Original Article

The effect of walking exercise on the stability indices, pain and disability in patients with chronic nonspecific LB

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ABSTRACT

Background: Previous research has shown that increasing the level of functional activity, including walking, reduces the probability of chronic back pain in the future. Therefore, this study aimed to the effect of walking exercise on stability indices, pain and disability in patients with chronic nonspecific LBP. In this randomized clinical trial, 36 subjects with nonspecific LBP were included. The subjects were randomly divided into a routine exercise group and walking group. Exercises were conducted three times per week for six weeks. Overall, stability indices were measured with the Biodex balance system. In the walking group, the overall dynamic stability index significantly changed from 1.85±0.544 to 0.483 ±0.222, the mediolateral dynamic stability index significantly changed from 0.955±0.206 to 0.233 ±0.118, and the anteroposterior dynamic stability index significantly changed from 1.41±0.609 to 0.399 ±0.216. There is no significant difference in the static and dynamic stability index between routine and walking groups. The positive effects of walking exercise on postural control reactions were shown, so we suggest that in addition to routine exercises, walking exercise should also be considered in subjects with chronic nonspecific LBP.

Keywords: Chronic Nonspecific LBP, Walking Exercise, functional Exercise, Biodex Balance System

Introduction

Low back pain is one of the most common disorders so that each person experiences it at least once in his or her life (1). The direct and indirect financial costs of low back pain are significant in all countries (2); therefore, inexpensive and rapid intervention is very important in maintaining the patient's intellectual and overall health (1). Musculoskeletal pain syndromes such as low back pain can lead to changes in the pattern of muscle recruitments. Changes in motor control and muscle timing may cause muscles to be activated in an inappropriate manner (3). In this regard, Janda states that chronic low back pain usually causes specific motor pattern and alter muscle activity pattern in the pelvic and low back stabilization muscles (4). Changes in motor pattern and movement control can also be associated with a change in balance and postural reaction (5, 6). Therefore, the therapeutic exercise to modify these patterns and restore the normal patterns and eliminate the complications has been mentioned. Based on the approach of functional exercise therapy, different methods of exercise are recommended.

Walking is one of the most basic movements in humans, but on the other hand, it is one of the most stressful activities can cause various injuries (7). Walking, as an intervention, will potentially be a relatively inexpensive and affordable method (8). The American College of Sports Medicine states that 3-5 minutes of walking helps maintain general body health (8). In a clinical trial study, Seok showed that stabilization and walking exercises significantly improve the intensity of pain in chronic low back pain patients (9). Torstensen et al., after 12 -week intervention and one -year follow up, observed a further reduction in pain in the walking group (10). Miroski et al. also reported the pain and range of motion in the stretching group with walking exercise were significantly changed (11).

Whether or not walking exercise as therapeutic intervention will be effective for low back pain patients is unknown and is a potential for future research (8). But in general, previous research (12-14) has shown that increasing the level of recreational activity, which includes walking exercise, reduces the probability of chronic back pain in the future (8). Review article in 2010 showed that there is generally a moderate to poor evidence of whether walking exercise as a therapeutic intervention is useful for patients with acute and chronic low back pain and there is a need for further studies (8).

According to the above, it is important to note that, given the high prevalence, low back pain is one of the health and psychological problems of the community. Also, walking is one of the most essential and basic human movements that can be recognized as an activity that affects postural reactions. Overall, the results of the relevant studies suggested that exercises could be effective in the low back pain. However, number of studies that have examined effects of walking exercise approach on postural reaction in low back patients are limited. In addition of few numbers of studies, it is difficult to make conclusion about effectiveness of walking exercise approach in the patients with low back pain due to low quality of studies and variations in methods. It indicates that the clinicians need to conduct more studies in this field. Thus, the aim of present study was the effect of walking exercise on postural reaction in nonspecific chronic low back pain patients.

Materials and Methods

This study was single blind randomized controlled trial. Forty subjects with non-specific chronic low back pain participate in this study and were divided into two groups by simple non-probability sampling method. The medical ethics committee at the Zahedan University of Medical Sciences approved the study ethics and issued the ethics certification number as IR.ZAUMS.REC.1402.255 and registered with the region's Clinical Trials Registry (IRCT20180714040466N7). All participants signed written informed consents.

