Effects of dynamic myofascial release on trunk mobility and standing balance in persons with chronic nonspecific low back pain

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Objective: Myofascial release (MFR) is used to restore tissue extensibility of the fascia tissue and is considered to be useful in a number of clinical settings, such as low back pain (LBP). Dynamic myofascial release (DMFR) is the manual therapy, which combined the conventional MFR with the joint mobilization. The purpose of this study was to investigate the effects of the DMFR on trunk mobility, and furthermore, whether the increase of trunk mobility can carry over the improvement of dynamic standing balance in persons with chronic nonspecific LBP.

Design: Randomized controlled trial.

Methods: Thirty persons with chronic non-specific LBP participated in the study and were randomly assigned to the DMFR group (n=15) or the control group (n=15). DMFR was performed for two sessions (15 minutes/session) per week for four weeks for the treatment group. Both the DMFR and control groups were allowed to perform low-intensity physical activities during the treatment period. The Modified-modified Schöber test (MMST) for trunk mobility and the Functional Reach Test (FRT) for dynamic standing balance were measured before and after the treatment period in both the DMFR group and the control group.

Results: The MMST value of DMFR group increased significantly in all trunk range of motion (flexion, extension, lateral flexion, and rotation) after treatment, compared with the control group ($p<0.05$). Additionally, the FRT value of the DMFR group improved significantly after treatment, compared with the control group ($p<0.05$).

Conclusions: We suggest that DMFR have a positive effect on trunk mobility and standing balance in persons with chronic LBP.

Key Words: Low back pain, Postural balance, Range of motion

Introduction

Chronic low back pain (LBP) is a significant medical problem that is common in modern society [1]. Furthermore, LBP is the second most common reason for clinical visits and the fifth most common reason for hospital visits for surgical procedures [2]. Non-specific LBP especially does not have a known pathophysiological cause, and the treatment focuses on reducing pain and increasing functional trunk mobility. Joint mobilization, myofascial release (MFR), and

simple message have been applied to decrease the symptoms of LBP in clinical practice [3,4].

Fascial tissue is considered to be a source of nociceptive pain (myofascial pain) in several musculoskeletal disorders including plantar fasciitis, Dupuytren's contracture, and non-specific LBP. Many therapies have been used for myofascial pain, such as varying forms of MFR, which have been based upon Rolf's structural integration model and has been developed over the past 30 years [5]. MFR involves manual application of low amplitude, long duration stretch-

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es to the fascial muscles in static posture [6].

Although there has been much research on the therapeutic effect of the MFR, there is a lack of research data on dynamic techniques, which is MFR combined with joint mobilization. Dynamic MFR (DMFR) is similar to joint mobilization for ROM increase and with the MFR for fascia release. However, MFR is a passive approach by therapists in the static posture, while DMFR differs in that it is a dynamic approach in which the patient is actively involved. Therefore, DMFR may be more effective in terms of stimulating proprioception and creating non-local systemic effects [7].

The purpose of this study was to investigate the effects of DMFR on trunk mobility, and furthermore, whether the increase of trunk mobility can carry over in improving dynamic stance balance. It is anticipated that there will be an increase in thoracolumbar ROM and distance of functional reach after DMFR.

Methods

Participants

Thirty persons with chronic nonspecific LBP were recruited and were randomly assigned to either the DMFR group (n=15) or the control group (n=15) (Table 1). Inclusion criteria were the following: (1) >12 weeks from LBP onset; (2) Visual Analog Scale scores of less than or equal to 5 and pain that does not aggravate the sitting position since the patients are required to perform DMFR; (3) no severe complications; (4) patients with no arterial hypertension and with progressive neurological deficits; (5) those who are not under pharmacological or psychiatric treatment. Written and verbal information was given to all participants and informed consent forms were signed. This study was approved by the institutional ethical committee of the Daegu Catholic University (IRB No. CUIRB-2018-0036).

Table 1. General characteristics of participants (N=30)

Variable	DMFR (n=15)	Control (n=15)
Sex (male/female)	7/8	7/8
Age (y)	61.01 (7.86)	62.05 (5.79)
Height (cm)	163.81 (6.85)	164.39 (5.34)
Weight (kg)	64.34 (4.69)	65.26 (3.26)

Values are presented as number only or mean (SD).
DMFR: dynamic myofascial release.

