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The effect of Tai Chi exercise on motor function and sleep quality in patients with stroke: A systematic review and meta-analysis

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ABSTRACT

Objective: The meta-analysis is to objectively evaluate the efficacy of Tai Chi exercise for motor function and sleep quality in patients with stroke.

Methods: Randomized controlled trials(RCTs) about the effects of Tai Chi versus a non-exercise or conventional rehabilitation exercise control group on motor function and sleep quality in patients with stroke were searched from multiple electronic databases(PubMed, Web of Science, the Cochrane Library, EMBASE, AMED, CBM, CNKI, Wanfang and VIP) until August 2016. Two investigators independently screened eligible studies, extracted data, and assessed the methodological quality by using the quality evaluation criteria for RCTs recommended by Cochrane Handbook. Then meta-analysis was performed by RevMan5.3 software.

Results: A total of 17 RCTs with 1209 participants were included. The meta-analysis indicated that there was a significant difference on improving the balance function($P < 0.001$) and ability of daily activity ($P = 0.0003$) of patients with stroke between Tai Chi group and control group. However, no significant effect was found on Tai Chi for walking function and sleep quality($P > 0.05$).

Conclusion: Tai Chi exercise can significantly improve the balance function and ability of daily activities of patients with stroke, and there are no significant differences in walking function and sleep quality. Therefore, lots of multicenter, large-sample, higher quality randomized controlled trials are needed to verify the effects of Tai Chi exercise in improving walking function and sleep quality for patients with stroke.

1. Introduction

Stroke, also known as cerebral vascular accident, is a group of acute cerebrovascular diseases which caused by different causes of acute cerebral circulation disorders (cramps, occlusion or rupture) leading to portion or diffuse brain dysfunction [1]. According to reported global estimates, approximately 15 million people suffer from a stroke each year, resulting in 5.5 million deaths, with 5 million cannot live independently because of disability [2]. In 2015, the “Chinese Stroke Prevention Report” pointed out that stroke has become the first leading cause of death among Chinese residents, and the prevalence of stroke continues to increase [3]. Disabilities following stroke can affect daily living activities of patients and lead to great suffering to patients and heavy economic burdens to the family and society [4]. This trend has profound financial and social consequences [5].

Hence, effectively treating stroke is important. Exercise training can promote spontaneous neural functional recovery in patients with cerebrovascular disease, thereby accelerate the process of functional recovery [6]. In recent years, Tai Chi is popular in stroke patients. All the participants noted various physical, functional, and psychological benefits from participating in the Tai Chi exercise, which was perceived as a good way of integrating various skills learned during rehabilitation [7]. Tai Chi,a kind of traditional Chinese low-moderate intensity aerobic exercise, incorporate slowness, rhythmic movements, relaxation, mental concentration, movement coordination, and flow into the next one with elements of meditation, body awareness, and imagery while breathing deeply [8,9]. Tai Chi exercise mode is a more reasonable way of

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rehabilitation exercise, and some studies have found that practicing TaiChi exercise can improve the ability of gait and balance, increase muscle strength for motor system function, and promote good mental state, which was useful for patients with stroke, and even for healthy adults [10,11]. In addition, studies have reported [12,13], Tai Chi exercise can effectively improve the sleep quality of the elderly. Although the results of some clinical studies investigating the effects of Tai Chi exercise on people with stroke have been reported, their findings have not been widely publicized or acknowledged. The objective of this study was to examine the evidence on the effect of Tai Chi exercise for motor function and sleep quality in stroke patients by performing a systematic review and meta-analysis of relevant randomized controlled trials (RCTs).

2. Methods

2.1. Search strategy

We carried on a comprehensive search of the literature in five English databases: PubMed, Web of Science, the Cochrane Library, EMBASE and AMED, and four Chinese databases: CBM, CNKI, Wanfang and VIP databases, which have been searched from their establishment to August 2016. We used following MeSH terms and all field terms when searching. The language was restricted to Chinese and English. The references of all included articles was searched twice and in order to avoid missing literature. The search strategy for PubMed is showed in Table 1.

