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THE EFFECT OF SAHRMANN'S EXERCISES ON LUMBO-PELVIC MOTOR CONTROL IN CHRONIC LOW BACK PAIN PATIENTS WITH ROTATION-EXTENSION SYNDROME

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ABSTRACT

Objective and background: Musculoskeletal disorders such as low back pain are associated with impaired lumbo-pelvic motor control. The objective of this study was to investigate the effect of Sahrmann exercises on lumbo-pelvic motor control in chronic low back pain patients with rotation-extension syndrome.
Materials and Methods: In this randomized controlled single-blind clinical trial, 30 chronic low back pain patients with rotation-extension syndrome were selected using available sampling method and they were randomly assigned to two groups of control group and Sahrmann exercises group. Treatment program in Sahrmann exercises group was based on Sahrmann method and in the control group; it included ultrasound, TENS (Transcutaneous Electrical Nerve Stimulation), hot pack. Lumbo-pelvic motor control were measured by pressure biofeedback unit before and after treatment. Treatment for both groups was performed for 4 weeks 3 times per week. To analyze the data, independent t-test and paired t-test were used.
Results: In Sahrmann exercises group lumbo-pelvic motor control reduced from 71/06±10/87 to 61/00±8/47 (p = 0/00). In the control group, reduced from 70/13±5/84 to 61/93±9/59 (p = 0/00). No significant difference was found between the two groups (P>0.05).
Conclusion: Significant difference was not found between Sahrmann exercises and control groups in terms of the impact on lumbo-pelvic motor control.

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Introduction

Low back pain is a musculoskeletal problem and one of the main causes of disease in high, middle and low income countries [1]. Nearly 80-85% of people are affected by this disease throughout their life, and given to its high prevalence; low back pain is considered a major public health and socio-economic problem in Iran [2]. Based on the classification used widely based on the duration of the symptoms, low back pain can be acute, sub-acute and chronic [3]. Specific low back pain occurs in about 2% of all patients with low back pain. Non-specific low back pain has become chronic inflammatorily or mechanically. Chronic low back pain refers to evidence of low back pain restricting the activity and reducing the mobility and muscle tolerance [2].

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Following reduced quality of life, the person becomes more irritable and more vulnerable, leading to feeling of weakness and fatigue [4]. M.M. Panjabi (1992) states that non-natural movement control is an outcome of inadequate stability in spinal, and it can be one reason for micro-trauma and low back pain [4]. Pelvic lumbar movement, occurring during an active and voluntary movement of the body, is important, since people perform a large number of movements in everyday life in the primary to the middle range [5]. If the pelvic-lumbar area moves along the primary range, lumbar-pelvic frequency throughout the day increases and this increased frequency might result in increased tissue stress in the lumbar-pelvic area [5].

Non-drug methods, which include a variety of physical factors, such as chiropractic [6], exercise [7], and electrotherapy [8], are the base of chronic low back pain [2]. In a research carried out by Aatit Paungmail et al in 2016, they evaluated lumbar-pelvic stability exercises compared to placebo treatment and control on tissue blood stream and control of lumbar-pelvic area movement in patients with chronic low back pain. The results of this research revealed that lumbar-pelvic stability tests, compared to placebo and control group, were more effective in improving tissue bloodstream in lumbar-pelvic area and controlling the movement of lumbar-pelvic area [9]. Studies indicate that low back pain should be treated with an understanding of training and an emphasis on the way to perform the movement correctly [4].

Despite many studies conducted on low back pain, no treatment has been found to have continuous effect in relieving symptoms associated with back pain [1]. Movement control in the lumbar-pelvic area can improve stability and be considered as an essential component of low back pain treatment [10]. Moreover, a wide variety of low back pain groups has resulted in various clinical treatments [11]. This requires classification systems, which have been stated in the last two decades [12]. One of these classification systems prescribed for diagnosis and treatment is reported motor patterns impairment classification system [13]. Accordingly, the classification of patients should be performed in homogeneous sets in accordance to their symptoms for better treatment of the low back pain [11]. These repetitive movements result in stress in soft tissue, accumulation of tissue stress, pathology in the low back, and chronic low back pain [14]. Without the stability of the spinal (which pelvic stability is part of the spinal stability), the lumbar area would have more movement than the hip joints. This stress caused by repetitive movements provides the conditions for impairment in controlling lumbar-pelvic movement.

