use of patient-driven, mind-body therapies for the treatment of symptoms of osteoarthritis of the knee.

METHODS

Literature Search

Literature searches of Medline (1950-present [September 2009]), CINAHL (1981-present [September 2009]), Psyc-INFO (1887-present [September 2009]), AltHealthWatch (1984-present [September 2009]), and SPORTDiscus with Full Text (1985-present [September 2009]) were conducted to locate articles describing clinical studies of mind-body therapies used to treat symptoms of osteoarthritis of the knee. Keywords included: osteoarthritis, knee, mind-body, relaxation, meditation, imagery, yoga, tai chi, qigong, and chi kung.

A detailed OVID Medline® search strategy is provided as an example; a keyword search was performed with the “map term to subject heading” checkbox selected. Pertinent subject headings were incorporated into the search strategy in an effort to locate all eligible studies. Note: In OVID Medline, exploding the subject heading (exp) retrieves articles containing the selected term as well as all of its more specific terms, and the suffix “.mp” denotes that the term was searched as a keyword.

OVID Medline® In-Process & Other Non-Indexed Citations and OVID Medline® 1950-Present (September 2009) was searched as follows: (1) osteoarthritis.mp. or exp Osteoarthritis/or exp Osteoarthritis, knee/[38952 hits]; (2) meditation.mp. or exp Meditation/[1738 hits]; Combining 1 AND 2 yielded 4 citations. (3) exp “Mind-Body Relations (Metaphysics)”/or mind-body.mp. [2130 hits]; Combining 1 AND 3 yielded 9 citations. (4) exp Relaxation Therapy/or relaxation techniques.mp. [6174 hits]; Combining 1 AND 4 yielded 16 citations. (5) yoga.mp. or exp Yoga/[1245 hits]; Combining 1 AND 5 yielded 9 citations. (6) tai chi.mp. or exp Tai Ji/[476 hits]; Combining 1 AND 6 yielded 21 citations. (7) qigong or qi gong or chi gong or chi kung).mp. [284 hits]; Combining 1 AND 7 yielded 5 citations. Combining all of these searches together (1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7) resulted in 51 unique citations.

Titles and abstracts of the citations were scanned to identify potential articles for the review. Appropriate articles were retrieved, and the bibliographies were searched for relevant studies that might have been missed by the database searches. Studies meeting the following eligibility criteria were included in this review.

Criteria for Inclusion and Exclusion

English-language articles were eligible for inclusion if they described case series, noncontrolled or controlled, nonrandomized or randomized, clinical trials of the effects of patient-driven, mind-body therapies, such as meditation, yoga, tai chi, or qigong, on

symptoms of OA of the knee. Articles were excluded if they: were unavailable in English, described a single case report, studied disorders other than OA, included joints other than the knee, or used therapies that had to be delivered by a health-care provider. One article was excluded as it reported results from a study duplicated in another article [11]; only the first publication related to the study was included in the review [12]. A qigong study that involved practitioners delivering external qigong to patients was also excluded [13]. Abstracts and dissertations were not included.

RESULTS

Eight eligible studies, representing 267 participants, were identified and included in this review (Table 1).

Participants

All participants had OA of the knee; one study relied on self-report of knee OA pain, [14] the others used diagnosis based on American College of Rheumatology clinical criteria [15–19] or radiographic evidence (grade 2 or higher on the Kellgren-Lawrence scale) [12,20]. Sample size in most studies was low, with the number of enrolled participants ranging from 8 (with 7 completing the study) [14] to 72 (with only 43 completing the study) [12]. Five of the studies were conducted in the US, [14,15,17–19] two in Korea, [12,20] and one in China [16]. Approximately 91% of all study participants were female. The studies reported mean subject ages ranging from 58.6 [17] to 83 [14] years.

Design

A controlled trial design was used by four of the studies (Yang-style tai chi, [19] Sun-style tai chi, [12] Tai Chi qigong, [20] and Baduanjin qigong) [16]. All four were described as randomized, controlled trials (RCTs); however, the Baduanjin qigong study [16] did not specify how randomization was accomplished. The others reported using a random table [12,19] or a computer generated balanced block randomization [20]. The Tai Chi qigong study [20] also provided information on allocation concealment, describing the use of sealed envelopes [20]. While the nature of the intervention prohibited participants from being blinded, three of the four RCTs blinded the assessors to the participant group assignment, [12,19,20] while the Baduanjin qigong study made no mention of blinding [16].

