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Original Article

Effects of McGill stabilization exercises and conventional physiotherapy on pain, functional disability and active back range of motion in patients with chronic non-specific low back pain

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Abstract. [Purpose] The aim of this study was to compare the effects of "McGill stabilization exercises" and "conventional physiotherapy" on pain, functional disability and active back flexion and extension range of motion in patients with chronic non-specific low back pain. [Subjects and Methods] Thirty four patients with chronic non-specific low back pain were randomly assigned to McGill stabilization exercises group (n=17) and conventional physiotherapy group (n=17). In both groups, patients performed the corresponding exercises for six weeks. The visual analog scale (VAS), Quebec Low Back Pain Disability Scale Questionnaire and inclinometer were used to measure pain, functional disability, and active back flexion and extension range of motion, respectively. [Results] Statistically significant improvements were observed in pain, functional disability, and active back extension range of motion in McGill stabilization exercises group. However, active back flexion range of motion was the only clinical symptom that statistically increased in patients who performed conventional physiotherapy. There was no significant difference between the clinical characteristics while compared these two groups of patients. [Conclusion] The results of this study indicated that McGill stabilization exercises and conventional physiotherapy provided approximately similar improvement in pain, functional disability, and active back range of motion in patients with chronic non-specific low back pain. However, it appears that McGill stabilization exercises provide an additional benefit to patients with chronic non-specific low back, especially in pain and functional disability improvement.
Key words: McGill stabilization exercises, Physiotherapy, Chronic non-specific low back pain

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INTRODUCTION

Low back pain is one of the most common problems of public health systems in the world. Approximately 84% of people are reported to have an experience of back pain in their life time[1)]. Although there is no obvious cause of low back pain, 90% of patients have been experiencing back pain without certain pathology, referred to as non-specific low back pain (NSLBP)[1, 2)]. The important characteristics of chronic non-specific low back pain (CNSLBP) consist of back pain for

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more than 3 months, pain between the 12th rib and the top folds gluteal with or without leg pain, and abnormal stability and coordination due to spinal muscles imbalance[2–4].

Exercise therapy is considered as one of the most effective treatments for CNSLBP[2, 3]. Lumbar stabilization exercises have been shown to provide normal stability and coordination in lumbar muscles[5–9]. According to the Panjabi's theory, spinal stability consists of three components: 1) active (muscles), 2) passive (ligaments), and 3) neural components. These components are called as spinal stability model that must be integrated together[5, 6, 8]. Active component of this spinal stability model is composed of the local and global stabilizer muscles and mobilizer muscles. Accordingly, stabilization exercises are classified into two training groups: 1) local or core stabilization exercises and 2) global stabilization exercises[5, 8]. Local stabilization exercises are designed to improve local muscles function for the purpose of segmental stability enhancement[5]. However, McGill has designed exercises in lumbo-pelvic region, based on the global muscle stabilization, in order to increase stability and coordination of the trunk muscles without any load on lumbar spine and to improve the function of the anterior, posterior, and lateral lumbar muscles[6–9].

Effects of stabilization exercises on pain, functional disability and lumbo-pelvic muscle function have been investigated in some studies[9–18]. These exercises are thought to increase the lumbar muscles function and improve pain and disability[11, 13, 15, 16, 18]. However, in some studies, a similar effect has been observed performing a non-specific exercise training[9, 10, 12, 14, 17]. Additionally, conventional physiotherapy exercises seem to increase the flexibility and strength in anterior or posterior lumbar muscles and improve the muscles function in patients with low back pain with a minimum load on the lumbar spine and more often are used to alleviate muscle spasm and pain[11–15]. Despite this abundance of studies of different exercise training on low back pain, a few of study is known about the effects of McGill stabilization exercises compared with other exercises training[9]. Therefore, the purpose of this study was to compare the effects of "McGill stabilization exercises" and "conventional physiotherapy" on pain, functional disability and active back flexion and extension range of motion in patients with chronic non-specific low back pain.

