Effect of Continuous Compression Stimulation on Pressure-Pain Threshold and Muscle Spasms in Older Adults With Knee Osteoarthritis: A Randomized Trial

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Abstract

Objective: The purpose of this study was to assess the effect of continuous compression stimulation on pressure-pain threshold and muscle spasms in older adults with knee osteoarthritis.

Methods: Thirty-two older adults with knee osteoarthritis on outpatient visits were randomly divided into 2 groups. Those in the treatment group (n = 16) received 5-minute massage therapy (continuous compression stimulation), and those in the control group (n = 16) received sham massage therapy (touch without compression). Immediately before and after single-intervention sessions, the pressure-pain threshold, muscle spasm, and pain were quantified.

Results: The change in pain on walking in the treatment group exceeded 1.9 cm, corresponding to the minimum clinically important difference. In the treatment group, the pressure-pain threshold improved significantly for pain both at rest and while walking, but the improvement in muscle spasm was not significant.

Conclusions: Massage therapy resulted in minimal clinically important changes for pain relief. There was an increase in the pressure-pain threshold in the older adults with knee osteoarthritis. We propose that the improvements in pain may be related to the medial thigh muscle rather than knee osteoarthritis. (J Manipulative Physiol Ther 2018;41:315-322)

Key Indexing Terms: *Massage; Osteoarthritis; Knee; Pain*

Introduction

Osteoarthritis is a painful musculoskeletal disease[1] that results from breakdown of the joint cartilage and underlying bone. It affects an estimated 12.1% of the adult US population[2] and is a leading cause of disability in the elderly.[3] Symptomatic knee osteoarthritis is frequently diagnosed in the clinical setting, and treatment usually targets pain relief, prevention of disability, and improvement of quality of life.

Cartilage loss, inflammation of the synovial membrane, mechanical stress within the joint, and stiffness of the peri-articular components are believed to cause pain. Muscle condition is one of the peri-articular components that has been targeted in massage therapy. Perlman et al reported the effect of massage therapy on pain relief in patients with knee osteoarthritis.[4,5] In addition, several studies have been performed to examine whether knee pain can be improved by acupressure and/or ischemic compression toward lower-extremity muscle.[6-10] One of the reasons for addressing these non-drug therapies is that these therapies are safer than drug therapies and have fewer side effects. However, the mechanism underlying the pain relief induced by massage therapy remains unclear. Understanding this mechanism would help in customizing massage therapy for each patient.

Recent studies have revealed that patients with knee osteoarthritis may have both peripheral and central sensitization of pain mechanisms, resulting in the spread of hyperalgesia.[11] Pain sensitization occurs in patients with knee osteoarthritis and may be associated with the severity of knee osteoarthritis symptoms.[12] A lower pressure-pain threshold, which is a sign of sensitization, has been observed in patients with osteoarthritis compared with healthy controls.[13] Lower pressure-pain thresholds have also been correlated with higher pain intensity, higher disability scores, and poorer quality of life.[14] These data

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suggest that an improvement in the pressure-pain threshold may partially relieve the pain in knee osteoarthritis. Other evidence indicates that massage therapy can improve the pressure-pain threshold[15-17] and muscle spasms.[18,19] However, this threshold has not been studied as a key factor in understanding the mechanism of pain relief in trials for patients with knee osteoarthritis.[4-10]

The purpose of this study was to test the hypothesis that an increase in the pressure-pain threshold and a decrease in muscle spasms induced by massage therapy can mediate pain relief in patients with knee osteoarthritis. Validating this hypothesis would help us to understand the mechanism(s) underlying pain relief induced by massage therapy.

Methods

Trial Design

In this randomized controlled trial, the treatment group received massage therapy and the control group received sham treatment. The allocation ratio was 1:1. This study was approved by the ethics committees of both Saiseikai Kure Hospital (No. 87) and Hiroshima International University (No. 13-100). All patients provided written informed consent after receiving complete information about the study objectives and content. The registration number of this trial is UMIN000022947.

Participants

Participants were outpatients who visited the Saiseikai Kure Hospital in Japan. The inclusion criteria were as follows: a positive diagnosis of knee osteoarthritis by an orthopedist based on plain radiography, knee pain either at rest or while walking, and age ≥50 years. The exclusion criteria were as follows: definitive neurological disorders, inability to respond to the questions unaided because of cognitive impairment (eg, dementia), and the presence of skin disease (eg, contact dermatitis). Because the change in pain derived from the peri-articular muscle condition was the focus of the present study, we did not investigate in detail whether the patient had an intra-articular prosthesis. At baseline, age, height, weight, severity of osteoarthritis (Kellgren-Lawrence grade), and comorbidities (diabetes and hypertension) were recorded.

Interventions

To evaluate the immediate effect of massage therapy, intervention was limited to 1 session. The second author (T.U.) took charge of therapeutic intervention, and the third author (Y.K.) measured outcomes. In both the treatment and control groups, intervention was performed on the anterior and distal portion of the medial thigh (Fig 1). The reasons for this were as follows: tenderness and pain were noted in this area while walking[20]; the location was easily accessible during massage therapy; and knee pain subsided on massaging this area according to our clinical experience. If the participants had undergone surgery in the past (eg, total knee arthroplasty), intervention was performed on the non-operated knee. If participants experienced pain in both knees and had not undergone any knee surgery, the more painful site was selected as the intervention target. We chose the continuous compression stimulation massage type, because the amount of compression stimulation applied could be converted into numerical values. To quantify the amount of compression stimulation applied, a manual load was provided via a hand-held dynamometer (Microfet2, Orsay, France).

Fig 1. *Continuous compression stimulation performed on the anterior and distal portion of the medial thigh. This photograph depicts application of stimulation at the right thigh.*

In the treatment group, the participants maintained a lateral posture, with the knee pointing down. The therapist stood near the treatment bed and approached the participants from behind. The therapist applied continuous compression load at the target area with his hand. During treatment, the therapist used his body weight by keeping the elbow in extension. The compression stress was increased gradually and stopped just before the patient experienced pain. Based on the degree of compression stress at this time, the pressure for massage for each patient was determined. The therapist monitored regularly to maintain the degree of compression load as high as possible. The duration of continuous compression was 5 minutes.

In the control group, the therapist placed a handheld dynamometer over the surface of the target area only and did not subject the patient to any compression (the force was almost 0).

Outcomes

The primary outcomes in this study included the pressure-pain threshold, muscle spasm, and pain at both rest and on walking. These were measured immediately before and after intervention. The secondary outcome was the general rating of change.

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