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Research Article

Self-Management of Myofascial Trigger Point Release by using an Inflatable Ball among Elderly Patients with Chronic Low Back Pain: A Case Series

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Abstract

Introduction: In this study, we devised a self-management technique involving Myofascial Trigger point (MTrP) release by using an inflatable ball to improve pain, pressure sensitivity, and joint flexibility in elderly individuals with chronic low back pain.

Materials and Methods: This study was a case series, and participants were recruited from a community welfare center. All participants had MTrPs in the gluteus maximus, gluteus medius, iliopsoas, and quadratus lumborum on at least one side, which had persisted for ≥3 months. We designed a 4-phasedintervention according to the level at which the treatment was applied.

Results: Statistically significant changes ($p<0.05$) were detected in low back pain (measured using the visual analog scale), pressure sensitivity (measured using the pressure pain threshold), and joint flexibility (measured on the basis of lumbar flexion and extension range of motion) after therapy.

Conclusion: Our results suggest that MTrP therapy using an inflatable ball improve pain, pressure sensitivity, and joint flexibility among elderly individuals with chronic low back pain. This therapy may be useful for rehabilitation among affected individuals.

Keywords: Chronic low back pain; Elderly; Inflatable ball; Myofascial trigger point therapy

Introduction

The scope of independently performing activities of daily living is greatly limited in the elderly, especially given that these individuals have a weakened muscular system [1,2]. Myofascial pain is a particularly common symptom among the elderly, due to muscle atrophy resulting from aging [3]. The number of Myofascial Trigger Points (MTrPs) increases with age, leading to muscle spasm and fatigue [4].

Myofascial trigger points (MTrPs) are hyperirritable spots related to hypersensitive palpable nodules in a taut band of skeletal muscle [4]. They are painful on compression and can be associated with soft tissue injury, referred pain, referred tenderness, and motor dysfunction [5]. MTrPs are classified as active or latent. Latent MTrPs occur in the taut band of the muscle belly and cause abnormal posture, psychological stress, muscle tension, and physical factors lead them to become active, resulting in pain [4-6]. Therefore, it is important to eliminate the cause of MTrPs.

In the clinic, many techniques are available to release myofascial trigger points, using gym balls, foam rollers, and other props to perform self-exercise and provide relief from chronic low back pain [7-9], which can result from micro-injury to the muscles or contusion in the elderly [10]. However, a lot of these are quite difficult to perform, control, and customize. The elderly has exceptionally poor muscle elasticity and can easily develop muscle spasms while exercising [10,11]. Therapy for MTrPs involving the use of an inflatable ball can alleviate several related symptoms by including balls of different elasticities. Further, it is convenient and easy to use [12]. Another advantage of the inflatable ball is that it easily relaxes the muscles, and MTrPs can be released safely [12,13]. In general, similar items were found to be unsuitable for the elderly because of the hardness of the balls, their large size, etc. However, inflatable balls allow customization of the technique to suit the individual's condition and are easy to use. Further, they are particularly useful to release MTrPs among elderly patients, who have muscle atrophy and delicate skin [4,12].

In the present study, we aimed to enable elderly individuals to self-manage chronic low back pain using a simple method of MTrP release therapy by using an inflatable ball. We hypothesized that this therapy would improve pain, pressure sensitivity, and joint flexibility among elderly individuals with chronic low back pain.

Materials and Methods

Study design

The design of this study was a case series. Participants were recruited from a community welfare center. All participants had MTrPs in the gluteus maximus, gluteus medius, iliopsoas, and quadratus lumborum on at least one side, which had persisted for ≥3 months.

