Tai chi for treating rheumatoid arthritis (Review)

Han A, Judd M, Welch V, Wu T, Tugwell P, Wells GA

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[Intervention Review]

Tai chi for treating rheumatoid arthritis

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ABSTRACT

Background

Rheumatoid arthritis (RA) is a chronic, systemic inflammatory autoimmune disease that results in the destruction of the musculoskeletal system. The major goals of treatment are to relieve pain, reduce inflammation, slow down or stop joint damage, prevent disability, and preserve or improve the person's sense of well-being and ability to function. Tai Chi, interchangeably known as Tai Chi Chuan, is an ancient Chinese health-promoting martial art form that has been recognized in China as an effective arthritis therapy for centuries.

Objectives

To assess the effectiveness and safety of Tai Chi as a treatment for people with RA.

Search strategy

We searched the Cochrane Controlled Trials Register (CCTR), MEDLINE, Pedro and CINAHL databases up to September 2002, using the Cochrane Collaboration search strategy for randomised controlled trials. We also searched the Chinese Biomedical Database up to December 2003 and the Beijing Chinese Academy of Traditional Medicine up to December 2003.

Selection criteria

Randomized controlled trials and controlled clinical trials examining the benefits and harms of exercise programs with Tai Chi instruction or incorporating principles of Tai Chi philosophy were selected. We included control groups who received no therapy, sham therapy or another type of therapy.

Data collection and analysis

Two reviewers determined the studies to be included in this review, rated the methodological quality and extracted data using standardized forms.

Main results

Four trials including 206 participants, were included in this review. Tai Chi-based exercise programs had no clinically important or statistically significant effect on most outcomes of disease activity, which included activities of daily living, tender and swollen joints and

patient global overall rating. For range of motion, Tai Chi participants had statistically significant and clinically important improvements in ankle plantar flexion. No detrimental effects were found. One study found that compared to people who participated in traditional ROM exercise/rest programs those in a Tai Chi dance program reported a significantly higher level of participation in and enjoyment of exercise both immediately and four months after completion of the Tai Chi program.

Authors' conclusions

The results suggest Tai Chi does not exacerbate symptoms of rheumatoid arthritis. In addition, Tai Chi has statistically significant benefits on lower extremity range of motion, in particular ankle range of motion, for people with RA. The included studies did not assess the effects on patient-reported pain.

PLAIN LANGUAGE SUMMARY

Tai chi for rheumatoid arthritis

Does Tai Chi help people with rheumatoid arthritis?

To answer this question, scientists analysed 4 studies. The studies tested 202 people who had rheumatoid arthritis. Some people attended classes, were taught or practiced Tai Chi for 8 to 10 weeks. The other people did not receive classes with Tai Chi. The studies were not high quality but this Cochrane Review provides the best evidence about Tai Chi that we have today.

What is Tai Chi and how could it help people with rheumatoid arthritis?

Rheumatoid arthritis is a disease in which the body's immune system attacks its own healthy tissues. The attack happens mostly in the joints of the feet and hands and causes redness, pain, swelling and heat around the joint. Tai Chi, also called 'Tai Chi Chuan' combines deep breathing and relaxation with slow and gentle movements. In older people, Tai Chi has been shown to decrease stress, increase muscle strength in the lower body, and improve balance, posture and the ability to move. It is not known whether Tai Chi could provide the same benefits for people with rheumatoid arthritis.

Does Tai Chi work?

Two studies tested and showed that people's ability to do daily chores, the tenderness in their joints, the number of swollen joints they had and the strength of their grip was about the same whether they did Tai Chi or not.

One study tested and showed that the range of motion of the ankle, hip and knee improved more when doing Tai Chi than not doing Tai Chi. After 10 weeks of Tai Chi and then 4 months later, people doing Tai Chi enjoyed the programme and felt that they had improved more than people who did not do Tai Chi.

The studies, however, did not test for improvements in pain or quality of life.

Were there any side effects?

In two of the studies, about one third of the people doing Tai Chi complained of a sore knee, shoulder or lower back during the first 3 weeks but the pain did decrease and they continued to do Tai Chi (except in one person). More people left the studies when they did not do Tai Chi.

What is the bottom line?

There is "silver" level evidence that Tai Chi improves the range of motion of the ankle, hip and knee in people with rheumatoid arthritis. It did not improve people's ability to do chores, joint tenderness, grip strength or their number of swollen joints nor did it increase their symptoms of rheumatoid arthritis. But, people felt that they improved when doing Tai Chi and enjoyed it.

It is still not known if it improves pain in rheumatoid arthritis or that person's quality of life. It is also not clear how much, how intense and for how long Tai Chi should be done to see benefits.

Based on Han A, Robinson V, Judd M, Taixiang W, Wells G, Tugwell P. Tai Chi for Treating Rheumatoid Arthritis. In The Cochrane Library, Issue 3, 2004 (in press).

BACKGROUND

Rheumatoid arthritis (RA) is a chronic, systemic, inflammatory autoimmune disease that results in the destruction of the musculoskeletal system. The disease is often progressive and results in pain, stiffness, and swelling of joints. In late stages deformity and ankylosis develop.

Because of the complex, systemic nature of the disease, treatment for RA is also complex and involves a variety of approaches. The major goals are to relieve pain, reduce inflammation, slow down or stop joint damage, prevent disability, and preserve or improve the person's sense of well-being and ability to function.

Preservation of muscle strength and endurance is also very important in individuals with RA. Muscle atrophy can quickly occur in these patients because of disuse, splinting, or the inflammatory process. Deterioration of functional capacity is associated with the decline of the musculoskeletal system (Li 2001).

Maintenance of near normal range of motion (ROM) in joints is important in preserving functional ability. One way to preserve muscle strength and endurance as well as to maintain ROM is through an exercise routine, designed to meet the specific needs of each patient. Exercise therapy is aimed at preserving and restoring overall functional ability by maintaining healthy and strong muscles, preserving joint mobility, and maintaining flexibility, balance, strength, endurance, aerobic capacity. A Cochrane review of dynamic exercise therapy demonstrated significant benefits on muscle strength, aerobic capacity and ROM (van den Ende 2003). This Cochrane review excluded the studies of Tai Chi.