The remaining studies used less robust designs: three (yoga, [17] Sun-style, [14] and Yang-style [15] tai chi) were 1-group, pretest-posttest, pilot studies; and one was a case series that assigned participants to either a yoga, exercise, or non-exercise condition [18]. All eight studies mentioned the number of withdrawals and dropouts. Three of the studies compared the attriters to the nonattriters, finding no significant difference between the groups [12,15,19]. Two trials included all allocated participants in the statistical analysis even if they did not complete the intervention (with the exception of one participant who died prior to receiving intervention) [14,20].

Groups - Intervention and Control

The eight studies involved the following interventions: two used 12-form, Sun-style tai chi, [12,14] two used 24-form, simplified Yang-style tai chi, [15,19] one used Tai Chi qigong, [20] one used Baduanjin [16] qigong, and two used Iyengar yoga [17,18].

Yoga is a traditional mind-body system originating in India. The practice of hatha yoga, the yoga of activity, was originally developed to prepare the body for meditation [21]. Iyengar yoga, named for its founder B.K.S. Iyengar, is a style of hatha yoga that is particularly

appropriate for adults with arthritis; as it allows them to make use of props, such as chairs, belts, and blankets, when necessary to perform the postures without strain.

Qigong, an ancient exercise for both mind and body that takes many forms, includes the following components: movement, body posture, mind exercises, concentration, relaxation, and breathing exercises [22]. Baduanjin, a qigong form consisting of eight sections (also known as Eight Section Brocade), moves and activates all parts of the body and is as popular as tai chi in China [23]. It is said to be less demanding, both physically and cognitively, than tai chi [16]. Tai Chi qigong is an 18 movement qigong form, stated to be simpler than other types of tai chi, while combining the benefits of both tai chi and qigong [20].

Tai chi, one of the most highly choreographed forms of qigong [24], is characterized by the performance of forms consisting of continuous flowing movements, done in a relaxed state with continued deep breathing throughout the routine [25]. Sun and Yang are two styles of tai chi; each named for the style's founding family. Sun-style is performed from a higher stance than Yang-style, which is characterized by a more deeply bent knee [12]. While the styles differ in characteristic posture and location of the center of gravity, they share a similar emphasis on movement coordination, mental concentration, and relaxation [26].

The control groups used in the four RCTs, all of which used a 2-group design, included: routine treatment, [12] no treatment, [16] wait list, [20] or attention control [19]. The case series assigned participants to a yoga, exercise, or non-exercise condition [18].

Treatment Parameters

The treatment period of the studies ranged from 6 to 15 weeks with a practice frequency of 1 to 5 sessions per week and a per session duration ranging from 20 to 90 minutes. Two studies used a treatment schedule of two, 60-minute sessions per week for a period of 6 weeks [15,18]. Three studies used an eight week treatment period, with a practice frequency of one to five times per week; and a session duration of 30 to 90 minutes [16,17,20]. A treatment schedule of three times per week for 12 weeks was used by two of the RCTs, with the sessions lasting 20 [12] or 40 [19] minutes. The longest treatment period was 15 weeks; participants practiced for 20–40 minutes, twice a week [14] (Table 1).

Outcomes

A variety of outcomes were assessed using self-report measures (such as questionnaires) and physical methods (such as walk times, range of motion, and muscle strength). The Outcome Measures in Rheumatology and Arthritis Clinical Trials (OMERACT) guidelines [27] and the Osteoarthritis Research Society task force on clinical trials [28] recommended three core outcomes for osteoarthritis trials: pain, physical function, and patient global assessment; these outcomes will be the focus of this section.

Pain

All eight of the studies included at least one measure of pain: five used the Western Ontario & McMaster Universities Osteoarthritis Index (WOMAC), [12,15–18,20] which includes a pain subscale, as the primary pain measure; two assessed pain using a 10-cm Visual Analog Scale (VAS) for overall and maximum knee pain [15,19]; and one used the SF-36 bodily pain subscale [14].

Seven studies reported reductions in pain [12,15–20]. The case series reported that nine participants (3 of 3 yoga, 0 of 4 controls, and 6 of 7 exercise) experienced an improvement in pain based on the Western Ontario & McMaster Universities Osteoarthritis Index (WOMAC). However, no data for the WOMAC pain subscale scores were specifically

provided; only the total WOMAC scores were graphically presented [18]. Two pre-post studies reported statistically significant reductions in WOMAC pain scores post-intervention [15,17]. The 1-arm, Yang-style tai chi study found a significant improvement in maximum pain but not overall pain as measured by a 10-cm visual analog scale (VAS), the primary pain measure for that study [15]. All four RCTs reported significant pain reduction for the intervention compared to the control using WOMAC [12,16,20] or VAS [19]. The only study that reported no statistically significant reduction in pain was the 1-arm, Sun-style tai chi study, [14] the only study that assessed pain using the SF-36 bodily pain subscale rather than a pain tool or disease-specific measure (Table 1).

