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Can therapeutic Thai massage improve upper limb muscle strength in Parkinson's disease? An objective randomized-controlled trial

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A B S T R A C T

Muscle weakness is a frequent complaint amongst Parkinson's disease (PD) patients. However, evidence-based therapeutic options for this symptom are limited. We objectively measure the efficacy of therapeutic Thai massage (TTM) on upper limb muscle strength, using an isokinetic dynamometer. A total of 60 PD patients with muscle weakness that is not related to their 'off' periods or other neurological causes were equally randomized to TTM intervention (n = 30), consisting of six TTM sessions over a 3-week period, or standard medical care (no intervention, n = 30). Primary outcomes included peak extension and flexion torques. Scale-based outcomes, including Unified Parkinson's Disease Rating Scale (UPDRS) and visual analogue scale for pain (VAS) were also performed. From baseline to end of treatment, patients in the intervention group showed significant improvement on primary objective outcomes, including peak flexion torque ($F = 30.613$, $p < .001$) and peak extension torque ($F = 35.569$, $p < .001$) and time to maximal flexion speed ($F = 14.216$, $p = .001$). Scale-based assessments mirrored improvements in the objective outcomes with a significant improvement from baseline to end of treatment of the UPDRS-bradykinesia of a more affected upper limb ($F = 9.239$, $p = .005$), and VAS ($F = 69.864$, $p < .001$) following the TTM intervention, compared to the control group. No patients reported adverse events in association with TTM. Our findings provide objective evidence that TTM used in combination with standard medical therapies is effective in improving upper limb muscle strength in patients with PD. Further studies are needed to determine the efficacy of TTM on other motor and non-motor symptoms in PD.

1. Introduction

By the time a diagnosis of Parkinson's disease (PD) is made, upper limb motor symptoms are usually evident. Besides the cardinal features (bradykinesia, rigidity, and rest tremor) in the upper limb, reduced muscle strength or weakness is one of the most frequent complaints amongst early PD patients with difficulties in manipulating objects or undertaking daily tasks reported.[1,2] While weakness in PD is usually relative, not apparent on standard neurological examination and may be attributed to fatigue, a number of well-designed studies have established a relationship between reduced muscle power and bradykinesia.[3,4] This combination of weakness and bradykinesia can contribute to reduced muscle strength, when patients fail to energize their muscles fully, for a number of reasons, including a lack of full volitional effort, insufficient recruitment of muscle force, and inability to maintain constant force.[5]

Although levodopa is an effective treatment of bradykinesia in PD, from a patient's perspectives, the benefit of levodopa is less

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impressive. In a recent study, there was only moderate patient-clinician agreement for the effect of levodopa on bradykinesia and rigidity when better concordance was demonstrated for tremor.[6] Moreover, weakness, as manifested by impaired dexterity of the upper limb, was found to be minimally responsive to levodopa.[7] Consequently, PD patients often seek complementary and alternative therapies (CAT) to try and improve weaknesses and/or bradykinesia. Early evidence of benefits of massage has been demonstrated for a range of PD symptoms, including reduction of tremors, enhancing shoulder range-of-motion, and improvements on gait, activities of daily livings (ADLs) and quality of life (QoL).[8–10] Therapeutic Thai massage (TTM, also known as 'Nuad Thai' in Thai) has been part of Thai traditional medicine for centuries and is a popular choice amongst Thai PD patients. TTM involves slow rhythmical stroking and kneading of the skin using different levels of strength on acupressure points and stretching along 10 major and 72000 minor energy lines, called 'SEN lines'.[11] The underlying mechanisms of TTM are likely to be complex involving stimulation of the parasympathetic nervous system or tissues underneath the skin resulting alleviating spasms, increasing circulation, reducing adhesions, and ultimately producing relaxation.[12]

While the beneficial effects of massage have been demonstrated as an improvement in a number of clinical rating scales, very few studies have evaluated the muscle strength of upper limbs in PD patients and objective measurements are seldom be included as primary outcomes in randomized controlled trial involving CAT in PD patients.[3,13] Our initial pilot study demonstrated a positive effect of TTM on hand functions in PD patients as demonstrated by isometric hand grip score.[14] Therefore, we further evaluate the efficacy of TTM as an add-on intervention to conventional therapies in a randomized-controlled trial on upper limbs muscle strength in PD patients who complain of muscle weakness that are not related to their 'off' symptoms using the isokinetic dynamometer method that allows objective measurement of muscular forces in dynamic conditions, reflecting muscle strength.[15]