Tai Chi is a traditional Chinese martial art that was developed in the 13th century and is based on the inspiration of a fight between a crane and a snake (Koh 1981). Although it has been widely practiced in China for centuries as an art form, religious ritual, relaxation technique, exercise, and a self-defence method, it was only during the early 1980s that Chinese scientists began to investigate the potential health benefits of Tai Chi (Forge 1997). A variety of health-related benefits of Tai Chi for older adults have since been documented, including stress reduction (Jin 1992), improved agility and balance (Tse 1991), posture control (Wolf 1997), and lower extremity strength (Duncan 2001). The benefits of Tai Chi can impede the decline of the muscular-skeletal system that occurs with aging and the associated deterioration in functional capacity and increased risk of falls and hip fractures (Li 2001). A further benefit of Tai Chi is that, compared to most drugs, it is a relatively inexpensive, low technological treatment (Wolf 1996).

Practiced internationally as a health-promoting exercise, Tai Chi Chuan combines deep diaphragmatic breathing and relaxation with slow and gentle movements, both isometric and isotonic, while maintaining good postures. Isometric exercises allow the patient to exercise specific muscle groups while avoiding joint motion. Isotonic exercises contract muscles in a way that causes joint movement. The philosophy behind Tai Chi practice is interconnected with Chinese medical theory. Good health is a result of the body's vital energy, the C'hi, circulating freely throughout the body. Illness occurs as a result of blockage of C'hi. Tai Chi is believed to promote the free flow of C'hi if practiced with the correct posture and sufficient relaxation.

Tai-Chi Chuan involves stepping with full weight-bearing on both lower extremities, but has a gentler heel-strike than walking because of slow and deliberate foot placement. It is unique for its slow, graceful movements with low impact, low velocity, and minimal orthopedic complications. When practiced correctly, the movements of Tai-Chi Chuan flow imperceptibly from one into another. Although Tai Chi is performed in slow, relaxed, and continuous movements, it demands a considerable amount of work by the leg muscles because forms are completed with bent knees in a squat-like position. In addition to the weight-shifting feature, Tai Chi has a number of therapeutic elements including (a) small to large degrees of motion (b) knee flexion (c) straight and extended head and trunk; (d) combined rotation of head, trunk, and extremities; and (e) asymmetrical diagonal arm and leg movements (Wolf 1993). In terms of metabolic demands, Tai-Chi Chuan is approximately equivalent to walking 6 km/h, and produces an average increase in heart rate of 50% using one type of short form (Zhuo 1984).

Although Tai Chi has been recognized in China for centuries as an effective therapy for arthritis for centuries (Lam 1998), to date, we are not aware of any existing systematic review of the evidence of the effectiveness of Tai Chi for rheumatic disease.

OBJECTIVES

To assess the effectiveness and side effects (safety) of Tai Chi for treating rheumatoid arthritis.

METHODS

Criteria for considering studies for this review

Types of studies

1. Randomized Controlled Trials (RCTs)
2. Controlled Clinical Trials (CCTs)

A controlled clinical trial refers to a study that compares one or more intervention groups to one or more comparison (control) groups. We allowed comparisons with no therapy, sham therapy or other active therapy.

Types of participants

Ambulatory adults with a diagnosis of RA.

Types of interventions

Only trials of exercise programs with Tai Chi instruction or incorporating principles of Tai Chi philosophy were selected.

Types of outcome measures

1. effectives
All the outcome measures in OMERACT 1993 were included for potential analysis.
OMERACT measures for effectiveness include:
a) Number of tender joints per patient
b) Number of swollen joints per patient
c) Pain
d) Physician global assessment
e) Patient global assessment
f) Functional status
g) Acute phase reactants
h) Radiological damage
2. Safety
i) Withdrawals overall
3. Additional Outcomes
j) Range of motion
k) Grip strength

Search methods for identification of studies

See: Cochrane Musculoskeletal Group search strategy
1. Electronic searches
We searched MEDLINE (1966 to September 2002) and the CINAHL databases (1982 to September 2002) using the same search strategy, with the one exception being search term #4. In order to accommodate different spellings of this search term by MEDLINE and CINAHL, the former database was searched using the spelling Tai Ji and the latter database was searched using the spelling Tai Chi. We also searched the databases of the Beijing Chinese Academy of Traditional Medicine and the Chinese Biomedical Database up to December 2003.
Search Strategy:see Appendix 1.
There were no language restrictions.
2. Hand searches
Reference lists of all the trials selected through the electronic search were manually searched to identify additional trials.
3. The Cochrane Controlled Trials Register (CCTR) was also searched up until December 2003.

Data collection and analysis

Data extracted from the publications included study, intervention and patient characteristics, methodological quality, outcome measures of effectivness and side effects. Data were extracted using a pre-tested extraction form by two independent reviewers (AH and VR). Differences were resolved by consensus.
1. Effectiveness
The results on effectivness were analyzed for the study endpoints which ranged from 8 to 10 weeks.
For continuous outcomes (e.g. range of motion, pain), we calculated weighted mean differences and 95% confidence intervals. We have also calculated the relative and absolute difference in percentage change from baseline.
For dichotomous outcomes (e.g. number of patients improved), we calculated relative risk and 95% confidence intervals.
2. Side Effects
We searched for withdrawals overall, withdrawals due to side effects and specific side effect reported.
3. Clinical Relevance
Clinical improvement was defined as a 15% improvement relative to a control. A relative percentage difference (RPD) as defined by the Philadelphia Panel on Rehabilitation Interventions (Wells 2001) of greater than 15% indicates clinical importance. RPD was calculated as the absolute benefit divided by the average of the baseline means (weighted for the treatment and control groups). Absolute benefit was calculated as the improvement in the experimental group less the improvement in the control group, in the original units.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.
Four controlled clinical trials, involving 206 participants, were identified in the literature (Jianjiang 1999; Van Deusen 1987; Kirsteins 1991A; Kirsteins 1991B).
Jianyang 1999: Controlled study, with no matching, in China (Jianjiang 1999). This study investigated the effectivness of oral Shan Pi Tang decoction in conjunction with health education, daily exercises, and massage and hot compress to the affected area. The health education included knowledge of RA and method of exercises. The daily exercises were done every morning for one hour, and included slow running, walking, gymnastics, Tai Chi. A massage and hot compress were also applied to the affected area every evening, for 30 and 15 minutes, respectively. There were three groups in this study. Group 1 received oral Lei Gong Teng and no exercise therapy. Group 2 received oral Shan Pi Tang decoction and no exercise therapy. Group 3 received oral Shan Pi Tang along with the health education, exercise therapy, massage and hot compress. There were 32 patients in group 1, 33 in group 2 and 35 in group 3 for a total of 100 patients. We included the comparison of Group 2 versus group 3 since the difference between these groups is the exercise based on Tai Chi, massage and hot compress.
Van Deusen 1987: Randomized, controlled study in the United States. This study was conducted to examine the effectivness of an exercise-and-relaxation program that integrated principles of occupational therapy and Tai Chi Chuan for ambulatory adults with