SUBJECTS AND METHODS

This study was a randomized clinical trial, registered in Iranian Registry of Clinical Trials (IRCT) with the number 2015051022202N1. Thirty four patients with CSNLBP ranging from 20 to 40 years-old recruited. All patients had an experience of low back pain without any specific pathologies and causes, back pain for more than six months without radiating pain to the leg, and not having physiotherapy treatment. The exclusion criteria were a history of pelvic, spine, upper or lower extremities surgery, cardiovascular diseases, hamstring and quadratus lumborum muscles shortening, pain or disability in upper and lower extremities, frequent neurological deficits, and professional athletes. The patients were informed of the study purpose and the treatment methods. Written informed consent was then obtained from all of the subjects, and the protocol was approved by the Tabriz University of Medical Sciences Ethics Committee with a code of 93170.

The total number of 34 patients participated at the early stage of the current study. The patients were assigned to two groups: 1) McGill stabilization exercises group (n=17) in which the patients performed Curl up (for training the rectus and obliques abdominis muscles and controlling pelvic motion), Side Bridge (for training the quadratus lumbarum muscles, as a key muscle in spinal stability), Bird Dog with one hand or one foot and one hand and the opposite leg (for training the anterior and posterior lumbar muscles, especially the transverse abdominis)[6–9], and 2) conventional physiotherapy group (n=17) in which the patients performed lumbar conventional physiotherapy exercises including single and double knee to chest (for stretching and flexibility of the back extensor and strengthening of the rectus-obliques muscles), prone lying with pillow with one leg sliding (for strengthening the back extensor muscles), cycling in supine (for strengthening the abdominal muscles and coordinating anterior and posterior lumbar muscles), and bridging exercises (for strengthening back extensor muscles). The patients in both groups performed the corresponding exercises 3 days a week and 10 repetitions of each exercise for a period of 6 weeks and a rest interval of 2 minutes between exercises. The exercises were taught to the patients at the end of the first session in both groups. Furthermore, an exercise booklet was prepared and handed to the patients in order to help them to perform exercises correctly. Then, a physiotherapist contacted patients at the end of each week to ensure about the correct performance of the exercises.

Randomized group allocation was determined by using a randomization software. Briefly, the patients were coded and the codes were recorded in this software. Then, the random allocation for sequential manner for the intervention and control groups was performed running functioning the software. Pain was assessed by visual analog scale (VAS) based on a 100 mm line[19]. Functional disability was evaluated by a reliable and validated Persian version of the Quebec Low Back Pain Disability Scale Questionnaire[20]. A Baseline Bubble Inclinometer (Model 10602 built by Fabrication Enterprise Inc., USA) was used to measure the active back flexion and extension range of motion without thoraco-lumbar pain. To evaluate the active thoraco-lumbar flexion and extension range of motion, the inclinometer was used at the T12–L1 spinous process[7, 21]. The clinical characteristics of the patients with CNSLBP including pain, functional disability, and range of back motion were evaluated at the beginning of the first week (Pre-test) and the end of the last sixth week (Post-test) exercises.

Statistical analysis was performed using Statistical Package for Social Sciences, version16.0 (SPSS, Chicago, IL, USA). Paired t-test and Independent t-test were performed for within-group and between-group comparisons, respectively. Significance was accepted for values of $p<0.05$ in all analysis.

RESULTS

Descriptive statistics of the patients' characteristics are presented in Table 1. Four patients (two patients from each group) were dropped from the final analysis because of unwilling to continue the treatment procedures due to family related problems. Therefore, a total number of 30 patients (15 patients in each group) were used for the final analysis. There were no statistically significant between-group differences in all descriptive characteristics ($p>0.05$). The results of the statistical analysis of the clinical characteristics are given in Table 2. There were significant improvements in pain ($p=0.001$), functional disability ($p=0.001$), and active back extension range of motion ($p=0.031$) in patients who performed McGill stabilization exercises following six weeks exercises. However, the group who performed conventional physiotherapy showed an increase in active back flexion range of motion ($p=0.026$) with no statistically significant changes in pain, functional disability, and active back extension range of motion.

The comparison of the clinical characteristic between the two groups revealed that the percentage of improvement in pain (15%), functional disability (13%), and back extension range of motion (9%) in the group of patients who performed McGill stabilization exercises was clinically greater than those of conventional physiotherapy group (6%, 7%, and 4%, respectively). However, we did not observe any significant difference between these clinical characteristics while compared these two groups of patients (Table 3, $p>0.05$).