Inclusion criteria

Inclusion criteria included men and women aged between 18 and 60 years, chronic LBP between the 12th rib and the rump region, pain in lumbar spine region without referral to the lower limbs (without root cause), a 3-month or prolonged course of the disease, no history of fracture, structural abnormalities, no history of dizziness and trauma. Also, no history of progressive rheumatic and neurological diseases, no history of long-term use of corticosteroids, no history of injury, malignancy and pregnancy, ability 20 minutes walking in daily (28).

Exclusion criteria

Exclusion criteria included receiving other treatment during the research, unwillingness to continue treatment, not completing the course of treatment, taking painkillers, sedatives and alcohol 48 hours before the test.

Sample Size

The sample size was determined based on a pilot study. Ten subjects were divided randomly into two equal groups, and the main part of study was conducted on them. The means and SDs for the parameters from this pilot study, with $\alpha = 0.05$ and 90% power were used to calculate the sample size. According to the results of the pilot and the formula stated, the sample size in each group was considered 18 patients.

The sampling method was the simple, non-probabilistic sampling method and from the available population. The participants will then be allocated randomly to two intervention groups, the routine group and walking group. Randomization would be performed using random number sequence. The administrator and participants were informed about the grouping data. But the physiotherapist who assessed the subjects, measured the outcome, and analyzed the data was blinded about the grouping.

Procedure

The initial clinical examination study was performed by demographic information, patient's history for diagnostic chronic nonspecific LBP. Then, the individuals were selected to enter the study by examining the inclusion and exclusion criteria.

Outcome

Pain and Disability Index

In order to assess the level of pain perception (rank), the Visual Analogue Scale (VAS) of the McGill Short Questionnaire was used. It was a scale sensitive to pain and its information had the reliability and validity. This scale was a 10-cm graded line, in which the patient had to determine his pain severity on this graded line from zero (no pain) to 10 (the most severe pain perceived) (15).

The functional disability of patients was assessed by the Oswestry Disability Index, which is a golden standard for assessing low back pain. This index had 10 items assessing the severity of pain, personal care, carrying things, walking, sitting, and standing, sleeping, having sex, social life, and travelling. Each item had 6 ranks, ranked from 0 to 5, and the maximum score of it was 50. The score of different items was summed up and divided by the number of 50 and multiplied by the number 100 to achieve the percentage of disability. If the patient does not answer one of the items, the total score of the items was divided by the number 45 and multiplied by the number 100 (16).

Disability Indices

The Biodex system consists of a circular moving desk with a diameter of 55 cm, which is placed at a height of 20 cm above the ground inside the body of the equipment. This desk can tilt in different directions up to 20 degrees relative to the horizon plane. The overall stability index shows the variance in plate deviation from the horizontal plane. The anteroposterior and mediolateral indices show the deviation of the plate from the horizontal position in the sagittal and frontal planes, respectively. The indices' scores show the deviation from the horizontal position, so the lower scores indicate better balance (16, 17).

The difficulty level is also adjustable, meaning the system can change the stiffness from 1 (least stable) to 12 (most stable).

The subjects stood on the balance board without shoes or stockings. To measure dynamic stability indices in the two-leg position, subjects at a stability level of 8 were tested with open eyes. Each test lasted 20 seconds and was repeated three times, and the rest time was selected to be 10 seconds. The parameters of the overall balance index, anteroposterior stability index, and mediolateral stability index were recorded.

Intervention

Subjects were randomly divided into two groups: Routine group and walking group. Patients in both groups received routine physiotherapy treatment including TENS (conventional, 20min), Hot pack (20min), US (5min) were performed.

In the Routine group, free active exercises including double knees to chest, abdominal bracing, bridge, and quadruped were performed. Techniques are performed 10 times and holding 5 seconds.

In walking group, patients walked on treadmill with desired speed. Exercise progression was done according **(Table 1)**.

Table 1. Exercise progression was done in walking group.

