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Original article

Effectiveness of incorporating Tai Chi in a pulmonary rehabilitation program for Chronic Obstructive Pulmonary Disease (COPD) in primary care—A pilot randomized controlled trial☆

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Abstract

Introduction: Studies have shown that pulmonary rehabilitation and Tai Chi are beneficial to patients with Chronic Obstructive Pulmonary Disease (COPD), which is a major public health problem. The aim of this single-blind randomized controlled study was to compare the self-efficacy and quality of life parameters of COPD patients who underwent pulmonary rehabilitation with or without Tai Chi elements incorporated in the exercise component.

Methodology: 192 COPD patients, recruited from four primary care clinics, satisfied the eligibility criteria and consented to randomization to either pulmonary rehabilitation program group (PRP) or the group with Tai Chi elements added to PRP (TC). Both groups received rehabilitation consisting of 2 sessions per week for 6 weeks with totally identical content except that Tai Chi exercises were added to TC group. Data collection was performed at baseline, 2 and 6-month post-intervention.

Results: Intention-to-treat analysis was performed for 192 subjects. Both groups did not differ in demographics and baseline variables except for COPD staging, mean FEV_1, FEV_1%-Pred, Saint George Respiratory Questionnaire SGRQ activity score and COPD-CSES self-efficacy score. Statistical improvements were seen in exercise capacity, health status and self-efficacy within both groups at 6-month post-intervention. Although more favorable improvements in physiological outcomes and health status were demonstrated in Tai Chi group, only the functional exercise capacity showed statistical improvement between groups at 6 months post-intervention ($\beta = 12.786$ m; 95% CI = 3.794, 21.777; $p = 0.006$).

Conclusion: The adjuvant effect of incorporating Tai Chi in pulmonary rehabilitation showed a modest complementary benefit in exercise capacity.

Keywords: Tai Chi; Pulmonary rehabilitation; Chronic Obstructive Pulmonary Disease (COPD); Quality of life; Self efficacy

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a major public health burden characterized by both lung function impairment and disease exacerbation [1]. The disease results in a progressive deterioration in physical ability, thus, affecting quality of life and self-efficacy. Pulmonary rehabilitation is a multi-disciplinary program of care for patients with chronic respiratory impairment that is individually tailored and designed to optimize physical and social performance. Evidence from several studies has proven the benefits of pulmonary rehabilitation in improving exercise capacity, self-efficacy and health-related quality of life in patients with COPD [2]. Long term effectiveness of exercise interventions at completion of formal pulmonary rehabilitation requires exercise adherence [3].

Tai Chi, which originated from China, is an exercise characterized by posture alignment, weight shifting and circular movements that incorporate elements of muscle strengthening,

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balance, relaxation and breathing control. Tai Chi has been suggested as an appropriate, if not ideal, form of exercise for patients with chronic cardiopulmonary disease, such as COPD. Tai Chi has also been shown to have proven benefits in improving exercise capacity, physiological status, quality of life health related status, self-efficacy and associated with higher compliance to exercise in COPD patients [4–6]. Thus, this study hypothesized that incorporating Tai Chi elements into the exercise component in standard pulmonary rehabilitation program would have adjuvant effect on self-efficacy, quality of life parameters and exercise capacity of COPD patients in primary care setting.

Methods

Sample size

Previous studies suggested a medium effect size for Tai chi exercises on health related quality of life (HRQL) measured by St George respiratory questionnaire (SGRQ) for COPD [3,4]. Given a moderate effect size, a power of 0.80, 5% significant level and potential attrition rate of 25%, a sample size of 170 participants or 85 subjects per group were needed.

Subjects

The aim was to recruit 200 subjects into the study. Subjects included were clinically diagnosed to have COPD as defined by American Thoracic Society (ATS) and Global Initiative for Chronic Obstructive Lung Disease (2010 GOLD) with Medical Research Council MRC dyspnea score of ≥ 2 using the 1–5 scale version [7–9]. Subjects had decreased forced expiratory ratios (FEV_1/FVC) of <70% that is poorly reversible with bronchodilators.

Subjects who had suffered from poor mobility, severe sensory or cognitive impairment, severe co-morbidities including acute myocardial infarction in preceding 6 months and had practiced Tai chi within a year prior to commencement of study were excluded. The Hospital Authority Kowloon West Cluster Research Ethics Committee has approved this study (KW/EX/10-015) and all subjects gave written informed consent.

Design and setting

This is a single-blind randomized controlled study conducted from March 2011 to May 2012 with a total of 192 participants recruited from four general out-patient clinics in Hong Kong.

A research assistant (RA), who was not involved in the recruitment, generated 200 random number sequences using Microsoft Excel 2002 for the investigators to randomly allocate patients to two groups, namely, pulmonary rehabilitation program group (PRP) and the group with Tai Chi elements added to PRP (TC). The same RA would conceal the allocation sequence with sequentially numbered envelopes. Each participant would receive one envelope and would be opened and allocated to assigned grouping by a different RA upon recruitment at T_1 (baseline) visit. Inter-rater reliability test among RAs was done to ensure consistency in data collection.

To minimize researcher bias, research assistants (RA) for data collection were blind to the study. A pilot study ($n = 21$) was also undertaken to test study design feasibility and instrument usage.

For trial registration, this study was registered as ID NCT01259245 in Clinical.Trials.gov Protocol.

Protocol

Intervention

Both groups received rehabilitation consisting of 2 sessions per week for 6 weeks with totally identical content except that Tai Chi exercises were incorporated to the TC group.

Each session would last for 1 h and 20 min with 6–10 subjects per session. Upon entering the intervention protocol, all subjects in both groups were required to participate in the 30 min educational session conducted by physiotherapist to improve their knowledge and skills in COPD management. A COPD booklet and home diary would be provided as supplementary materials. The formal pulmonary rehabilitation program in the PRP group would consist of warm up and cool down exercise and aerobic exercises. Patients performed 5 min warm-up exercises. Then, two aerobic activities including treadmill exercise and lower limb ergometry exercise lasting for 20 min each were prescribed. 15 min rest was given between each exercise. After the aerobic exercises, 5 min cool down followed by 15 min of relaxation exercise was conducted before subjects completed that session. In the TC group, the formal pulmonary rehabilitation program was totally identical to the PRP group, except 15 min of Tai Chi exercises was substituted to the 15 min of relaxation exercise. 5 forms of Sun Style Tai chi were taught by Tai Chi accredited physiotherapist for ease of mastery. PRP group was instructed to perform 1 h daily of unsupervised home exercises consisting of 5 min warm up, 5 min of Thera-Band exercises, 30 min of aerobic exercises, 5 min cool down and 15 min of relaxation exercises for 5–7 days a week. Thera-Band exercises, which utilized a rubber-based resistance band known to optimize muscle strengthening exercises, was also taught as home exercises for both groups. The TC group was also instructed to perform 1 h daily of totally identical unsupervised home exercises as the PRP group except for 15 min of Tai chi replacing the relaxation exercises for 5–7 days a week. Both groups were instructed to document home exercises in their compliance diary.

Study instruments

Outcome measures were collected at baseline (T_1), 2 months (T_2) and 6 months (T_3) post-intervention. Primary outcome measures used to assess self efficacy and health status included, COPD self-efficacy scale (COPD-CSES), self-efficacy for managing shortness of breath (SEMSOB) and St George Respiratory questionnaire-Hong Kong Chinese version SGRQ-HKC), respectively.

The validated Chinese version of COPD-CSES, which is a reliable and internally consistent 34-item instrument measuring a person's confidence in managing breathing difficulties in different situations, was used [10–13]. There are two methods in