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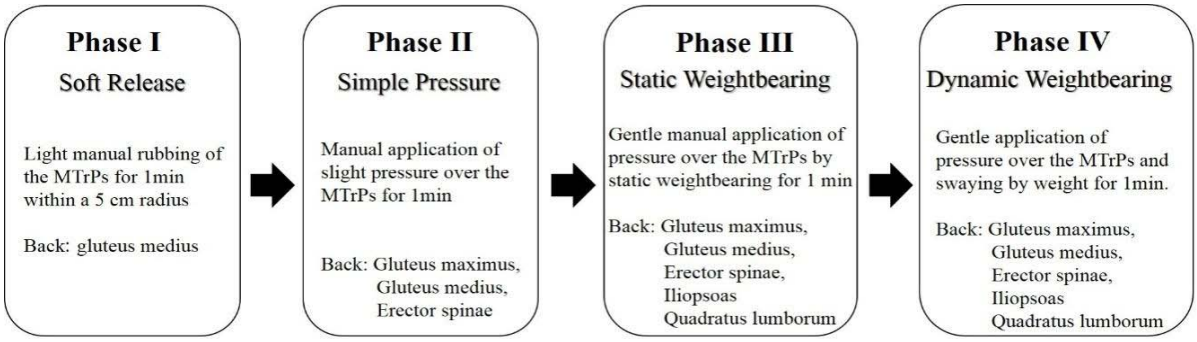

Figure 1: The 4 phases of myofascial trigger point release treatment using an inflatable ball among elderly individuals with chronic low back pain.

Table 1: Baseline characteristics by participant.

Participant	Age (years)	Sex	Dysfunction Type	Duration (months)	MMSE-K	SF36
P1	68	F	Flexion	4	28	50
P2	74	F	Extension	6	25	45
P3	65	F	Extension	5	26	58
P4	71	M	Extension	7	28	52
P5	69	F	Flexion	12	28	47
P6	65	F	Extension	7	27	50
P7	69	F	Extension	4	28	51
P8	72	M	Extension	8	28	53
P9	73	M	Flexion	11	27	45
P10	65	F	Extension	11	27	47
P11	69	F	Extension	7	28	45

M: Male; F: Female; MMSE-K: Mini-Mental State Examination-Korean version; SF36: Short Form 36.

Measurement

We asked participants personal information of age, sex and duration before intervention. And, we examined dysfunction type by McKenzie lumbar spine assessment. In addition, baseline characteristics of participant were measured by using Mini-Mental State Examination-Korean version (MMSE-K) and short form health survey (SF-36). Participant pain was measured by using the Visual Analog Scale (VAS) and Pressure Pain Threshold (PPT). Physical function was assessed by using the Lumbar Flexion Range of Motion (LFR) and Lumbar Extension Range of motion (LER).

Selection criteria

The inclusion criteria were as follows: (1) 65 years or older; (2) chronic low back pain without any relevant ongoing pathologies such as compression fracture, a tumor or metastasis, Ankylosing spondylitis, infection, or radiating pain; and (3) willingness to participate in the study and providing informed consent. The exclusion criteria were (1) other pain syndromes; (2) spinal or hip surgery in the past 6 months or having to undergo surgery or invasive examinations during the study; (3) neurological disease; (4) psychiatric disease; and (5) serious chronic disease that could interfere with the outcomes (e.g., cardiovascular disease, rheumatoid arthritis, epilepsy, or other disqualifying conditions).

The criteria for the diagnosis of MTrPs were as follows: (1) palpable hypersensitive tender spot in a taut band, (2) pain reproduced by compression of the tender spot, (3) local twitch response on muscle palpation, and (4) referred and spontaneous pain elicited by firm compression [14,15]. The purpose and procedures of this study were explained to all the participants, and informed consent was obtained. This study was approved by the Korea University Institutional Review Board.

Treatment protocol

We designed a 4-phase study according to the level at which the treatment was applied (Figure 1). Phase I involved soft release by light manual rubbing of the MTrPs for 1min within a 5cm radius. The next phase (II) involved simple application of slight pressure over the MTrPs for 1 min. Phase III involved static weight bearing by gentle application of pressure over the MTrPs by static weight bearing for 1min. Lastly, phase IV involved dynamic weight bearing by gentle application of pressure and swaying of the MTrPs by dynamic weight bearing for 1min.

