

Gait analysis of patients with knee osteoarthritis before and after Chinese massage treatment

Zhu Qingguang, Fang Min, Gong Li, Jiang Shuyun, Sun Wuquan, Li Jianhua, Li Yong

Zhu Qingguang, Jiang Shuyun, Department of Physical Therapy with Chinese Massage, Yueyang Hospital of Integrated Traditional Chinese and Western Medicine, Shanghai University of Traditional Chinese Medicine, Shanghai 200437, China; Research Institute of Chinese Massage, Shanghai Academy of Traditional Chinese Medicine, Shanghai 200437, China

Fang Min, Gong Li, Sun Wuquan, Li Jianhua, Li Yong, Department of Physical Therapy with Chinese Massage, Yueyang Hospital of Integrated Traditional Chinese and Western Medicine, Shanghai University of Traditional Chinese Medicine, Shanghai 200437, China

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Correspondence to: Fang Min, Department of Physical Therapy with Chinese Massage, Yueyang Hospital of Integrated Traditional Chinese and Western Medicine, Shanghai University of Traditional Chinese Medicine, Shanghai 200437, China. fangmin19650510@163.com

Telephone: + 86-2165161785

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with knee OA, who then underwent Chinese massage therapy three times per week for 2 weeks. The patients underwent gait evaluation using a six-camera infrared motion analysis system. They completed Western Ontario and McMaster Universities Osteoarthritis Index questionnaires before and after treatment. We calculated the forward speed, step width, step length, total support time percentage, initial double support time percentage, and single support time percentage. We also measured the angles at the knee, hip, and ankle during the stance phase of walking. The results showed statistically significant mean differences in knee pain relief, alleviation of stiffness, and physical function enhancement after therapy ($P < 0.05$). The patients gained significantly faster gait speed, greater step width, and increased total support time percentage after the Chinese massage therapy ($P < 0.05$). There were no significant differences in the range of motion or initial contact angles of the knee, hip, or ankle during the stance phase of walking. We concluded that Chinese massage is a beneficial complementary treatment and an alternative therapy choice for patients with knee OA for short-term pain relief. Chinese massage may improve walking ability for these patients.

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Key words: Gait; Osteoarthritis, Knee; Massage

Abstract

The objective of this study was to evaluate the effectiveness of Chinese massage therapy in patients with knee osteoarthritis (OA) by measuring lower-limb gait parameters. We recruited 20 women

INTRODUCTION

Osteoarthritis (OA) is estimated to be the fourth leading cause of disability strongly associated with aging, and populations in the Asian region are aging rapidly.

Most of the disability burden is attributable to knee OA.¹ A recent survey in six Chinese cities reported that, for people aged ≥ 40 years, 32.8% of women and 23.5% of men have been diagnosed with radiographically confirmed knee OA.² Patients suffering from knee OA also experience knee pain, limited daily activities, and loss of functional independence $\frac{3}{4}$ all of which affect their quality of life.

Traditional Chinese massage therapy has a history of more than 2000 years and is one of the most popular complementary and alternative therapies in China for patients with knee OA. Patients with knee OA commonly undergo Chinese massage therapy two or three times a week for 2 weeks. Although some studies showed beneficial effects of this alternative therapy for reducing pain and improving physical knee function, these studies were evaluated primarily by medical imaging and self-assessment questionnaires.³⁻⁷ The outcome of subjective questionnaires is dependent on patient self-reporting. Medical imaging cannot provide adequate insight into the kinematics that occur during daily activities, such as walking. Movement analysis offers a more accurate way to study joint kinematics. Gait analysis is a particularly effective tool for examining changes in movement patterns in joints and has been used to study the gait data for knee OA.⁸⁻¹¹ The purpose of this study was to apply motion analysis to assess the efficacy of Chinese massage in improving kinematic features in patients with knee OA.

MATERIALS AND METHODS

Patients

A total of 20 women diagnosed with knee OA were recruited from Yueyang Hospital of Integrated Traditional Chinese and Western Medicine in Shanghai between January 2012 and May 2013. Inclusion criteria were based on the clinical criteria for knee OA (bilateral) as indicated in the clinical criteria of the American College of Rheumatology¹² for those 50-70 years of age. All patients were diagnosed with knee OA based on a clinical assessment that included knee radiography and a physical examination. The main physical examination included determining the range of motion (ROM) and location of the knee pain. The anterior drawer test was used to evaluate injury of the anterior cruciate ligament, and the McMurray test was used to determine if there was a meniscal injury. Only those with negative anterior drawer and McMurray tests were included in the study. Radiographic assessment of the erect anteroposterior and mediolateral views of both knees was undertaken. The classification was based on anteroposterior or tibiofemoral radiographs using the Kellgren-Lawrence (K/L) grading scale (0-4) for knee OA,¹³ in which a grade of ≥ 1 was regarded as indicating the presence of knee OA. Subjects were recruited (K/L 1-2) according to the K/L scale classification.

Patients were excluded if they had had previous lower limb surgery, other orthopedic problems of the hip, knee, or ankle, or a neurological disease (e.g., Parkinson's, dementia, vertigo, cerebral apoplexy).

A summary of the patients' demographics appears in Table 1.

Table 1 Demographics of all patients with knee osteoarthritis

Characteristic	Mean (SD)	Range
Age (years)	60.35 (5.18)	50-70
Height (cm)	158.35 (8.23)	140-175
Weight (kg)	62.45 (8.59)	45-78
BMI (kg/m ²)	24.93 (3.15)	17.58-31.05
K/L grade ^a	I: 15, II: 25	I- II

Notes: SD: standard deviation; OA: osteoarthritis; BMI: body mass index; K/L: Kellgren-Lawrence. ^aGrades I and II of the K/L radiographic classification for knee OA were assigned to 15 and 25 patients, respectively.

The Research Ethics Committee of the Yueyang Hospital of Integrated Traditional Chinese and Western Medicine, affiliated with Shanghai University of Traditional Chinese Medicine, approved the trial protocol. The study was conducted according to the common standard guidelines of the Declaration of Helsinki. All patients were requested to sign a written informed consent statement before the study. The trial was registered in the Chinese Clinical Trial Registry (ChiCTR-TRC-1300396).

Chinese massage treatment protocols

Patients with knee OA underwent 25- to 30-min sessions of Chinese massage therapy three times a week for 2 weeks provided by a professional Chinese massage therapist. Each session consisted of pressing and thumb-kneading on eight acupoints following World Health Organization standard acupuncture point locations¹⁴ around the knee area: Yinlingquan (SP 9), Xuehai (SP 10), Liangqiu (ST 34), Heding (EX-LE 2), Xiyuan (EX-LE 5, inside and outside Xiyuan), Zusanli (ST 36), Yanglingquan (GB 34), Weizhong (BL 40).^{15,16} Various muscles and ligaments on the thigh and leg were massaged by thumb-kneading the quadriceps femoris, gracilis, sartorius, semimembranosus, semitendinosus, biceps femoris, peroneus longus, gastrocnemius, and tibialis anterior muscles, as well as the quadriceps, patellar, and hamstring tendons and the iliotibial band.

Gait analysis

In a gait laboratory at Yueyang Hospital of Integrated Traditional Chinese and Western Medicine in Shanghai, all patients performed barefoot walking trials at their self-selected, comfortable walking speed. Three successful gait cycles for each limb were recorded for each patient, visually verified by the test leader. A Helen Hayes retroreflective marker set (Motion Analysis Corp., Santa Rosa, CA, USA) was used to determine

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