rheumatoid arthritis. The program duration was 8 weeks. There were two groups in this study: (1) an experimental group that was taught a series of eight, 90-minute, weekly health education classes which included a repetition of a 7-minute ROM Dance sequence accompanied by a poem and music, a guided relaxation experience, and a group discussion, and (2) a control group that was not taught the classes, but did receive a brochure outlining the range of motion (ROM) Dance Program and the research project. The experimental participants were also encouraged to practice ROM Dance sequences daily at home along with relaxation techniques, while the control group was not given any instructions regarding home rest and exercise. A total of 46 participants were included in the study, divided into 23 experimental participants and 23 control participants.

Kirsteins 1991: Two separate studies in centres in the United States (these are labelled Kirsteins 1991A and Kirsteins 1991B). These studies were conducted to evaluate the safety and potential use of Tai Chi as a weight-bearing exercise for patients with rheumatoid arthritis. The Tai Chi program duration was 10 weeks, along with a 1-week period of clinical disease activity testing both before and after the study. The selected patients had American Rheumatism Association functional class II or III RA , were diagnosed with RA after age 18, walked without any assistive devices, and were on a stable regimen of medications for a sufficient time. Patients with severe osteoporosis, or a history of noncompliance or chemical dependency (defined as using additive substances in quantities exceeding their physician's prescriptions) were excluded. All patients were graduates of an Arthritis Foundation Self-Help class and had been instructed in self-range of motion exercises.

Kirsteins 1991A: The experimental group was taught Tai Chi Chuan exercises for 1 hour session once a week.

Kirsteins 1991B: The experimental group was taught Tai Chi Chuan exercises for 1 hour session twice a week.

The control groups of both of these studies did not receive Tai Chi Chuan exercise instruction.

Each class consisted of a 15-20 minute warm-up period, followed by a 5 minute rest period. The rest of the class was devoted to a repetition of a series of 15 movements derived from the Yang Style Tai Chi Chian Short Form. The movements involved a combination of stepping and transferring weight with deep breathing, relaxation, and arm movements. The experimental group was also instructed to practice the Tai Chi exercises on their own for approximately 20 minutes a day as tolerated and keep a daily log.

A total of 47 patients were included in the first study (Tai Chi 1/week) (Kirsteins 1991A), divided into 25 experimental participants and 22 control participants.

A total of 28 patients were included in the second study(Tai Chi 2/week) (Kirsteins 1991B), divided into 18 experimental participants and 10 control participants.

Some of the participants from Kirsteins 1991A also participated in the second study as follows:

From the control group of the first study, 4 participated in the experimental group and 2 participated in the control group.

From the experimental group of the first study, 9 participated in the experimental group and 4 participated in the control group of the second study.

A fifth trial by Zhu et al (Zhu 1999) is waiting further assessment as more detailed information is needed regarding study design and data in order to determine if it should be included in this review. We have requested additional information from the authors of this trial.

Risk of bias in included studies

The methodological quality of the studies was assessed by two independent reviewers (AH, VR) using a quality scale validated and published by Jadad 1996 (Jadad 1996). This scale includes an assessment of randomization (2 points), double-blinding procedures (2 points) and description of withdrawals and dropouts (1 point). The possible range of scores is 0 (worst) to 5 (best). Two studies had a score of 1 (Jianjiang 1999; Van Deusen 1987) because they included a description of randomization. The two other studies had a score of 0 (Kirsteins 1991A; Kirsteins 1991B).

Effects of interventions

Four controlled clinical trials (CCT) were included in the analysis (Van Deusen 1987; Kirsteins 1991A; Kirsteins 1991B, Jianjiang 1999). Two trials (Kirsteins 1991A, Kirsteins 1991B) were reported in the same article and results were pooled for these two studies. The number of participants in each trial is represented by an N in the results below.

FUNCTION

Functional assessment was determined in the Kirsteins studies (Kirsteins 1991A; Kirsteins 1991B) by a self-administered survey that listed 20 activities of daily living, such as buttering bread, dressing, stair climbing and getting off the toilet. A numerical score was assigned for the degree of dependence the patient reported for each activity.

Functional assessment (2 CCT, N=43) was not statistically different between Tai Chi and control groups (WMD: 0.01, -2.94, 2.97). The time to complete a 50 foot walking test (2 CCT, N=48) was not statistically different (WMD: 0.35 seconds, 95%CI, -1.14 to 1.84).

TENDER AND SWOLLEN JOINTS

Joint tenderness (in 2 CCT, N=53) using the Ritchie index reached clinical importance in both trials (18% and 37%) but did not reach statistical significance (WMD: -0.83, 95% CI, -3.30, 1.64). Swollen joints were not statistically different between control and treatment groups (WMD: 2.45 joints, 95% CI, -0.45,5.36) and did not reach clinical importance (15% or greater).

RANGE OF MOTION

Two outcomes of range of motion were statistically different: ankle plantar flexion (WMD:24.00 degrees, 95% CI, 3.34, 44.66) and

lower extremity flexion (WMD: 34.00 degrees, 95% CI, 10.79, 57.21). Clinical importance could not be assessed due to missing data.

Other range of motion outcomes were not statistically different: shoulder flexion (WMD 21.00 degrees, 95% CI, -17.56, 59.56); shoulder internal and external rotation (WMD: 42.00 degrees, 95% CI, -7.97,91.97) and upper extremity ROM: (WMD: 56.00 degrees, 95%CI: -63.90, 175.90).

STRENGTH

Grip strength (in 2 CCT, N= 52) was not statistically different: (WMD: -0.08, 95% CI, -0.26, 0.10).'

SUBJECTIVE ASSESSMENTS OF ENJOYMENT

One CCT (N=95) reported statistically significant improvement in enjoyment of exercise/rest (p=.0002) and self-reported benefit from exercise/rest (p=.006) at both end of therapy (10 weeks) and 4 months later.