Study design

This study included an experimental design conducted was a triple-blind (participants, researcher, and therapist), randomized, and controlled design. Both the DMFR and control group were allowed to perform low-intensity physical activities and routine lumbar stabilization exercises during the treatment phase. DMFR was performed over two sessions (15 minutes/session) per week for four weeks. A professional physiotherapist with a clinical experience of over five years performed the DMFR. After the treatment period, trunk range of motion (ROM) (flexion, extension, lateral flexion, and rotation) and the Functional Reach Test (FRT) was performed to measure dynamic standing balance.

Dynamic myofascial release

DMFR involves a manual application of low amplitude, long duration stretch to the fascia and muscle, between the levels T6-12. Participants were instructed to relax as much as possible, and the therapist proceeded to smoothly move the joints in a diagonal or horizontal direction at a slow rate within the ROM. The therapist repeatedly pushed, pulled, or shook the joint area about three to five times for about 3 seconds with slight motion at the end of ROM (Figure 1). In step 1, the therapist stood facing the participants and supported one arm of the participants to move. The therapist pulled and pushed gently on the side of the shoulder. When the participant shifted the weight forward, the therapist simultaneously moved to the front side slowly with breathing (Figure 1A). In step 2, the participant put both hands on his neck, and the therapist flexed the knee to 90° and placed the participant's elbows on his lap. When the participant shifted his body weight forward, the therapist slowly adjusted the patient's breathing (Figure 1B). In step 3, the therapist supported the patient's upper flexed knee on his thigh. He made movements of the pelvis and lower limb which was similar to the gait pattern (Figure 1C). In step 4, the therapist supported the patient's upper flexed knee using one hand. Therapist pushed and pulled the iliac crest to the anterior, posterior, upward, and downward directions (Figure 1D). Finally, the patient was prone-lying the therapist fixed one of the shoulder or pelvis and then moved the other part for counter rotation between the shoulder and the pelvis (Figure 1E).

Modified-modified Schöber test

Trunk mobility was measured with the Modified-modi-

Figure 1. Dynamic myofascial release. (A) Step 1, (B) step 2, (C) step 3, (D) step 4, (E) step 5.

Figure 2. Modified-modified Schöber test. (A) Lateral flexion, (B) flexion, (C) extension, (D) rotation.

fied Schöber test (MMST) using tape measurement (Figure 2). The representative value was defined as the mean value of three measurements [8]. For lateral flexion of the trunk, the participant stood with their feet shoulder-width apart (Figure 2A). The examiner measured the changes in the level of the tip of the middle finger on the thigh after maximal lateral flexion. For flexion of the trunk, the participant stood with placing both hands on the iliac crests and extending the knee (Figure 2B). The examiner recorded the changes in the distance between the spinous processes of C7 and S2 after maximal flexion. As the same way, trunk extension was measured (Figure 2C). For rotation of trunk, the participant was sitting with the feet supported on a stool with arms crossed in front of the chest (Figure 2D). The participant held the end of the tape on the lateral aspect of the acromion process, and the examiner held onto the other end of the tape on the greater trochanter. The examiner measured the changes in the distance between the acromion process and greater trochanter

after maximal trunk rotation (Figure 2E). The MMST demonstrated moderate validity ($r=0.67$; 95% confidence interval [CI], 0.44-0.84), excellent reliability (intra: intra-class correlation coefficient [ICC]=0.95; 95% CI, 0.89-0.97; inter: ICC=0.91; 95% CI, 0.83-0.96) and a MMDC of 1 cm [9,10].

Functional Reach Test

Dynamic standing balance was measured with the FRT. Participants were instructed to reach forward with the left arm horizontally while maintaining a fixed base of support to evaluate standing balance [11,12]. A 150 cm yardstick was mounted horizontally on the wall at the height of the acromion process. Reaching distance was measured as the displacement of the finger between the starting and end position. FRT demonstrated moderate validity and high reliability [13].