Physical Function

Seven studies reported on physical function, assessing it using the WOMAC [12,15–20]; only the 1-arm, Sun-style tai chi study did not include a physical function measure [14]. As with pain, the yoga case series stated that nine participants had improved function as indicated by their WOMAC scores, without providing data from the physical function subscale [18]. Of those studies reporting p values, two 1-arm, pre-post studies [15,17] and three RCTs [12,16,19] reported statistically significant improvement in function post-intervention. One RCT, the Tai Chi qigong study, [20] found no significant improvement in function (Table 1).

Patient Global Assessment

Only two of the studies included a measure identified as a patient global assessment, both were yoga studies [17,18]. Nine cases (3 of 3 yoga, 0 of 4 controls, and 6 of 7 exercise) reported improvement (Table 1) [18]. The change in patient global assessment post-intervention was not statistically significant in the 1-arm yoga study [17].

Noncore-set Outcomes

Noncore-set outcome measures used in the studies included: physician/instructor global assessment [17,18]; quality of life or utility of health status measures, such as SF-36 [16,20]; performance-based measures, such as walk time, [17,20] walking distance, [16] and muscle strength [12,16,18,20]; and examination-based measures, such as range of motion [15,19]. Briefly, there was some evidence of improvement in quality of life, [20] walk time [15,20] and distance, [16] and muscle strength [12,16] (Table 1).

Findings by Intervention

The studies evaluating Yang-style tai chi included a 1-arm, pre-post study that analyzed data from 40 completers, [15] and an RCT that compared 18 tai chi group participants to 13 attention controls (Table 1) [19]. Both studies resulted in statistically significant improvements in both pain (as measured by VAS) and WOMAC physical function (Table 1). Sun-style tai chi was also represented by a pre-post study and an RCT. The pre-post had only seven participants in the analysis, and was the only study that resulted in no significant reduction in pain [14]. The other study of Sun-style tai chi was an RCT based on 43 completers that reported statistically significant improvements in K-WOMAC pain and physical function in the tai chi group (n = 22) compared to a routine treatment control (n = 21) [12].

Eight weeks of Tai Chi qigong (n = 29) [20] and Baduanjin qigong (n = 11) [16] were also found to significantly reduce pain when compared to wait list (n = 15) and no-intervention controls (n = 10), respectively. The Tai Chi qigong study was the only one to report no significant improvement in physical function compared to control (Table 1).

The two Iyengar yoga studies included a case series [18] and a small, 1-arm, pre-post study [17]. The case series stated that three of three yoga participants showed improvements in pain and physical function; the pre-post study, with seven participants analyzed, reported statistically significant improvements in both of these outcomes as well (Table 1).

DISCUSSION

Findings of these eight studies suggest that mind-body therapies may improve specific outcomes related to osteoarthritis of the knee, notably pain and physical function. There were four tai chi studies (two Yang-style [15,19] and two Sun-style [12,14]); three of the four reported statistically significant reductions in pain, and all four yielded statistically significant improvements in physical function. The evidence regarding qigong comes from two RCTs, one of Tai Chi qigong [20] and the other of Baduanjin qigong, [16] both of which found statistically significant pain reduction in the qigong group *vs.* control. The Baduanjin qigong study also reported improved physical function, while the Tai Chi qigong did not. The weakest evidence was provided by the two Iyengar yoga studies, a case series [18] and a pre-post design [17]. While both reported improvements in pain and physical function, they only represented 10 yoga group participants between them; larger controlled trials are needed before any generalized conclusions can be drawn.

In addition to the evidence reviewed here specific to OA of the knee, yoga, tai chi, qigong, and other mind-body practices such as imagery, meditation, mindfulness-based stress reduction, and progressive muscle relaxation have also been reported to alleviate symptoms in persons with OA in sites other than or in addition to the knee, [29–33] and in patients with rheumatoid arthritis, [34–37] ankylosing spondylitis, [38] carpal tunnel, [39] chronic neck [40] or low back pain, [41–47] fibromyalgia, [48–51] and other chronic pain syndromes [8,10,34,47,52–54].

The mechanisms underlying the reported beneficial effects of mind-body therapies on OA symptoms remain unknown. However, recent controlled studies have shown tai chi, qigong, and yoga to increase strength or endurance, [55–58] enhance cardiopulmonary fitness, [55,58–61] and improve balance [24,55,62,63] in a range of populations, including older adults. In addition, a now growing number of controlled investigations suggest that the practice of yoga, tai chi, and qigong may reduce psychological distress and enhance emotional well-being, [22,55,64–67] improve sleep, [55,62,64,67,68] decrease perceived stress and reactivity to stressors, [67,69–71] improve coping skills, [67,72,73] and reduce sympathetic activation [60,67,74,75]. These changes, in turn, may contribute to the decreased pain and enhanced physical function reported following the practice of these active mind-body therapies.