WITHDRAWALS OVERALL

There were statistically greater withdrawals from the control group (RR 0.37, 95% CI: 0.19, 0.72) than the experimental group. This result was consistent across trials (chi square for heterogeneity, p=0.44). The withdrawals were 11 out of 101 (11%) for the experimental group and 25 out of 88 (28%) for the control group.

Statistical significance:

Ankle plantar flexion, lower extremity flexion and withdrawals (from the control group) were the only statistically significant results.

Clinical importance:

Clinically important relative difference was demonstrated for joint tenderness (measured by the Ritchie index) of 18% in one study and 37% in the other. No other measures of disease activity reached clinical importance of 15% or greater, including swollen joints, 50 foot walk and grip strength.

Clinical importance could not be calculated for range of motion outcomes since pre-test data were not reported and not available from the author.

SIDE EFFECTS:

The authors of two of the studies (Kirsteins 1991A; Kirsteins 1991B) report that approximately one-third of the patients complained of soreness in the knee, shoulder or lower back during the first 3 weeks of the studies. The pain eventually subsided for all patients and they were able to continue the program without altering practice time or quality of movement. The only exception was one patient, who complained of knee pain. The authors also report that there were complaints of soreness in the quadriceps and/or shoulders after the three 90-minute sessions during the course of the studies. The number of patients with this complaint was not reported. Because these joint and muscle pain complaints diminished during the course of the study and did not cause withdrawals, they were not considered to be important by the investigators of the study. One patient from one study (Kirsteins 1991B) complained of leg cramps and ankle soreness after the first class and therefore switched from the test group to the control group upon his physicians's advice. The patient was not examined and it therefore remains unclear whether this was due to a joint flare-up.

DISCUSSION

This systematic review summarises the results of 4 randomised trials on the effectivness and safety of Tai Chi for RA patients. Only studies that incorporated Tai Chi or Tai Chi philosophy into a treatment program for RA were included for this review. The period of the Tai Chi programs ranged from 8 (Van Deusen 1987) to 10 weeks (Kirsteins 1991A, Kirsteins 1991B). This review found no effect of Tai Chi on the majority of outcome measures, particularly those that measure disease activity such as activities of daily living, swollen and tender joints. The exception was clinically and statistically significant benefit on ankle plantar flexion of greater than 15% relative difference.

The finding that Tai Chi benefits shoulder and ankle ROM should be considered in a broader context. Range of motion is not part of the OMERACT core set, partially due to lack of consensus about its validity (methods of measuring ROM have poor validity and reliability) and importance to both patients and clinicians. To perform many activities of daily life less than full joint ROM is required (Magee 1992). Therefore improvement in joint ROM may not always translate into improved function in daily activities.

In terms of safety, there were no detrimental effects of Tai Chi on clinical disease activity of RA patients. The included studies demonstrated no statistically significant differences in joint tenderness, joint swelling, time to walk 50 feet, handgrip strength, and activities of daily living. This review showed that Tai Chi is a safe form of exercise for patients with RA, which is consistent with other studies which have shown that exercise does not exacerbate the clinical disease activity of RA patients (Hansen 1993; Nordemar 1981). Unlike the other studies that used non-weight bearing exercises, however, Tai Chi is a weight-bearing exercise. It therefore has the potential advantage over traditional exercise programs of stimulating bone formation and strengthening connective tissues (Gerber 1986).

The methodological quality of the trials was low (0 and 1 out of 5). Double-blinding is acknowledged as one of the most important factors in reducing bias (Schulz 1995). Double-blinding was not conducted for any of the four included trials. Therefore, participants in the experimental and control groups were aware of their status. The experimental group may have had greater improvements due to both patient and evaluator bias. It is not feasible to blind participants in exercise studies to the fact they are participating in an exercise intervention. However , it is possible to blind evaluators to participants group allocation and this should be done in future studies.

Yet another limitation is that the dose of Tai Chi was not clear in the trials included in this review. In the Kirsteins studies (Kirsteins 1991A; Kirsteins 1991B), test patients were instructed to practice the exercises on their own for around 20 min/day as tolerated and keep a daily log. There was poor compliance with the patient practice logs, however, and less than one-third of the participants submitted them. In the Van Deusen study (Van Deusen 1987), the experimental participants were encouraged to practice the ROM Dance sequence and relaxation techniques during daily periods of rest on a daily basis at home in addition to any specific exercises recommended by their physician or therapist. It is unclear whether the participants followed these recommendations, and if so, for how many minutes a day Tai Chi exercises were practiced.

Furthermore, the control group in the Van Deusen 1987 trial was given a brochure which explained the range of motion (ROM) Dance Program and the research project. Although they did not receive any specific instructions regarding home rest and exercise, their knowledge of the program and exercises may have produced beneficial effects on the RA of these patients. This would make it difficult to detect differences attributable solely to Tai Chi in the experimental group.

WITHDRAWALS

There were significantly more withdrawals in the control groups of these studies (19% absolute risk difference). It is uncertain whether this difference in withdrawals is due to greater enjoyment and perceived benefit of participants in the experimental group. However, this interpretation is supported by the analysis by 1 CCT (n=95) that found statistically significantly greater enjoyment and perceived benefit of the exercises amoung members of the Tai Chi group.

From the initial sample of 75 patients in the Kirsteins studies (Kirsteins 1991A; Kirsteins 1991B), 43 of which were experimental patients, only 55 patients attended post-study testing. In the first study, (Kirsteins 1991A), the compliance of the experimental group in attending post-study testing was 80%, while it was approximately 50% for the control group. The high dropout rate of the control patients was attributed by the authors to adverse weather conditions (i.e. a sudden drop in temperature from 45 degrees Fahrenheit to approximately 20 degrees Fahrenheit) and the lower rate of pay that the controls were paid to attend post-testing than the experimental group. This discrepancy in post-testing attendance between experimental and control patients could have influenced the accuracy of the reported results. From the initial sample of 46 patients in the Van Deusen study (Van Deusen 1987), 39 attended post-testing. The drop-outs were attributed by the authors to illness, geographical move, or other reasons.

AUTHORS' CONCLUSIONS

Implications for practice

This systematic review indicates that Tai Chi appears to have no detrimental effects on the disease activity of RA in terms of swollen/tender joints and activities of daily living.