2. Patients and methods

2.1. Patients

Patients with a diagnosis of PD according to the United Kingdom Parkinson's Disease Society Brain Bank criteria, were screen by two movement disorder neurologists (OJ and RB). Inclusion criteria were: 1) Hoehn and Yahr stage 1–3, 2) stable pharmacological treatment during the past three months, 3) mini-mental state examination score (MMSE) > 25, and 4) complaints of muscle weakness in the upper limbs that were not related to their 'off' symptoms as identified during clinical interviews, and confirmed by PD diaries. Patients were excluded if muscle weakness was due to other neurological causes rather than PD (such as stroke, radiculopathies, myopathies, etc.), or they had other neck, shoulder, or elbow dysfunctions that could interfere with the performance. Wheelchair and bed-bound patients were not enrolled due to their difficulty attaining correct positioning during isokinetic tests. Of the 60 PD patients who were enrolled into this study, 30 were randomized to TTM intervention whereas the rest received no intervention, designated as a control group. Ethical approval was given by the Human Ethics Committee of the Faculty of Medicine, Chulalongkorn University (IRB No. 083/58, COA No. 388/2015) and the study was executed in accordance with the declaration of Helsinki. All patients provided written informed consent before randomization.

2.2. Study design

This was a randomized, single-blinded, controlled study conducted in a single center (Chulalongkorn Center of Excellence for Parkinson's Disease & Related Disorders, www.chulapd.org) between July 2015 and June 2016. Screening took place up to 4 weeks before baseline evaluation on Day 1 when patients were randomized (1:1) to treatment with TTM or control (standard medical care, no TTM). Interventions were performed during patients' 'on' period. Patients in the intervention group received six TTM sessions over a 3-week period, conducted by the investigator (YM) who is a certified TTM practitioner (under the Ministry of Education, Thailand) and over 10 years of experience (Fig. 1a). The TTM protocol used in this study was the standard TTM protocol, listed in the benchmark training curriculum for 'Nuad Thai' of the World Health Organization and approved by Thai Ministry of Education.[11] Each 30-minute TTM session consisted of kneading and pressing with moderate intensity, within patient's range of comfort, along six designated 'SEN' lines of the upper limbs (Fig. 1b–c). Detailed descriptions of the TTM protocol were included in the supplementary data 1. The control group received no intervention. During the 3-week study period, all participants were instructed not to undergo additional TTM or similar interventions and activity diaries were checked to ensure that all patients complied to the study protocol.

2.3. Isokinetic muscle strength

Elbow flexor and extensor muscle strength was assessed with an isokinetic dynamometer (CON-TREX®, Physiomed Elctromedizin AG, Germany). Patients were seated with fully pronated forearm, positioned horizontally and flexed 90°, with respect to their upper arm (Supplementary data 2). The forearm was attached at the wrist to a stiff bar by Velcro straps. Muscle strength was measured in both upper limbs using a previously published protocol, 60°/second with a five-second interval isometric holding and a 30-second rest period between each test.[16,17] Three submaximal cycles and one maximal cycle were completed as practice runs before the collection of three maximal repetitions at 60°/second. The best value (peak torque) was retained for further statistical analysis. The same investigator (NA) conducted the tests for all subjects.

2.4. Scale-based assessments

Scale-based assessments were performed at baseline and study end by the same investigator (JS) who was blinded to all subjects. Rating scales included Unified Parkinson's Disease Rating Scale (UPDRS) total scores, UPDRS-III (motor) sub-score, the Visual Analogue Scale for Pain (VAS), and the scoring index of the eight-item Parkinson's Disease Questionnaire (PDQ-8 SI).

2.5. Statistical analysis

Baseline characteristics were summarized using either means, standard deviation, frequencies or percentages as appropriate. Comparisons for categorical and continuous variables were carried out by the Chi-square test and independent *t*-test respectively. Maximal torque and clinical scale endpoints were mean change from baseline to end of treatment period, using observed data. To determine intervention effects between intervention and control groups from baseline to end-of-treatment, we utilized two-way mixed ANOVA with one within-subjects factor and one between-groups factor. Category refers to the between-subjects factor, whereas sequence refers to the within-subjects factor. Pearson's correlation was performed to determine correlation coefficients