However, despite the promise of active mind-body therapies for alleviating pain, enhancing physical function, and improving quality of life in persons with OA of the knee, rigorous investigations are very few. Of the eight studies specifically targeting knee OA, six, including all four RCTs, involved tai chi or qigong; our search revealed no randomized controlled trials to date examining the effects of yoga or other patient-driven, mind-body therapies on knee OA symptoms. Interpretation of existing studies is limited by small sample sizes, lack of appropriate control groups, possible selection bias, failure to adjust for baseline health status, lifestyle factors, and other potential confounders such as possible medication changes, lack of a disease-specific measure or pain tool, and other methodological limitations [76,77]. In addition, differences in the nature, design, duration, frequency and delivery methods of the mind-body interventions employed renders comparison across studies problematic. Publication bias may also contribute to the selective reporting of positive results [78].

While every effort was made to locate all relevant studies meeting our inclusion criteria, this review was limited in that it did not include unpublished studies, dissertations, abstracts, or articles in languages other than English; however findings are consistent with those reported in other, more inclusive reviews (e.g., Lee *et al*., 2008 [79]).

In conclusion, collectively these studies suggest that specific mind-body therapies may help reduce pain and improve physical function in persons with osteoarthritis of the knee. However, there are few rigorous controlled trials and the potential benefits of several mind-body interventions have not yet been systematically investigated. Additional high-quality studies are needed to clarify the effects of specific mind-body therapies on standardized measures of pain, physical function, and related indices in persons with OA of the knee, and to investigate possible underlying mechanisms.

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Table 1

Summary of Studies

First author, Year	Participants	Groups (Intervention, Control)	Main Outcomes	Findings
Design				
Uncontrolled Studies				
Bukowski, 2006	15 participants with knee OA	**1. Iyengar Yoga** (n=3) [Group A]		Number of Participants Reporting Improvement
Case series US	-ACR clinical criteria	2 classes/wk for 6 wks(~l hr)	WOMAC	A: 3/3; B: 0/4; C: 6/7
	2 males, 13 females	2. Non-exercise (n=4) [Group B]	Sit and reach test	A: 3/3; B: 2/4; C: 4/7
	Age range; 54–79 yrs [X=63.9]	3. Exercise (n=7) [Group C]	Quadriceps strength	A: 3/3; B: 2/4; C: 4/7
	14 completed	2 classes/wk for 6 wks	Patient Global Assessment	A: 3/3; B: 0/4; C: 6/7
			Instructor Global Assessment	A: 3/3; B: 0/4; C: 7/7
Kolasinski, 2005	11 subjects with knee OA	1. **Iyengar Yoga** (n=7)	WOMAC	
Pre-post US	-ACR clinical criteria	1 class/wk for 8 wks (1–1.5 hours)	**Pain subscale**	***p*=0.04**
	9 attended at least 1 session		**Physical function subscale**	***p*=0.04**
			Stiffness subscale	NS, *p*=0.06
	7 completed ≥ 5 classes		AIMS2	
	and post-assessment		**Affect**	***p*=0.002**
	7 females		Symptom, Social Interaction, Role	NS
	Mean Age 58.6; range 50–68		Patient Global Assessment	NS
			Physician Global Assessment	NS
			50-ft walk time	NS
Shen, 2008	48 subjects with knee OA	1. **Yang-style Tai Chi** (n=40)	Gait	
Pre-post US	-ACR clinical criteria	2 group classes/wk for 6 wks (60 min)	**Stride length (m)**	***p*=0.023**
	6 males, 42 females		**Cadence (steps/min)**	***p*=0.014**
	Mean Age: 64.4 ±8.3		**Speed (m/s)**	***p*<0.025**
	40 completed study		ROM (ankle, knee, and hip)	NS
			WOMAC Physical function	*p*<0.001
			Knee Pain	
			VAS-Maximum pain	***p*=0.002**
			VAS-Overall pain	NS
			Chronic Pain Self-Efficacy	NS
			Additional measures	