A statistically significant and clinically important benefit of Tai Chi compared to a control group was shown on the range of motion outcomes of ankle plantar flexion. Tai Chi appears to be safe, since only 1 participant out of 121 withdrew due to adverse effects and withdrawals were greater in the control groups than the Tai Chi groups.

One trial (Van Deusen 1987) reported a statistically significant benefit of Tai Chi group therapy on self-reported frequency and enjoyment of exercise immediately after and 4 months after completion of the ROM dance program.

Implications for research

This review compared people with rheumatoid arthritis performing Tai Chi exercises to control groups.

This review indicates that compared to a control intervention, Tai Chi demonstrated benefit for selected ROM outcomes, self-reported frequency and enjoyment of exercise. Furthermore, there was no detriment or exacerbation of arthritis signs or symptoms of tender and swollen joints or ability to perform activities of daily living.

It is unclear whether Tai Chi programs affect patient-reported pain and quality of life since they were not measured or reported in the studies included in this review. Based on this review the dose (frequency, intensity and duration) of Tai Chi required to achieve improved joint ROM and "enjoyment of exercise" is not clear.

A study comparing Tai Chi to another form of exercise that includes patient reported quality of life and pain is recommended. Also, when designing future studies it is important to consider the quality of the measurement and reporting of the dose (frequency, intensity and duration) of Tai Chi received by participants.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Jianjiang 1999

Methods	CCT
Participants	adults (age 16-56) with rheumatoid arthritis.
Interventions	oral Shan Pi Tang decoction with: health education (RA knowledge adn method of exercises); exercise every morning for one hour (slow running, walk, gymnastics, Tai Ji Quan, massage on diseased articulation 30 min every evening, and hot compress there using Shan Pi Tang's decocted herbs residues 15 mnutes)
Outcomes	Recovery rate, markedly effective rate, effective rate, relapse rate (how many participants were tested at posttest)
Notes	Quality R0, B0, W0

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Kirsteins 1991A

Methods	RCT
Participants	(from inclusion criteria) ambulatory adults diagnosed with rheumatoid arthritis after age 18 and on a stable regimen of medications for a sufficient time for maximal results. Age: 37-70
Interventions	tai-chi instruction frequency = once per week for 10 weeks, for 60 minute sessions
Outcomes	Joint tenderness, functional assessment, # swollen joints, 50 foot walk, grip strength
Notes	Quality R0, B0, W0

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

Kirsteins 1991B

Methods	RCT
Participants	(from inclusion criteria) ambulatory adults diagnosed with rheumatoid arthritis after age 18 and on a stable regimen of medications for a sufficient time for maximal results. age: 38-72
Interventions	tai-chi instruction frequency = twice per week for 10 weeks, for 60 minute sessions
Outcomes	Joint tenderness, functional assessment, # swollen joints, 50 foot walk, grip strength
Notes	R0, B0, W0

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

Van Deusen 1987

Methods	RCT
Participants	Ambulatory adults with rheumatoid arthritis who had medical recommendations for home rest and exercise and no prior ROM Dance experience age: 55.91, 29-80, 2.60 disease duation: 10.92. 0-38. 2.17
Interventions	tai-chi ROM Dance program (including health education) frequency = once per week for 8 weeks, for 90 minute sessions
Outcomes	upper and lower range of extremity range of motion, frequency, benefit adn enjoyment of exercise of dance program. (scale 3-15)
Notes	R1, B0, W0

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

R = assessment of randomisation (2 points)
B = double-blinding procedures (2 points)
W = description of withdrawals and dropouts (1 point)

Characteristics of excluded studies *[ordered by study ID]*

Hartman 2000	Study on osteoarthrits

DATA AND ANALYSES

Comparison 1. Efficacy: Functional and clinical outcomes

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Functional assessment	2	52	Mean Difference (IV, Fixed, 95% CI)	0.01 [-2.94, 2.97]
2 Joint tenderness (Ritchie index)	2	53	Mean Difference (IV, Fixed, 95% CI)	-0.83 [-3.30, 1.64]
3 # swollen joints	2	50	Mean Difference (IV, Fixed, 95% CI)	2.45 [-0.45, 5.36]
4 50 foot walk (seconds)	2	48	Mean Difference (IV, Fixed, 95% CI)	0.35 [-1.14, 1.84]
5 Grip strength	2	51	Mean Difference (IV, Fixed, 95% CI)	-0.08 [-0.26, 0.10]
6 Patient global: number rated "recovery" at 2 months	1	68	Risk Ratio (M-H, Fixed, 95% CI)	0.67 [0.35, 1.30]
7 Patient global: number rated "recovery" at 3 months	1	68	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.47, 1.87]

Comparison 2. Efficacy: Range of motion

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Shoulder flexion (degrees)	1	33	Mean Difference (IV, Fixed, 95% CI)	21.01 [-17.56, 59.56]
2 Shoulder internal and external rotation (degrees)	1	33	Mean Difference (IV, Fixed, 95% CI)	42.00 [-7.97, 91.97]
3 Total upper extremity combined: above ranges plus elbow flexion and wrist flexion (degrees)	1	33	Mean Difference (IV, Fixed, 95% CI)	56.01 [-63.90, 175.90]
4 Ankle plantar flexion (degrees)	1	33	Mean Difference (IV, Fixed, 95% CI)	24.01 [3.34, 44.66]
5 Lower extremity flexion: hip, knee, ankle dorsal flexion (degrees)	1	33	Mean Difference (IV, Fixed, 95% CI)	34.01 [10.79, 57.21]

Comparison 3. Efficacy: self-reported enjoyment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Enjoyment (3-15 scale)	1	96	Mean Difference (IV, Fixed, 95% CI)	0.90 [-0.86, 2.66]
2 Benefit (3-15 scale)	1	96	Mean Difference (IV, Fixed, 95% CI)	0.60 [-0.55, 1.75]
3 Frequency (3-15 scale)	1	95	Mean Difference (IV, Fixed, 95% CI)	0.80 [-0.85, 2.45]

Comparison 4. Safety: Tai Chi versus control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Withdrawals Overall	4	189	Risk Ratio (M-H, Fixed, 95% CI)	0.37 [0.19, 0.72]

Analysis 1.1. Comparison 1 Efficacy: Functional and clinical outcomes, Outcome 1 Functional assessment.

