Original Article

Effects of resistance exercise using the elastic band on the pain and function of patients with degenerative knee arthritis

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Abstract. [Purpose] This study examined the effects of resistance exercise using the elastic band on the pain and function of patients with degenerative knee arthritis. [Participants and Methods] Thirty patients with degenerative knee arthritis were classified into an experimental group of 15 patients on whom resistance exercise using the elastic band was applied and a control group of 15 patients on whom conservative physical therapy was applied. Both groups received treatments three times a week for four weeks. Pain was measured by the visual analogue scale and function was evaluated by the Korean Western Ontario and McMaster Universities Osteoarthritis Index (K-WOMAC). [Results] The intragroup comparison showed significant decreases in the visual analogue scale and the K-WOMAC in both the experimental and control groups. In the intergroup comparison after treatment, the experimental group showed significantly lower visual analogue scale and K-WOMAC values than the control group. [Conclusion] The results suggest that resistance exercise using the elastic band is an effective intervention for the pain and function of patients with degenerative knee arthritis.

Key words: Knee arthritis, Elastic band, Function

INTRODUCTION

Degenerative knee arthritis is the most frequent chronic disease among the elderly aged 65 years or older. These patients suffer repeated cycles of worsening and relief of symptoms, which cause various physical and psychological problems1). Degenerative knee arthritis develops frequently in the synovial joints and is often accompanied by pathological changes such as damage to articular cartilage and osteophytosis, radiological changes such as narrowing of the joint cavity, joint pain, rigidity, limitation of movement, and joint friction. The patients experience restriction of functional activities due to continuous pain and rigidity of the joints2). The primary goal of the treatment of degenerative knee arthritis is to relieve pain and rigidity and recover joint movement ability3). Treatments of degenerative knee arthritis include drug therapy, physical therapy, and surgical methods. Among the treatments focused on relieving pain and improving movement function, exercise therapies are known to be effective. Among these therapies, resistance band exercises that can increase muscular strength against the retraction force of the band have been found to be effective4). Resistance band exercises stimulate the proprioception and deliver information about the position and movement of joints to the cerebrum to help maintain more accurate positions.
They are also good for the elderly because they are low-impact exercises\(^5\). In this study, the effects of resistance exercise using elastic bands on the pain and function of patients with degenerative knee arthritis were examined.

**PARTICIPANTS AND METHODS**

The participants of this study were 30 patients aged 65 and over who visited the B Orthopedics Clinic in Daegu, South Korea as outpatients and were diagnosed with degenerative knee arthritis by the doctor through clinical findings and the Kellgren & Lawrence Grade 2 level results of examinations using medical equipment, such as X-ray machines. Those who had cardiovascular diseases, neurological diseases, rheumatic diseases, or other disorders that impair activity were excluded. The experimental group (EG, n=15; male: 6, female: 9) on whom resistance exercise using the elastic band was applied had a mean age of 69.3 ± 4.2 years, a mean height of 160.2 ± 7.2 cm, and a mean weight of 60.4 ± 10.3 kg. The control group (CG, n=15; male: 5, female: 10) on whom conservative physical therapy was applied had a mean age of 70.0 ± 5.3 years, a mean height of 160.9 ± 7.7 cm, and a mean weight of 60.4 ± 10.3 kg. The two groups showed no significant differences in the homogeneity comparison. Ethical approval for the study was granted by the U1 University institutional review board. All participants read and signed consent forms, in accordance with the ethical standards of the Helsinki Declaration.

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The conservative physical therapy for the CG consisted of hot pack treatment for 20 min, 100 bps interference wave therapy for 15 min, and deep diathermy using ultrasound for five min. The EG carried out resistance exercises using elastic bands (3NAUM theraband, NAUM, Malaysia) after receiving conservative physical therapy. The exercise therapy was performed three times a week for four weeks. Each exercise session consisted of warm-up, main exercise, and cool-down. The duration of one exercise session was 30 min. The resistance of the elastic bands increased by color in the order of yellow, red, green, blue, and black\(^6\). In the beginning, the participants used the yellow band. Two weeks after the start of exercise, when they could perform two sets of 10 of each motion, the red band was used. In this way, the exercise intensity was gradually increased. Frequency of resistance exercise was conducted three times a week. The warm-up and cool-down consisted of stretching and simple gymnastics, which were performed for five min each in a comfortable state without burdening the joints. The main exercise consisted of a bending and extension exercise of the hip joint in a standing position with an elastic band tied to the foot, while the band was pulled back or pushed forward. Then a bending and extension exercise of the knee was performed in a sitting position with one end of the band tied to a chair leg and the other end tied to the ankle of the participant.