Phase I engaged the gluteus medius; phase II, the gluteus maximus, gluteus medius, and erector spinae; and phases III and IV, the gluteus maximus, gluteus medius, erector spinae, iliopsoas, and quadratus lumborum.

Intervention

We applied the MTrP therapy program to all subjects for 6 weeks. Two physical therapists with >5 years' clinical experience instructed the participants about self-administration of this therapy using an inflatable ball. They explained the purpose of the program by using previously developed specifications. The participants used an inflatable therapy ball (Good Ball; Korean Association of Self-Release, South Korea), which was a smooth-surfaced elastic silicone ball of diameter 6.5 cm [12]. To adjust the pressure depending on the sensitivity of the MTrPs, the participants controlled the compression of the inflatable ball by using an air pump. The pressure needed to be at the maximum tolerable level, for increasing soft tissue flexibility [16]. As the participants began to experience less discomfort and pain with progressive sessions, we guided them on controlling the pressure applied by the inflatable ball by them.

The inflatable ball therapy used in this study focused on releasing soft tissue tension and targeted MTrPs in the back muscles. It was performed in 4 phases, lasting a total of 10 min. Each phase comprised 4 trials, for 1 min each, with 1 min for resting and changing position between each trial.

Table 2: Pain, pressure sensitivity and Joint flexibility outcome measures for each participant.

Measure	Participant										
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
VAS (Rt)*											
Pre	5.5	3.2	8.1	4.8	4.2	4.6	7.6	4.2	3	4.7	7
Post	2.9	2.1	5.3	3.5	5.3	2.3	6.8	1.1	5.7	3.2	2.7
VAS (Lt)											
Pre	5.7	7.8	7.9	4.5	4	5.6	9.1	4.3	4	3.9	6.6
Post	2.1	2.3	4.5	3.2	5	2	8.8	1.1	5.5	3	2.1
PPT (Rt) **											
Pre	2.9	2.9	4.3	2.9	5	4.7	5.5	3.2	4.3	5.2	2.5
Post	5.2	7.5	3.5	6.6	4.2	5.6	6.2	7.5	4.3	4.1	6.7
PPT (Lt)											
Pre	2.8	2.8	4.5	5.7	4.8	6.2	3.3	3.5	3.3	4.4	2.4
Post	5.1	4.7	4.5	6.6	5	5.5	6.7	7.9	4.6	4.6	4.1
LFR†											
Pre	69	70	85	89	101	80	102	110	112	75	92
Post	110	110	120	85	118	133	101	94	110	104	110
LER‡											
Pre	10	12	18	25	19	5	18	23	30	13	20
Post	52	60	58	47	69	69	51	55	58	54	50

VAS: Visual Analog Scale; Rt: Right; Lt: Left; PPT: Pressure Pain Threshold; LFR: Lumbar Flexion Range of motion; LER: Lumbar Extension Range of motion; Pre: before intervention; Post: after intervention.
White, dark gray, and light grey indicate no improvement, positive outcome, and negative outcome, respectively.
* 0 = no pain, 10 = maximum pain.
** 0 = maximum pain, 30 = no pain.
† over70° = normal range of motion.
‡over30° = normal range of motion.