Review: Tai chi for treating rheumatoid arthritis

Comparison: 1 Efficacy: Functional and clinical outcomes

Outcome: 1 Functional assessment

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Kirsteins 1991A	20	3.7 (5.5)	10	5.3 (6.2)		42.3 %	-1.60 [-6.14, 2.94]
Kirsteins 1991B	14	3.8 (4.6)	8	2.6 (4.4)		57.7 %	1.20 [-2.69, 5.09]
Total (95% CI)	**34**		**18**			**100.0 %**	**0.01 [-2.94, 2.97]**

Heterogeneity: $Chi^2 = 0.84$, df = 1 (P = 0.36); $I^2 = 0.0\%$

Test for overall effect: Z = 0.01 (P = 0.99)

Analysis 1.2. Comparison 1 Efficacy: Functional and clinical outcomes, Outcome 2 Joint tenderness (Ritchie index).

Review: Tai chi for treating rheumatoid arthritis

Comparison: 1 Efficacy: Functional and clinical outcomes

Outcome: 2 Joint tenderness (Ritchie index)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Kirsteins 1991A	20	10 (7.3)	11	12.3 (13.8)		8.0 %	-2.30 [-11.06, 6.46]
Kirsteins 1991B	14	3.1 (2.5)	8	3.8 (3.2)		92.0 %	-0.70 [-3.28, 1.88]
Total (95% CI)	**34**		**19**			**100.0 %**	**-0.83 [-3.30, 1.64]**

Heterogeneity: Chi² = 0.12, df = 1 (P = 0.73); I² =0.0%

Test for overall effect: Z = 0.66 (P = 0.51)

Analysis 1.3. Comparison 1 Efficacy: Functional and clinical outcomes, Outcome 3 # swollen joints.

Review: Tai chi for treating rheumatoid arthritis

Comparison: 1 Efficacy: Functional and clinical outcomes

Outcome: 3 # swollen joints

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Kirsteins 1991A	18	7.2 (5.1)	10	5.1 (6.2)		41.5 %	2.10 [-2.41, 6.61]
Kirsteins 1991B	14	4.7 (6.8)	8	2 (1.9)		58.5 %	2.70 [-1.10, 6.50]
Total (95% CI)	**32**		**18**			**100.0 %**	**2.45 [-0.45, 5.36]**

Heterogeneity: Chi² = 0.04, df = 1 (P = 0.84); I² =0.0%

Test for overall effect: Z = 1.65 (P = 0.098)

Analysis 1.4. Comparison 1 Efficacy: Functional and clinical outcomes, Outcome 4 50 foot walk (seconds).

Review: Tai chi for treating rheumatoid arthritis

Comparison: 1 Efficacy: Functional and clinical outcomes

Outcome: 4 50 foot walk (seconds)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Kirsteins 1991A	20	11.7 (2.6)	9	11.3 (2.8)		48.0 %	0.40 [-1.76, 2.56]
Kirsteins 1991B	11	10.2 (2.6)	8	9.9 (2)		52.0 %	0.30 [-1.77, 2.37]
Total (95% CI)	**31**		**17**			**100.0 %**	**0.35 [-1.14, 1.84]**

Heterogeneity: Chi^2 = 0.00, df = 1 (P = 0.95); I^2 =0.0%

Test for overall effect: Z = 0.46 (P = 0.65)

Analysis 1.5. Comparison 1 Efficacy: Functional and clinical outcomes, Outcome 5 Grip strength.

Review: Tai chi for treating rheumatoid arthritis

Comparison: 1 Efficacy: Functional and clinical outcomes

Outcome: 5 Grip strength

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Kirsteins 1991A	20	24.2 (13.3)	10	23.6 (17.5)		0.0 %	0.60 [-11.71, 12.91]
Kirsteins 1991B	13	0.45 (0.18)	8	0.53 (0.22)		100.0 %	-0.08 [-0.26, 0.10]
Total (95% CI)	**33**		**18**			**100.0 %**	**-0.08 [-0.26, 0.10]**

Heterogeneity: Chi^2 = 0.01, df = 1 (P = 0.91); I^2 =0.0%

Test for overall effect: Z = 0.86 (P = 0.39)

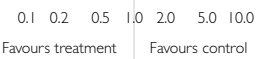
Analysis 1.6. Comparison 1 Efficacy: Functional and clinical outcomes, Outcome 6 Patient global: number rated "recovery" at 2 months.

Review: Tai chi for treating rheumatoid arthritis

Comparison: 1 Efficacy: Functional and clinical outcomes

Outcome: 6 Patient global: number rated "recovery" at 2 months

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Jianjiang 1999	10/35	14/33		100.0 %	0.67 [0.35, 1.30]
Total (95% CI)	**35**	**33**		**100.0 %**	**0.67 [0.35, 1.30]**
Total events: 10 (Treatment), 14 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.18 (P = 0.24)					



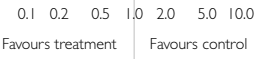
Analysis 1.7. Comparison 1 Efficacy: Functional and clinical outcomes, Outcome 7 Patient global: number rated "recovery" at 3 months.

Review: Tai chi for treating rheumatoid arthritis

Comparison: 1 Efficacy: Functional and clinical outcomes

Outcome: 7 Patient global: number rated "recovery" at 3 months

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Jianjiang 1999	11/35	11/33		100.0 %	0.94 [0.47, 1.87]
Total (95% CI)	**35**	**33**		**100.0 %**	**0.94 [0.47, 1.87]**
Total events: 11 (Treatment), 11 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.17 (P = 0.87)					



Analysis 2.1. Comparison 2 Efficacy: Range of motion, Outcome 1 Shoulder flexion (degrees).

Review: Tai chi for treating rheumatoid arthritis

Comparison: 2 Efficacy: Range of motion

Outcome: 1 Shoulder flexion (degrees)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Van Deusen 1987	17	291 (75)	16	270 (30)		100.0 %	21.00 [-17.56, 59.56]
Total (95% CI)	**17**		**16**			**100.0 %**	**21.00 [-17.56, 59.56]**

Heterogeneity: not applicable

Test for overall effect: Z = 1.07 (P = 0.29)

Analysis 2.2. Comparison 2 Efficacy: Range of motion, Outcome 2 Shoulder internal and external rotation (degrees).