First author, Year	Participants	Groups (Intervention, Control)	Main Outcomes	Findings
			WOMAC subscales and total	All $p<0.001$
Tsai, 2009	8 cognitively impaired	1. **Sun-style Tai Chi** (n=7)	SF-36 bodily pain	Both doses NS
Pre-post US	long-term care residents	2 classes/wk for 15 wks (20–40 min)		
	-self-report of knee OA pain	≥21 sessions = Regular dose group		
	7 analyzed (1 death)	<21 sessions = Low dose group		
	1 male, 6 females			
	Mean Age: 83 ±6			
Controlled Trials				
Song, 2003	72 female arthritis clinic	**1. Sun-style Tai Chi** (n=22) [Group A]	Physical Symptoms	
RCT [Korea]	outpatients with knee OA	minimum 3x/wk for 12 weeks	**K-WOMAC pain**	**A>B, p=0.034**
	-Kellgren-Lawrence grade ≥ 2	3 group classes/wk for 1st 2 wks	**K-WOMAC stiffness**	**A>B, p=0.039**
	72 females	1 class PLUS ≥ 3 home practices/ wk	Physical Fitness	
	43 completed study	for last 10 wks (20 min/home practice)	**Balance**	**A>B, p=0.002**
	Avg Age: 63	2. Routine treatment control (n=21) [Group B]	Knee flexibility	A *vs.* B, NS
		no exercise during study period,	Knee endurance	A *vs.* B, NS
		offered tai chi after study period	Muscle Strength	
			Abdominal	**A>B, p=0.009**
			Knee	A *vs.* B, NS
			BMI	A *vs.* B, NS
			Cardiovascular function	A *vs.* B, NS
			Physical Function (K-WOMAC)	**A>B, p=0.008**
Brismee, 2007	41 adults with knee OA	1. **Yang-style Tai Chi** (n=l 8) [Group A]	**Knee Pain (VAS)**	**A>B, $p<0.05$**
RCT US	-ACR clinical criteria	3 group classes/wk for 1st 6 wks (40-min)	Knee ROM	A *vs.* B, NS
	7 males, 34 females	home video practice 3x/wk for next 6 wks	**Physical Function (WOMAC)**	**A>B, $p<0.05$**
	Mean Age: 70 ±9.2	2. Attention control (n=13) [Group B]		
	31 completed study	3 group sessions/wk for 6 wks (40-min)		
Lee, 2009	44 patients with knee OA	1. **Tai Chi Qigong** (n=29) [Group A]	Quality of Life	
RCT Korea	-Kellgren-Lawrence grade ≥ 2	2x/wk for 8 wks (1 hour)	**SF-36 Total**	**A>B, $p<0.05$**
	3 males, 41 females	2. Wait list control (n=15) [Group B]	**SF-36 Physical health**	**A>B, $p<0.05$**
	Mean Age: 69.1 ±5.4	no intervention during study period,	**SF-36 Mental health**	**A>B, $p<0.05$**

First author, Year	Participants	Groups (Intervention, Control)	Main Outcomes	Findings
	41 completed	offered tai chi qigong at end of study	Physical Function (WOMAC)	A *vs.* B, NS
	TCQG(n=28);Ctrl(n=13)		**6-m Walking Time** (s)	**A>B, p<0.01**
	44 in Intent to Treat analysis		WOMAC Total	A *vs.* B, NS
			WOMAC Pain change	**A>B, *p*=0.030**
			WOMAC Stiffness	A *vs.* B, NS
An, 2008	28 females with knee OA	1. **Baduanjin Qigong** (n=11) [Group A]	WOMAC	
RCT China	-ACR clinical criteria	5 group classes/wk for 8 wks (30-min)	**Pain subscale**	**A>B, *p*=0.006**
	28 females	2. Control (n=10) [Group B]	**Stiffness subscale**	**A>B, *p*=0.029**
	Age: QG 65.4±8.2; Ctrl 64.6±6.7	no intervention	**Physical function subscale**	**A>B, *p*=0.024**
	21 completed study		SF-36	
			General Health subscale	A *vs.* B, NS
			Social Function subscale	A *vs.* B, NS
			Mental Health subscale	A *vs.* B, NS
			6-Minute Walk Test (m)	**A>B, *p*=0.036**
			Peak Torque of ISKE (ft-Ibs)	**A>B, *p*=0.016**

OUTCOMES: AIMS2=Arthritis Impact Measurement Scale 2; ISKE-Isokinetic Strength of the Knee Extensors; K-WOMAC=Korean Western Ontario & McMaster Universities OA Index; QG=QiGong; ROM=Range of Motion; SF-36=Short Form-36; TC=Tai Chi; TCQG=Tai Chi QiGong; VAS=Visual Analog Scale; WOMAC=Western Ontario & McMaster Universities OA Index FINDINGS: A>B=Group A improved compared to Group B; A *vs.* B=Group A compared to Group B; NS=not statistically significant.