The gluteus maximus was targeted because the inferior gluteal nerve is associated with the roots of the 5thlumbar nerve for indirect stimulation of the back muscles. With the patient lying in the supine position, the inflatable therapy ball was applied over the gluteus maximus, with 45° hip abduction and 90° knee flexion on the same side. The opposite leg was fully extended to ensure adequate stimulation. In the second stage, the gluteus medius was targeted because the superior gluteus nerve is associated with the roots of the 4th or 5thlumbar nerve. With the patient in the side-sitting position, the inflatable therapy ball was applied over the gluteus medius with the leg at full extension and over the gluteus medius of the opposite side, with 45° hip abduction and 90° knee flexion. In the third stage, the iliopsoas was selected because of its association with the roots of the 1st to 3rdlumbar nerves. With the patient in the prone position, the inflatable therapy ball was applied over the iliopsoas with 45° hip abduction and 90° knee flexion on the same side and the opposite leg fully extended. In the fourth stage, the quadratus lumborum was targeted because of the anterior branches of the ventral rami of the 1st to 4thlumbar nerves. With the patient in the supine position and the hip and knee at full flexion pulled using both hands, and the inflatable therapy ball was applied to the quadratus lumborum of the same leg. The opposite leg was fully extended. All these processes were performed for both sides.

Data collection

Normal distribution was estimated using the Shapiro-Wilk test. The independent t-test and chi-square tests were conducted to check the homogeneity of demographic characteristics. The values of the VAS score, PPT, LFR, and LER were represented as mean and standard deviation over three measurements. Further, the paired t-test was used to compare variance between pre- and post-intervention values. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS; version 21.0; Chicago, IL, USA). The level of significance was set at 0.05.

Results

A total of 11 participants completed all treatment phases. The demographic characteristics of the participants included the disease period, type of dysfunction, and the scores on the Mini-Mental State Examination-Korean version (MMSE-K) and 36-item Short-Form Health Survey (SF-36) (Table 1). The pain, pressure sensitivity and joint flexibility outcomes of each participant are shown in (Table 2).

Pain and pressure sensitivity outcomes

The VAS score decreased significantly ($t = 4.146$, $p = 0.002$) while the PPT scores increased significantly after the intervention ($t= 5.655$, $p = 0.000$) (Figure 2).

Joint flexibility

The LFR score improved significantly ($t =-2.840$, $p = 0.018$) and the LER score increased significantly after the intervention ($t =-10.904$, $p = 0.000$) (Figure 2).

Discussion

Our 4-phase MTrP therapy using an inflatable ball improved pain, pressure sensitivity, and joint flexibility among elderly patients with chronic low back pain. But, most previous studies adjusted to MTrP therapy without phase [12-14]. We confirmed post-therapy pain alleviation using both the VAS and PPT. The VAS score reflected current pain, while the PPT represented latent pain on trigger point palpation. The VAS and PPT findings were largely similar among the patients. This VAS and PPT results were similar of previous study [12]. Most participants experienced less pain after therapy, although 2 participants (P5 andP9) reported negative outcomes of therapy on the VAS. In the PPT test, one of these participants (P5) again reported a negative outcome, but the other Participant (P9) reported alleviation of left back pain. The negative outcomes may be attributable to reduced muscle elasticity and severe stiffness in these patients.

In terms of joint flexibility, positive changes were observed in both LFR and LER after therapy, although the LER improved to a greater extent than the LFR did. Changes in the LER indicated that the MTrP therapy using an inflatable ball affected back extension related to erector spinae muscles. Also, previous studies the positive effect of MTrP therapy for back muscles [17,18]. Four participants (P7, P8, and P9) showed only slightly decreased LRF. We believe that these participants require continuous intervention, because although their pain was alleviated, their joint flexibility did not improve much. Nonspecific chronic back pain can affect soft tissue stiffness around the cervix, thorax, and sacrum [13]. Therefore, further studies are needed to better understand the effects of this MTrP therapy on all segments of the spine in elderly individuals with nonspecific