	Forward walk	Rest	Backward walk	Rest	Sidewalk
First week	10 minutes				
Second week	20 minutes				
Third week	10 minutes	2 minutes	5 Minutes	2 minutes	5 minutes (2.5 minutes from each side)
Fourth week	5 Minutes	2 minutes	10 Minutes	2 minutes	10 minutes (5 minutes from each side)
Fifth week	10 minutes	2 minutes	10 Minutes	2 minutes	10 minutes (5 minutes from each side)
Sixth week	15 minutes	2 minutes	10 Minutes	2 minutes	10 minutes (5 minutes from each side)

Exercises were completed under the supervision for the six weeks. Five minutes were added to the walking time every week, so that in the sixth week it reaches 30.

Patients were treated in eighteen sessions three days a week for six weeks. All the variables were measured before and after intervention.

Data analysis

Results were presented as mean values and standard deviation (SD). Criterion of significancy was set as $p<0.05$. Data analysis was performed with SPSS version 27. The assumption of a normal distribution was assessed using the Shapiro-Wilk test. The assumption of equality of variances was tested using Levene's test. The paired and student t-tests were used for within- and between-group comparisons.

Results and Discussion

Forty-eight people were nominated for this study, and 20 patients in each group were divided into two groups: routine group and walking group (Figure 1).

The pilot study showed that 18 subjects would be needed for each group (a total of 36 subjects). Ultimately, 36 subjects finished the study procedure. Eight of them were not eligible based upon the inclusion and exclusion criteria. Tow subjects from the routine group and Tow subjects from walking group left the study because of personal problems, unwillingness to continue treatment and incomplete treatment or reasons unrelated to the investigation. The flowchart of choosing participants in the study is shown in (Figure 1).

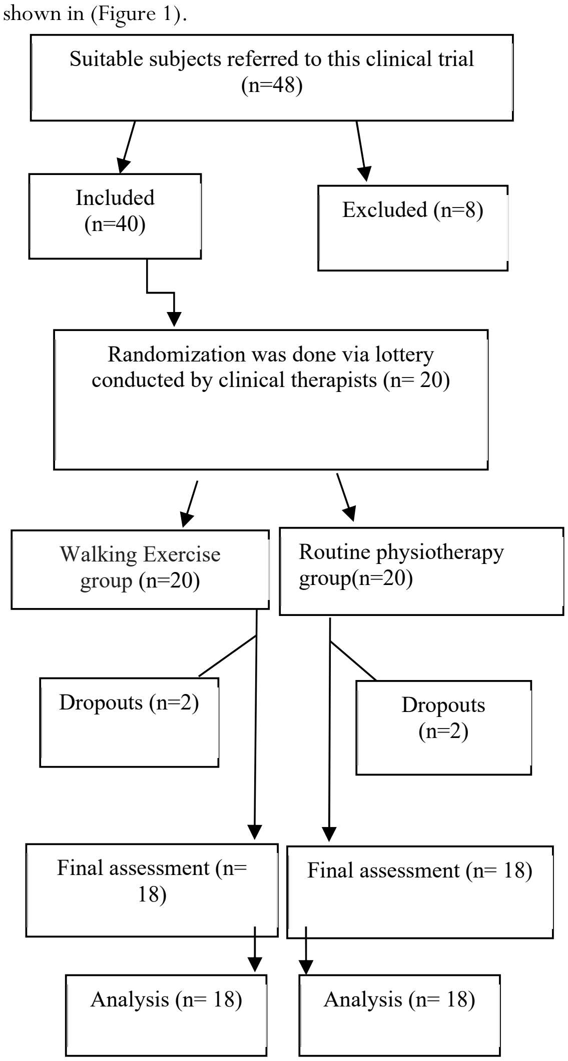

Figure 1. Flow diagram of study selection.

Data were analyzed in SPSS 27 software. The normality of data distribution was examined by the Shapiro-Wilk test. The p-value was not less than 0.05 in the variables of the study. Thus, the tests do not reject the hypothesis of normality and the data are normal ($p>0.05$).

Table 2 presents the demographic characteristics of patients including age, height, weight, and body mass index. The demographic characteristics of the patients, which were recorded before intervention, were compared between the two groups.

Table 2. Comparison of demographic characteristics between two groups.