Review: Tai chi for treating rheumatoid arthritis

Comparison: 2 Efficacy: Range of motion

Outcome: 2 Shoulder internal and external rotation (degrees)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Van Deusen 1987	17	290 (81)	16	248 (65)		100.0 %	42.00 [-7.97, 91.97]
Total (95% CI)	**17**		**16**			**100.0 %**	**42.00 [-7.97, 91.97]**

Heterogeneity: not applicable

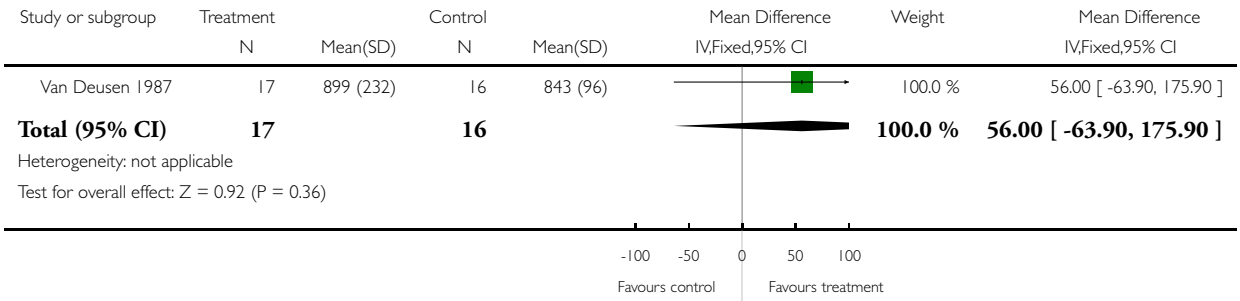
Test for overall effect: Z = 1.65 (P = 0.099)

Analysis 2.3. Comparison 2 Efficacy: Range of motion, Outcome 3 Total upper extremity combined: above ranges plus elbow flexion and wrist flexion (degrees).

Review: Tai chi for treating rheumatoid arthritis

Comparison: 2 Efficacy: Range of motion

Outcome: 3 Total upper extremity combined: above ranges plus elbow flexion and wrist flexion (degrees)

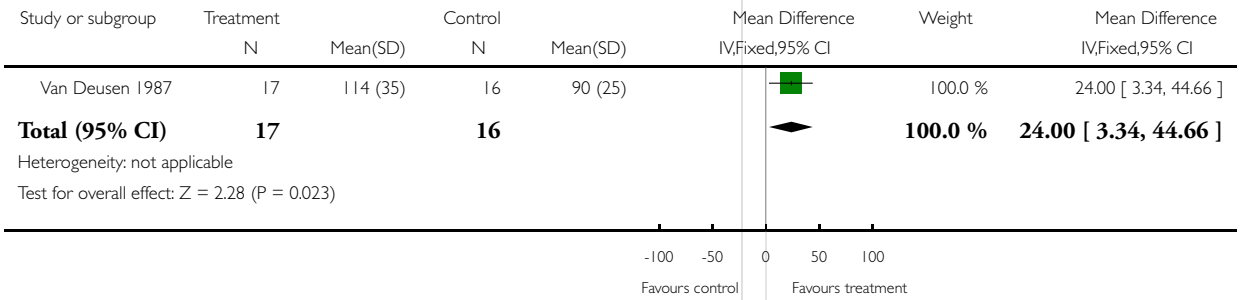


Analysis 2.4. Comparison 2 Efficacy: Range of motion, Outcome 4 Ankle plantar flexion (degrees).

Review: Tai chi for treating rheumatoid arthritis

Comparison: 2 Efficacy: Range of motion

Outcome: 4 Ankle plantar flexion (degrees)



Analysis 2.5. Comparison 2 Efficacy: Range of motion, Outcome 5 Lower extremity flexion: hip, knee, ankle dorsal flexion (degrees).

Review: Tai chi for treating rheumatoid arthritis

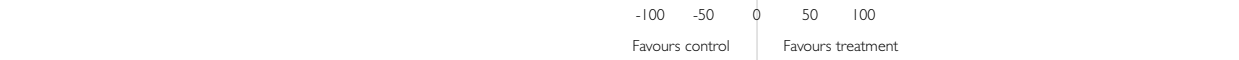
Comparison: 2 Efficacy: Range of motion

Outcome: 5 Lower extremity flexion: hip, knee, ankle dorsal flexion (degrees)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Van Deusen 1987	17	487 (36)	16	453 (32)		100.0 %	34.00 [10.79, 57.21]
Total (95% CI)	**17**		**16**			**100.0 %**	**34.00 [10.79, 57.21]**

Heterogeneity: not applicable

Test for overall effect: Z = 2.87 (P = 0.0041)



Analysis 3.1. Comparison 3 Efficacy: self-reported enjoyment, Outcome 1 Enjoyment (3-15 scale).

Review: Tai chi for treating rheumatoid arthritis

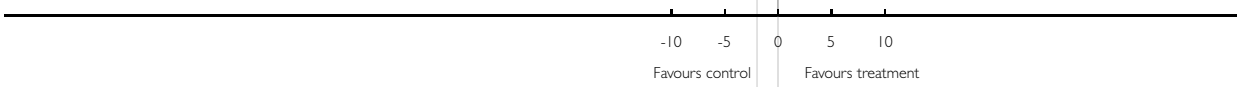
Comparison: 3 Efficacy: self-reported enjoyment

Outcome: 1 Enjoyment (3-15 scale)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Van Deusen 1987	58	8.7 (4.3)	38	7.8 (4.3)		100.0 %	0.90 [-0.86, 2.66]
Total (95% CI)	**58**		**38**			**100.0 %**	**0.90 [-0.86, 2.66]**

Heterogeneity: not applicable

Test for overall effect: Z = 1.00 (P = 0.32)

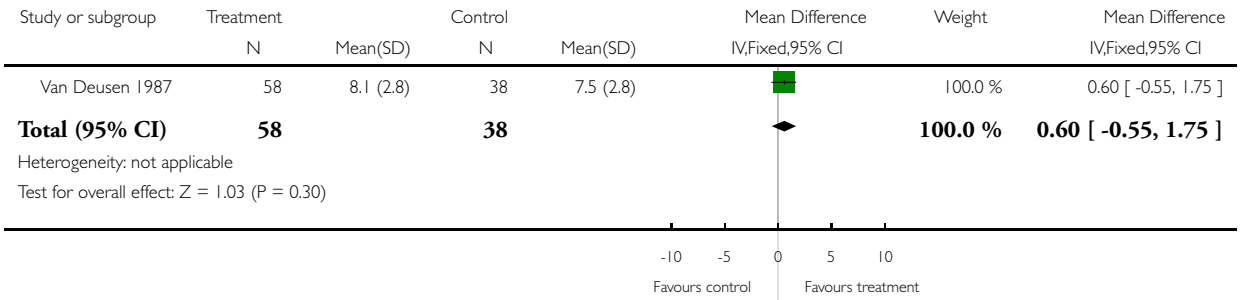


Analysis 3.2. Comparison 3 Efficacy: self-reported enjoyment, Outcome 2 Benefit (3-15 scale).