DISCUSSION

The primary results of this study were that there are improvements in main symptoms of chronic non-specific low back pain including pain, functional disability, and active back range of motion[1, 4, 16] following six weeks of physiotherapy exercises. Improvements in the clinical characteristics of CNSLBP in McGill stabilization exercises group were clinically and statistically greater ($p<0.05$). Although improvements in the most symptoms of CNSLBP in conventional physiotherapy

Table 1. Descriptive statistics (mean ± SD) of patients' characteristics with chronic non-specific low back pain (CNSLBP) in McGill stabilization exercises group and conventional physiotherapy group

	McGill stabilization exercises	Conventional physiotherapy
Gender (male/female)	7/8	7/8
Age (years)	23.8 ± 3.5	20.9 ± 1.2
Height (cm)	171.8 ± 8.0	171.2 ± 7.0
Weight (kg)	70.5 ± 10.9	69.7 ± 12.6
CNSLBP Onset (months)	16.0 ± 6.4	14.9 ± 6.4

Table 2. Within-group changes in clinical characteristics (mean ± SD) of patients with non-specific low back pain (CNSLBP) in McGill stabilization exercises group and conventional physiotherapy group

Clinical characteristics	McGill stabilization exercises			Conventional physiotherapy		
	Pre-test	Post-test	Mean difference	Pre-test	Post-test	Mean difference
Pain (mm)	29.5 ± 4.8	25.0 ± 4.9	4.5*	28.3 ± 6.5	26.5 ± 7.8	1.7
Functional disability	25.6 ± 9.7	22.4 ± 9.0	3.2*	30.1 ± 11.6	28.0 ± 10.1	2.1
Flexion (deg.)	92.2 ± 14.2	94.9 ± 14.8	−2.5	94.2 ± 13.4	97.6 ± 12.4	−1.4*
Extension (deg.)	27.8 ± 7.3	30.3 ± 5.9	−2.7*	32.2 ± 8.4	33.6 ± 8.3	−3.5

*$p<0.05$.

Table 3. Percentage improvement in clinical characteristics in patients with non-specific low back pain (CNSLBP) in McGill stabilization exercises group and conventional physiotherapy group

Clinical characteristics	McGill stabilization exercises (%)	Conventional physiotherapy (%)
Pain (mm)	15.3	6.1
Functional disability	12.1	6.8
Flexion (deg.)	2.9	3.7
Extension (deg.)	8.9	4.5

exercises were not statistically significant, those are of great importance from the clinical point of view. Although these improvements did not differ between the two groups, it appears that McGill stabilization exercises provide an additional benefit to patients with CNSLBP, especially in pain and functional disability. This can be explained by some evidences that McGill stabilization exercises may increase stiffness and improve coordination between the antero-posterior and lateral lumbar muscles. This might in turn, create a stable lumbar spine during functional activities as well as help to reduce pain and improve function in patients with low back pain[6–8]. However, in conventional physiotherapy exercises, an increase in muscle strength and flexibility are thought to make patients to perform functional activities[11–15].

A literature review of physiotherapy treatments on patients with low back pain revealed that stabilization exercises reduce pain and improve function in patients with low back pain[9, 11–15, 18]. Cho et al. reported that although the stabilization exercises and/or usual conservative treatments for 6 weeks improved the function, the stabilization exercises are more effective than the usual conservative treatments[14], possibly due to an improvement in the coordination of muscle motor units which may occur during stabilization exercises[14]. The results of the current study was similar to the results of studies performed by Koumantakis et al., and Cairns et al[10, 17]. In these studies, there was no significant difference within and between two groups.

The study of Ammer, is one of the few studies to examine the effects of the McGill stabilization exercises on function compared with the conventional exercises. The author reported an improvement in the function performing two types of the exercises. However, McGill stabilization exercises significantly improved the function compared with that in the conventional exercises[9]. In the conventional physiotherapy group, active back flexion range of motion was the only clinical characteristic that significantly increased following six weeks exercises ($p=0.026$) which was similar to those reported by Cho et al[16]. In our study, back extension range of motion increased in McGill stabilization exercises group, due to possible an improvement in coordination between posterior lumbar muscles. However, an increase in back flexion range of motion in patients who performed conventional exercises might be associated with a stretching exercise that was a part of the treatment protocol.

In conclusion, McGill stabilization exercises and conventional physiotherapy provide approximately similar improvement in pain, functional disability, and active back range of motion in patients with CNSLBP. However, it appears that McGill stabilization exercises provide an additional benefit to patients with CNSLBP, especially in pain and functional disability improvement.

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Conflict of interest

None.

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