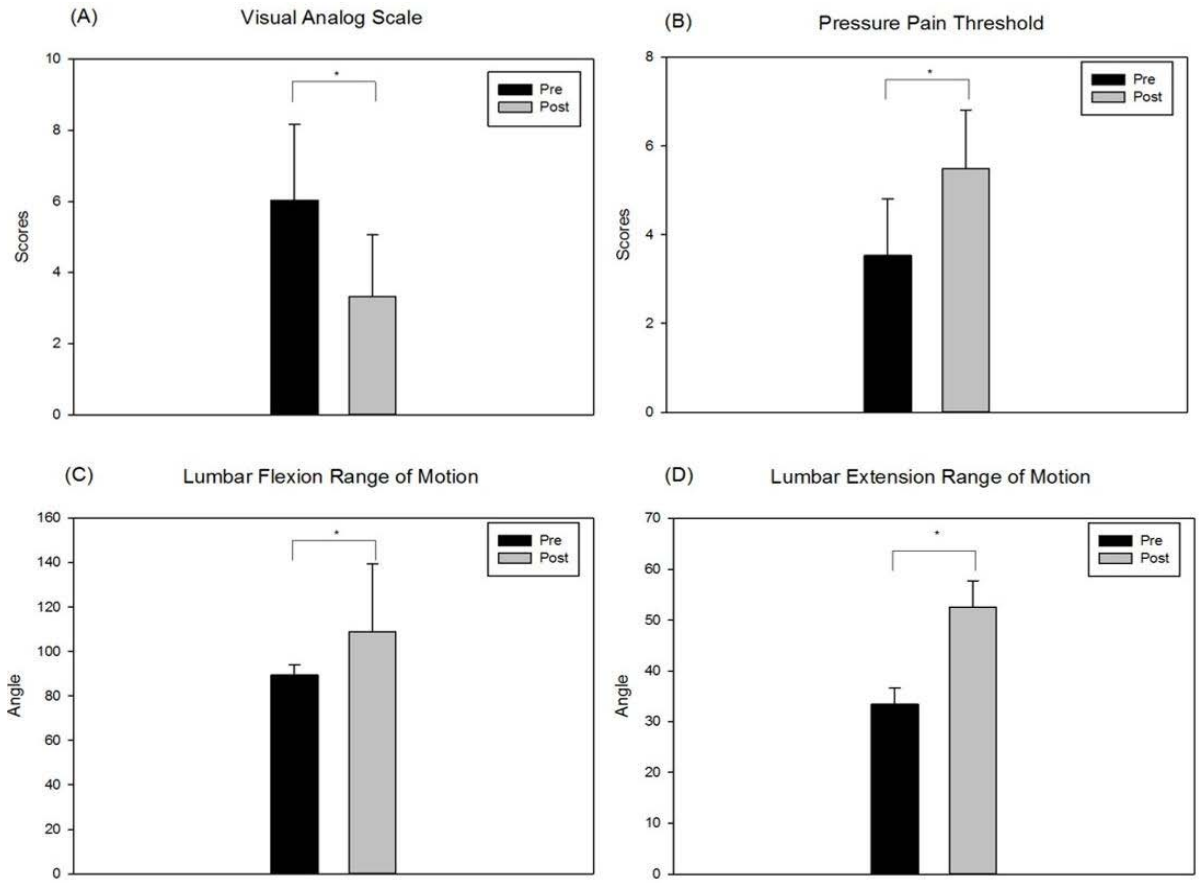

Figure 2: Pain and functional average outcomes for all participants. (a) Visual analog scale scores (sum of right and left sides); (b) pressure pain threshold score (sum of right and left sides); (c) lumbar flexion range of motion; (d) lumbar extension range of motion. Pre: before intervention; Post: after intervention.

chronic low back pain. Nonetheless, we hope that the MTrP therapy protocol we developed will be clinically useful in alleviating pain and promoting physical activity among elderly individuals with chronic low back pain.

Limitations

This study's main limitation was that it did not include a control group. Further studies are needed to more thoroughly examine MTrP therapy using an inflatable ball and compare it with conventional therapy.

Conclusion

This study showed that MTrP therapy using an inflatable ball improves pain, pressure sensitivity, and joint flexibility in elderly individuals with chronic low back pain. Pain was alleviated and the scope to perform physical activity increased significantly by this treatment. We believe that MTrP therapy with an inflatable ball may have positive effects on rehabilitation in elderly individuals with chronic low back pain.

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