Review: Tai chi for treating rheumatoid arthritis

Comparison: 3 Efficacy: self-reported enjoyment

Outcome: 2 Benefit (3-15 scale)

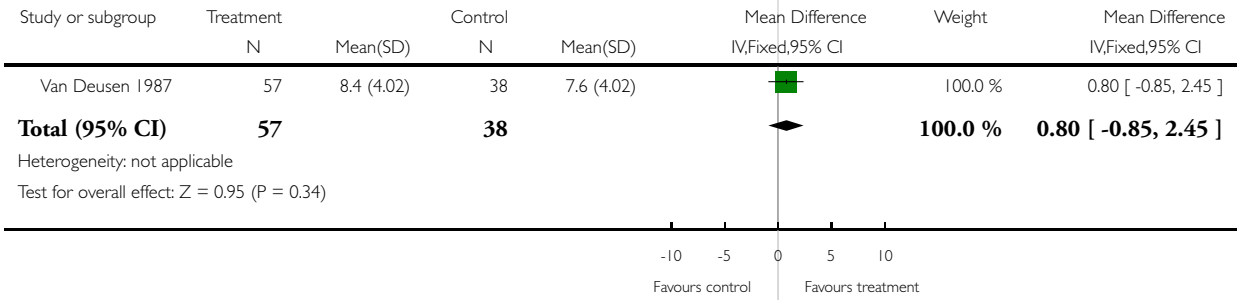


Analysis 3.3. Comparison 3 Efficacy: self-reported enjoyment, Outcome 3 Frequency (3-15 scale).

Review: Tai chi for treating rheumatoid arthritis

Comparison: 3 Efficacy: self-reported enjoyment

Outcome: 3 Frequency (3-15 scale)

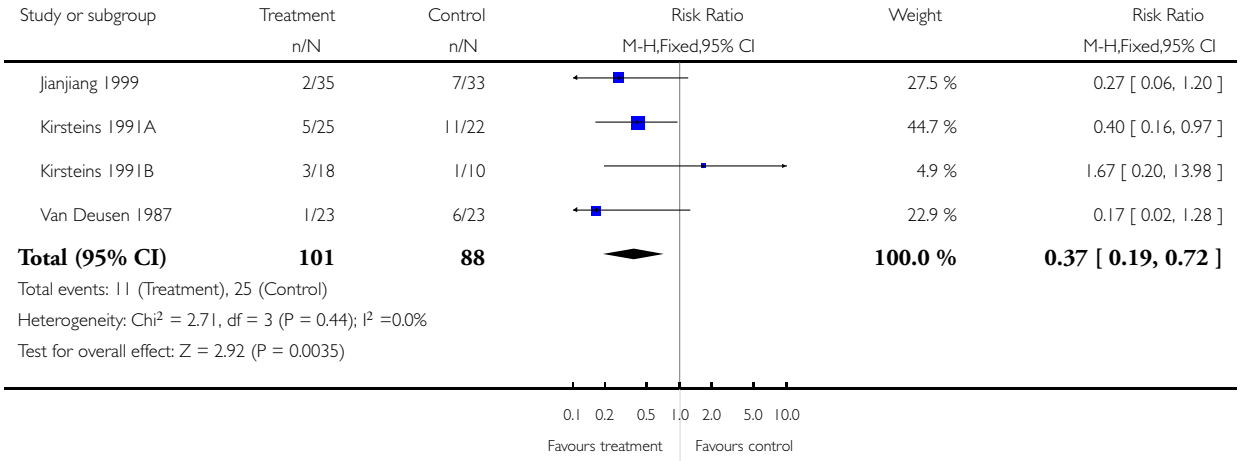


Analysis 4.1. Comparison 4 Safety: Tai Chi versus control, Outcome 1 Withdrawals Overall.

Review: Tai chi for treating rheumatoid arthritis

Comparison: 4 Safety: Tai Chi versus control

Outcome: 1 Withdrawals Overall



APPENDICES

Appendix 1. Search Strategy

Identifying arthritis patients:
1. exp ARTHRITIS/
2 exp RHEUMATOID ARTHRITS/
3. 1 or 2
Identifying intervention:
4 exp Tai Ji/ or tai chi.mp.
5 tai chi.tw.
6 tai chi chuan.tw.
7 tai-chi.tw.
8 or/4-7
Identifying trials:
9. clinical trial.pt.
10. randomized controlled trial.pt.
11. tu.fs.
12. dt.fs.
13. random$.tw.
14. placebo$.tw.
15. ((sing$ or doubl$ or tripl$) adj (masked or blind$)).tw.
16. sham.tw.
17. or/9-16
18. 3 and 8 and 17
19. from 18 keep 1-2

WHAT'S NEW

Last assessed as up-to-date: 25 April 2004.

9 November 2008	Amended	Converted to new review format. CMSG ID: C086-R

HISTORY

Review first published: Issue 3, 2004

CONTRIBUTIONS OF AUTHORS

AH was responsible for selecting trials of the initial review, extracting and analyzing data and writing of the manuscript.

VR assisted in selecting trials for the initial review, extracting and analyzing data and in writing the manuscript.

MJ commented on drafts, provided input into intrepretation of analyses and results and added to the discussion and conclusion of the review. JM developed the search strategy.

WT conducted the searches in Chinese databases, translated articles written in Chinese and helped to extract and analyze data from these Chinese articles.

GW and PT contributed methodological expertise and commented on early drafts.

DECLARATIONS OF INTEREST

None known.

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- Institute for Population Health, University of Ottawa, Canada.
- Paulista Centre for Health Economics, Federal University of Sao Paulo, Brazil.

External sources

- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)

Arthritis, Rheumatoid [*rehabilitation]; Controlled Clinical Trials as Topic; Range of Motion, Articular; *Tai Ji

MeSH check words

Humans