Given what was stated above, patients with chronic low back pain have difficulty in controlling the lumbar-pelvic movement. As no research has been conducted so far in the form of clinical trial to examine the effects of Sahrmann's exercises on the control of the lumbar-pelvic movement and as extension rotation syndrome was more prevalent in these patients, this research was conducted to evaluate the effect of Sahrmann's exercises on controlling the pelvic-lumbar movements in patients with chronic low back pain and with impaired extension rotation movement. It was hypothesized that both therapeutic methods of Sahrmann's exercises and treatment in the control group improve lumbar-pelvic control and the effect of Sahrmann's exercises is higher than that of the other group.

Materials and Methods

Study design:

This single-blind randomized clinical trial was conducted in 2016 at the Zahedan University of Medical Sciences. In this study, 30 chronic low back pain patients with rotation-extension syndrome were randomly assigned to two groups of Sahrmann exercises (n = 15) and control (n = 15). Sahrmann exercises were carried out for 4 weeks, 3 times per week, and in the control group, it was carried out for 4 consecutive weeks and 3 times per week [15]. Study variables were measured and recorded before and after the treatment.

The study population and screening the patients:

for this study, 30 chronic low back pain patients with rotation-extension syndrome were selected through simple random sampling method. Inclusion criteria were: age between 18-50 years [16], chronic low back pain [16], positive rotation-extension syndrome based diagnostic tests, lack of cardiovascular disorders [17], vestibular system, central nervous system [18], no history of vision problems [17].

Exclusion criteria: Patients who did not complete their regular sessions and treatment were excluded and was replaced by another patient. After reading and signing written informed consent form, they were included in the study. The study was approved by the Scientific Committee and Ethics Committee of the University of Rehabilitation Department of Zahedan University of Medical Sciences.

Collecting Information: Meter with an accuracy of centimeter was used to measure the height of subjects, digital scale was used to measure body weight (to calculate body mass index), and was used pressure biofeedback unit to measure lumbo-pelvic motor control.

Randomization: randomly classification into two groups was carried out by physiotherapist using successive procedure.

Evaluation of the lumbo-pelvic motor control:

Lumbar-pelvic movement control patterns were assessed during bent knee fall out (BKFO) and knee lift abdominal tests (KLAT) tests using a compressive biofeedback unit. In the KLAT test, the patient was placed in the crook lying position. The patient was asked to lift up one leg from the table and rise the the leg up to 90 degrees of leg flexion with knee flexion while he has simultaneously maintained the lumbar spinal cords fixed. The pressure in the compressive biofeedback was adjusted to 40 mm Hg. In BKFO test, the patient was asked to be placed in partial crook lying in the supine position. Then, the patient slowly lowered the bent leg up to approximately 45 degrees of abduction / side rotation, while his bent leg has been placed beside the smoothed foot, then it returned the starting position. At the same time, abdominal muscles were lowered to provide activated stabilization, while they were in the form of leg eccentric up to abduction / side rotation. The method used in the KLAT test was also implemented to score the BKFO test [19].

Clinical tests:

The patient was evaluated in particular group before classification. Assessments were conducted by tests in special directions. In this study, if the symptoms of the patient increase in the rotation-extension, it indicates that the test is positive. During the assessment, the patient state was kept for at least 10 seconds to record the symptoms. Physiotherapist examined the person's posture in the positions of supine, prone, quadruped, sitting, standing, and side lying [20].

Treatment method

Intervention group: the first part of treatment program in the intervention group was Sahrmann exercises based on the Sahrmann method that these exercises were carried out for 4 weeks, 3 times per week, and 10-15 seconds for each exercise with a total time of 30 minutes. These exercises were considered in eight states of standing, supine, side lying, prone, quadruped, sitting, and sitting to standing and walking [1]. These exercises include:

Exercises in the supine status:

patient was asked to make one knee closer to his chest and he with the help of both of his hands, he made knee closer to the chest and he brought the opposite side knee to extension while he placed a pillow under the smoothed knee and thereby he helped hip flexion of the same side, and simultaneously he contracted the abdominal muscles. Then, he brought the bent knee to extension, and bent it again and contracted abdominal muscles simultaneously. In this status, the patient was asked to bring bent hip joint of the knee went to flexion to abduction and lateral rotation and keep the hip from rotation by contraction of abdominal muscles. Then, this exercise was repeated for the opposite side.

Exercises in side lying status:

the patient was asked to place a pillow between the knees to control the medial rotation bringing hip joint to lateral rotation. In this status, hips was kept fixed.