Table 2. Comparison of difference values of pre and post-test between the DMFR group and control group on MMST and FRT (N=30)

Variable	DMFR (n=15)			Control (n=15)			t (p)
	Pre-test	Post-test	Change	Pre-test	Post-test	Change	
MMST (cm)							
Flexion	4.05 (0.55)	8.53 (1.25)	4.48 (1.10)	5.29 (1.06)	5.83 (1.04)	0.55 (0.22)	13.36 (<0.001)
Extension	5.29 (1.06)	13.80 (1.15)	1.18 (0.42)	9.34 (0.96)	10.06 (1.08)	0.46 (0.19)	6.06 (<0.001)
Lateral flexion	8.60 (0.78)	13.80 (1.15)	5.20 (0.68)	9.34 (0.96)	10.06 (1.08)	0.72 (0.30)	22.51 (<0.001)
Rotation	2.03 (0.40)	3.15 (0.45)	1.13 (0.18)	2.25 (0.24)	2.71 (0.28)	0.46 (0.26)	7.92 (<0.001)
FRT (cm)	15.60 (2.99)	19.66 (2.61)	4.06 (0.90)	15.59 (2.98)	16.34 (2.90)	0.75 (0.21)	13.36 (<0.001)

Values are presented as mean (SD).

DMFR: dynamic myofascial release, MMST: Modified-modified Schöber test, FRT: Functional Reach Test.

Statistical analysis

The Shapiro-Wilk test was used to confirm that the data was normally distributed ($p>0.05$), thus justifying the use of parametric tests. The independent t-test was used to compare the general characteristics between the DMFR group and the control group and compare the difference value of pre and post-test between groups on the FRT and trunk ROM. The IBM SPSS Statistics ver. 21.0 software (IBM Co., Armonk, NY, USA) was used for statistical analysis and a CI of 95% (p -value<0.05) was used.

Results

There were no significant differences in the general characteristics of the participants between the DMFR group and the control group ($p>0.05$, Table 1). The DMFR group increased significantly, compared with the control group in all trunk ROM; flexion, extension, lateral flexion, and rotation ($p<0.05$). Additionally, the DMFR group increased significantly, compared with the control group on the FRT results ($p<0.05$, Table 2).

Discussion

In this study, trunk ROM of the DMFR group increased significantly after the intervention. We found that the DMFR, which was a combination of MFR and joint mobilization, was useful for increasing trunk ROM. DMFR was applied with focus on the thoracic spine than the painful lumbar spine itself. DMFR was first applied to the thoracic spine and then to the lumbar spine. LBP patients have to correct abnormal trunk movement pattern, which can be improved

by changing trunk muscle activities or muscle lengths. Therefore, the therapist should seek how to apply substituted thoracic trunk movements when lumbar spine movement is limited in persons with LBP [14,15]. It was reported that joint mobilization applied to the thoracic region could help to maintain proprioception and control pain in the lumbar spine in persons with LBP [16]. Some studies reported that joint mobilization on the thoracic spine was more effective than direct motion at the lumbar spine on improving lumbar stability [17].

Our study showed that trunk mobility increased significantly in the DMFR group compared with the control group and that dynamic standing balance improved significantly in the DMFR group compared to the control group. DMFR applied to the local area promoted an increase in thoracolumbar ROM by the biomechanical effect as well as improved dynamic standing balance by system effect [6,18]. That is, when stimulated, the Ruffini corpuscles (mechanoreceptors) have been associated with a further decrease in activity of the sympathetic nervous system of the autonomic nervous system, as fascia has a high density of free nerve endings that belong to the sympathetic nervous system, leading to a more relaxed parasympathetic response, thus allowing for greater ROM and better dynamic stance balance [5].

Some studies reported that elderly patients with non-specific LBP decreased their reliance on ankle strategy and hip strategy proprioceptive signals during balance control [19]. Some studies have shown that MFR or joint mobilization is effective in improving the balance of persons with non-specific LBP [20]. Also, the myofascial connections (myofascial trains or sequences) could be directly effective in the organization of movement and muscular force transmission, and

finally the released stiffness could have an influence on motor control and improve balance [21]. Similarly, our current study showed increased trunk motility could lead to improvements in functional dynamic standing balance.

There were some limitations to this study. Firstly, we did not distinguish the various pathological causes of LBP. Secondly, there was a small sample of only 15 participants for each group, warranting further studies with a full sample size calculated by a power analysis to follow after this study to ensure the generalization of these results.

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Conflict of Interest

The authors declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

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