To examine the degree of pain, the Visual Analogue Scale (VAS) was used. For the functional assessment tool for activities of daily living, the Korean Western Ontario and McMaster Universities Osteoarthritis Index (K-WOMAC) was used. More specifically, the K-WOMAC is used as a questionnaire for assessing the treatment result of patients with osteoarthritis. The questions are divided in three parts: pain (five questions), rigidity (two questions), and discomfort due to difficulty performing daily life activities (17 questions). The score is given in a range from 0 to 4 points; 0 indicates no problem regarding function, pain, and rigidity; 4 indicates the most severe condition.

For statistical analysis of the research results, an intragroup comparison was performed by a paired sample t-test and an intergroup comparison was performed after treatment by an independent sample t-test. The significance level \(\alpha\) was set to 0.05.

**RESULTS**

The result of the intragroup comparison showed that the VAS and K-WOMAC both decreased significantly in the experiment and control groups (\(p<0.05\)). Furthermore, the result of the intergroup comparison after treatment showed significantly lower VAS and K-WOMAC results of the experiment group than those of the control group (\(p<0.05\)) (Table 1).

**DISCUSSION**

Degenerative knee arthritis frequently develops among the elderly and causes discomfort during daily life activities due to pain. The goal of treatment is to reduce pain and joint rigidity and restore the joint function by preventing the transformation

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**Table 1. Comparison of the VAS and K-WOMAC within each group**

| Group | VAS (cm) | Pre | Post |
|-------|---------|-----|------|
| EG    | 7.5 ± 1.2 | 3.3 ± 1.0<sup>**</sup><sup>††</sup> |
| CG    | 7.5 ± 1.5 | 5.9 ± 1.4<sup>**</sup> |

| Group | K-WOMAC (points) | Pre | Post |
|-------|------------------|-----|------|
| EG    | 35.9 ± 8.8 | 14.3 ± 8.1<sup>**</sup> |
| CG    | 297 ± 8.6 | 244 ± 8.1<sup>**</sup> |

VAS: visual analogue scale; K-WOMAC: Korean Western Ontario and McMaster Universities Osteoarthritis Index; EG: experimental group; CG: control group. **paired t-test, **\(p<0.01\), ††independent samples t-test, ††\(p<0.01\).
of joints. To examine the effect of exercise therapy using elastic bands, conservative physical therapy and elastic band resistance exercise therapy were applied on 30 elderly participants with degenerative knee arthritis for four weeks. Yeo et al. applied elastic band exercise on 48 patients with total knee arthroplasty for 10 days and reported significant differences in pain and the range of motion of joints. Lee found that elastic band exercise was effective in reducing pain in patients with rheumatoid arthritis. Jette et al. applied muscular strength exercise on the elderly and found that their muscular strength increased and their physical disabilities decreased by 15–18%. Furthermore, Deyle et al. reported that gait and function improved in patients with knee arthritis when muscle strength exercise using elastic bands was applied for four weeks. In the present study, the experiment group showed significantly lower pain and function compared to the control group after the elastic band exercise treatment. This result suggests that elastic band resistance exercise can improve muscular strength and increase the range of motion of joints by stretching rigid tissues. As a result, normal movements are promoted and the proprioceptive sense stimulates normal nerve firing before perception of hazardous stimuli.

This study had several limitations: the number of participants was small (because they were patients who visited our hospital for four weeks), the lesion was limited to the knee, it was difficult to completely control the daily life of subjects, it was difficult to completely control the effects of taking medicine, and long-term treatment could not be performed. In future studies, these limitations should be addressed and the scope should be extended to include various musculoskeletal patients in addition to patients with degenerative knee arthritis.

Conflict of interest
None.

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