Exercises in prone status:

the patient was asked to place a pillow below the belly and to contract the abdominal muscles simultaneously, while he has bent one knee and then bent other knee. In this status, physiotherapist kept hip fixed with his hands and he stopped the movement in each point of the movement where hip tilt or patient symptoms began.

Exercises in the quadruped status:

in this status, the status of patient hip joints was placed at the abduction, and patient carried out backward rock and everywhere patient symptoms began, the movement stopped.

Exercises in sitting status:

in this status, the patient conducted the knee extension with ankle dorsiflexion.

Exercises in sitting to standing status:

patient moved to the end of the seat with the help of his hands and he prevented any rotation in the hip joint from one side to the other side. In this status, hip and knees should be placed in one direction and patient should stand smooth and prevent any movement causing exaggerated extension of low back. Then, the patient sat.

Exercises in standing status:

In this status, the patient is standing with his back to the wall. He puts his feet away from the wall while bending the hip and knees. In this status, he should be able to smooth the lumbar spine. Then, patient was asked to contract his abdominal muscles. Then, he smoothed knee and hip joints and he stopped the movement at any point where patient symptoms were created.

Exercises in the walking status: in this status, the patient walks slowly and the patient should restrict the rotation of hip or anterior tilt, which often included steps smaller than the normal [9].

Analysis and change of everyday activities: The second of the treatment in intervention group includes the analysis and change of the everyday activities that the patient was taught to change everyday activities that cause pain and symptoms [21].

Control group

Treatment in the control group included common physiotherapy treatments such as TENS (Transcutaneous Electrical Nerve Stimulation), US (Ultra Sound) and HP (Hot Pack), that these treatments, as intervention group, lasted four weeks and 3 sessions per week and 40 minutes per session [15].

Determining the sample size: sample size was determined based on the preliminary study. Initially 10 patients were selected and they were randomly assigned to two groups.

The main stage of the research was conducted on them. Based on the mean and SD obtained from these two groups, the sample number required for the main study was estimated with confidence level of 95% and power test of 80%.

Statistical analysis: After collecting data, they were analyzed by SPSS 16 software. Normality of data distribution was examined by Kolmogorov-Smirnov test. Equality of variances was performed using the Levene test. Paired t-test and independent t were used respectively to intra-group and inter-group comparison. Significance level was considered less than five percent.

Results

The mean age range, weight, height, and body mass index in the two group of Sahrmann exercises and control are shown in Table 1. Using experimental study, sample size was determined to be 30 persons for the two groups (15 persons for each group). The match of data distribution with a normal distribution was examined using Kolmogorov-Smirnov test.
The results showed the normal distribution of the data (Table 1). Mean and standard deviation of data related to lumbo-pelvic motor control, comparing the results before and after treatment in two groups, and p value and comparing the results after treatment between two groups and p value are shown in Tables 2.

Intra-group comparison

In the Sahrmann exercises group, lumbo-pelvic motor control showed significant reduction (P<0.05) (Table 2).
In the control group, lumbo-pelvic motor control showed significant change compared to before intervention (P <0.05) (Table 2).

Inter-group comparison: in order to be ensure the randomization process, the data before study were compared in 2 groups. The results showed no difference between the two groups in terms of the variable studied and patients were matched in terms of variables studied in two groups (P>0.05). Comparing the results between the two groups after treatment showed that there is no significant difference between the two groups of Sahrmann exercises and control (Table 2)

Table 1. comparing demographic characteristics between two groups

Variable	Sahrmann exercises (n=15)	Control group (n=15)	*p value
Age (year)	**6.32±31.06	7.76 ±32.86	0.49
Weight (kg)	10.21±74.13	14.71± 71.86	0.61
Height (m)	10.64 ±1.67	11.64 ±1.65	0.67
Body mass index (kg per square meter)	3.30±26.59	6.71 ±26.68	0.96

** Data were stated in the form of SD±mean
* P<0.05 is significant

Table 2. comparing mean of data before and after treatment of lumbo-pelvic motor control in two groups and comparing the results after treatment between two groups