2.2. Eligibility and exclusion criteria

Research papers selected and analyzed in this study had to meet the following eligibility criteria:

P (population): patients meet the 1995 fourth cerebrovascular disease diagnostic criteria, duration ≤6 months, and by electronic computer X-ray tomography technique(CT), magnetic resonance imaging(MRI) confirmed stroke;
I (intervention): TaiChi, Taiji, Tai Ji Quan, Tai Chi Chuan with or without other treatment;
C(comparison):any type of conventional rehabilitation exercise (including general care, routine exercise therapy)
O(outcome): outcome measures followed: (1)Balance function(using the Berg Balance Scale (BBS) to assess); (2)Walking function(using the gait, the Timed Up-and-Go Test(TUG) and Holden walking grading scale to evaluate); (3)Ability of daily activities (using Activities of Daily Living(ADL), Barthel Index, Modified Barthel Index, Tunk Impairment Scale(TIS), physical function scores of Short Form Health Survey 36 (SF-36) and Generic Quality of Life Inventory-74(GQOLI-74) to evaluate); (4) Quality of sleep (using the Pittsburgh Sleep Quality Index(PSQI) to assess).

Table 1
Search strategies.

#1	Stroke[Mesh]
#2	"Apoplexy" OR "Cerebrovascular Accident" OR "Cerebrovascular" OR "Apoplexy Cerebrovascular Stroke"OR"Brain Vascular Accident" OR"Cerebral Stroke" OR "Acute Stroke" OR "Acute Cerebrovascular Accident" [All fields]
#3	#1 OR#2
#4	Tai Chi[Mesh]
#5	"Taiji" OR"Tai Ji Quan"OR "Tai Chi Chuan"[All fields]
#6	#4 OR#5
#7	"randomized controlled trial" OR "random*" OR "RCT"
#8	#3 AND#6 AND#7

MeSH: Medical Subject Heading.

S(study design): RCT, English and Chinese studies were selected.

Studies were excluded if they met any of the following: (1)case reports or reviews or systematic reviews; (2) duplicate record literature; (3) multiple intervention measures, making it difficult to evaluate the effects of a single measure; (4)can not to obtain effective data. After conducting search, two reviewers perused independently the title and abstract of the studies resulting from the search criteria we had set for qualified studies. Furthermore, we thoroughly read the contents of these research papers and considering select those papers that met the criteria of this study.

2.3. Data extraction

Two reviewers screened independently according to the inclusion and exclusion criteria. Each included study is extracted data independently by two reviewers using a pre-designed data extraction form. The following information was extracted:study characteristics (eg, author and year), subjects characteristics (eg, age and number of sample), study design, place of study, description of interventions, duration of trial period and indexes of assessed outcomes. During the processes above, disagreements between the two reviewers were resolved through consulting, if the consensus could not be reached, the third reviewer was consulted for a final decision.

2.4. Risk of bias assessment

The risk of bias was assessed by two reviewers using the Cochrane Handbook for Systematic Reviews of Interventions [14]. Two reviewers assessed independently for risk of bias in each included study. Six components associated with the risk of bias were assessed: randomization sequence generation, allocation concealment, blinding of outcome assessors, incomplete outcome data, selective reporting, and other biases. Each item would be rated as "low risk of bias","unclear risk of bias", or "high risk of bias" in the light of Cochrane Handbook [14]. In our study, it is impossible to blind researchers and subjects in the non-pharmacological clinical trials. However, it is feasible to blind the outcome assessors (blinding to the study objectives and outcomes). So, for the purposes of this review, blinding of outcome assessors was considered as adequate. The independent evaluation is completed, the two researchers on the evaluation results were discussed and reached a consensus. If there was disagreement, the third researcher was consulted.

2.5. Statistical analysis

The meta-analysis was performed by using the RevMan 5.3 software. When meta-analysis was conducted for continuous variables, if all studies assessed the same outcome by the same scale, the weighted mean difference(*WMD*) was used as a summary statistic in meta-analysis; if all studies evaluated the same outcome by different scales, the standardized mean difference(*SMD*) was used as a summary statistic in meta-analysis, and all analysis were calculated 95% confidence interval (95%*CI*).In meta-analysis, statistical heterogeneity be measured by Chi-square test, I^2 and *P* value. When $P > 0.1$ and $I^2<50\%$, a fixed-effects model would be applied and $P < 0.1$ and $I^2\geq 50\%$,a random-effects model would be applied if articles were considered clinically similar enough. We only use descriptive analysis if the heterogeneity is too obvious which can not determine the source. Corresponding 95% *CI* and *P* value as pooled effect would present the result of meta-analysis. A $P < 0.05$ was considered to be statistically significant. Publication bias was assessed by means of funnel plot and Egger's test of asymmetry [15].

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