	First group (Sahrmann exercises) (n=15)			Second group (control) (n=15)			Comparing the results after intervention
Variable	Before intervention	After intervention	P value	Before intervention	After intervention	P value	P value
BKFO trial 1	71/06±10/*87	61/00±8/47	0/000*	70/13±5/84	61/93±9/59	0/003*	0/85
BKFO trial 2	71/33±11/15	62/00±9/83	0/000*	69/40±14/75	64/26±11/18	0/013*	0/68
KLAT trial 1	56/80±5/14	51/46±3/92	0/000*	59/86±9/88	53/20±7/09	0/002*	0/29
KLAT trial 2	56/73±5/22	51/40±4/06	0/000*	59/86±8/03	55/00±8/09	0/000*	0/21

*: P< 0.05 is significant before and after treatment (intra-group)
**: P< 0.05 is significant after treatment (inter-group)
***: Data have been stated in the form of SD±Mean

Discussion

The results of this research support a large part of the first hypothesis, which states that Sahrmann's exercises and treatment in the control group improve the control of lumbar-pelvic movement. In addition to the second hypothesis, there was no difference between the two treatments methods.
The results of the current research showed that in the Sahrmann's exercises group, the control of lumbar-pelvic area movement after a 4-week treatment period changed significantly. In the control group, improvement was observed in control of lumbar-pelvic area movements. Comparing the inter-group results showed that the two groups did not show a significant difference in the control of the lumbar-pelvic area movements. The results of current research in terms of the effect of Sahrmann's exercises

on improving the control of lumbar-pelvic movements are in line with the results of the research conducted by Hodges Paul W et al. [22], Panjabi Manohar M et al [23], O Sullivan, Peter B et al. [24], and Aatit Paungmali et al [26].
In a research conducted by Aatit Paungmali et al in 2016, it was reported that lumbar-pelvic stability tests and treatment in the control and placebo groups showed significant improvement in the control of the lumbar-pelvic area movement [9]. Results of this research in terms of improvement in the mean control of lumbar-pelvic are in line with those of current research. Previous studies have reported that improvement in lumbar-pelvic area movement control was created by inter-segmental stiffness, preventing shear force that causes injury in the lumbar area. As a result, it relieves the pain in patients with chronic low back pain [25]. However, in a research conducted by Aatit Paungmali et al., it was reported that increased tissue blood stream can be a reason for pain relief and control of lumbar-pelvic area movement in patients with chronic low back pain [9]. Two important theories, including vicious cycle theory and the new pain adaptation theory, may support such clinical reason following pelvic-lumbar stability exercises [26]. In vicious cycle theory, the proposed clinical reason is ischemic spasm in the lumbar-pelvic muscles following vascular adaptation [26]. This ischemic spasm might result increased pain in the tissues of lumbar-pelvic area [9].
The pain might prevent more movement in the lumbar-pelvic area and cause spasm- pain-spasm. On the other hand, pain adaptation theory suggests that pain reduces contractibility of the lumbar-pelvic area muscles, leading to their inadequacy [9]. This issue might lead to poor performance of the lumbar-pelvic area and poor movement control of the lumbar-pelvic area [9]. Thus, improving the tissue blood stream in the muscles of the lumbar-pelvic area might lead to improvement in back pain and lumbar-pelvic area movement control. However, none of these mechanical and vascular changes were observed in the control and placebo groups [9]. Thus, the goal of rehabilitation is to increasing the blood circulation and movements in the lumbar-pelvic area to clean the harmful inflammatory substances and facilitate muscular activity [9].
Therefore, lumbar-pelvic stability exercises lead to improved tissue blood stream, which might reduce harmful inflammatory substances, and thereby, help improve the movement pattern in patients with chronic low back pain [9]. The results of these studies are also in line with those of our research. In our research, treatment in the control group led to increased blood stream and removal of waste substances, and as a result, reduced spasm and pain, and thereby, it led to improved control of lumbar-pelvic area movements. Sahrmann's exercises group, correct movement pattern training and movement modification lead to reduced stress, inflammation and pain. In addition, Sahrmann's exercises lead to coordination in movement of lumbar-pelvic area and prevent micro-trauma, and thereby, improve the control of lumbar-pelvic movement.
In addition, no significant change was reported between the two groups in the mean scores of lumbar-pelvic movement control, while score of lumbar-pelvic movement control in the Sahrmann's exercises group was lower and showed tendency toward improvement. Given what was stated above, it can be stated that Sahrmann's exercises are effective in improving the control of lumbar-pelvic movement. To report significance of this index in two groups, it is required that more treatment time to be considered.

Conclusion

results of the study showed that there is no difference between Sahrmann exercises and treatment in the control group in terms of impact on lumb0-pelvic motor control measured.

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