Variable	Routine group (n=18)*	Walking Group (n=18) *	p-value**
Age (Years)	42.16 ± 8.41	39.00 ± 8.23	0.2
Weight (Kg)	81.38 ± 16.96	75.72 ± 11.41	0.2
Height (Cm)	162.05 ± 11.7	161.94 ± 9.07	0.9
Body Mass Index (BMI) (m2/Kg)	31.17 ± 6.54	29.08 ± 5.17	0.2

*mean ± standard deviation. ** A significance level of less than 0.05.

Within group and between group comparison

There was no significant difference between the two groups **(Table 3)**.

Table 3. Within and between group's comparison.

	Routine group (n=18)*		P value-within group**	Walking Group (n=18) *		P value-within group**	P value-between group**
	Before	After		Before	After		
Pain	5.66 ± 1.08	2.88±1.07	0.0	4.94 ±1.05	2.22±0.73	0.0	0.03
Disability	35.44±14.22	18.00±10.80	0.0	22.33±10.01	7.55±4.68	0.0	0.0
Static Overall Stability index	0.57±0.37	0.46±0.43	0.1	0.63±0.38	0.44±0.33	0.09	0.8
Static Anterior Posterior Stability index	0.43±0.22	0.41±0.40	0.8	0.51±0.37	0.35±0.36	0.1	0.6
Static Medial Lateral Stability index	0.28±0.22	0.16±0.10	0.04	0.25±0.17	0.16±0.91	0.05	1.0
Dynamic Overall Stability index	1.85±0.61	0.75±0.56	0.0	1.85±0.54	0.48±0.22	0.0	0.07
Dynamic Anterior Posterior Stability index	1.13±0.36	0.62±0.52	0.0	1.41±0.60	0.39±0.21	0.0	0.09
Dynamic Medial Lateral Stability index	1.23±0.48	0.28±0.19	0.0	0.95±0.20	0.23±0.11	0.0	0.3

*mean ± standard deviation. ** A significance level of less than 0.05.

To examine the homogeneous of samples in the two studied groups before intervention, a t-test was used. The results show that the samples in the two groups were equal and homogeneous ($p>0.05$).

The results of **(Table 3)** show that the changes in the pain and disability index were significant before and after intervention in both groups ($p<0.05$). Also, no significant changes were observed in static overall stability index, static anterior posterior stability index, static medial lateral stability index before and after intervention in both groups ($p<0.05$). The results of **Table 3** show that the changes dynamic overall stability index, dynamic anterior posterior stability index, dynamic medial lateral stability index were significant before and after intervention in both groups ($p<0.05$). The results of the between group comparison show no significant difference in Static overall stability index, static anterior posterior stability index, static medial lateral stability index, dynamic overall stability index, dynamic anterior posterior stability index, dynamic medial lateral stability index after intervention ($p>0.05$). There was significant difference between the two groups in the pain, disability index after intervention ($p<0.05$).

The most important finding of the research showed that walking exercise can be effective in reducing pain and disability in patients with non-specific low back pain. Walking exercise can also improve dynamic stability indices.

In general, chronic nonspecific low back pain patients have more postural reaction than healthy people. As a result, correcting postural control reaction in these people is considered one of the main concerns of the rehabilitation program (6). In the new approaches, emphasis is placed on improving the function and task of patients, and the based on this approach functional exercise is used for the management and modifying postural control reaction of chronic nonspecific low back pain patients (8). Not only walking is known as the most basic human activity but also various forms of this activity has been used as a therapeutic method for the prevention and treatment of musculoskeletal pain syndrome as well as low back pain (7-8). Torstensen et al. randomly placed 208 patients in the drug, routine physiotherapy and the walking groups. After 12 -week intervention and one -year follow up, they observed a further reduction in pain in the walking group than the other two groups (18). In another study, Taylor NF et al. showed that 10 minutes of treadmill walking decreased the pain in the low back pain patients (19). As the results of our study also show that walking exercise improve the intensity of the pain and score of disability. Walking back or sides create more neuromuscular needs than walking forward because of its connection to faster speed and shorter step length (20). As Masumoto et al. (21) showed that walking back leads to more central muscle activity than walking forward. So, Walking and performing its different patterns due to the different kinematic and kinetic and different muscle activity can affect in postural reactions through learning and applying different muscle patterns. Dufek et al. reported that walking backwards could reduce low back pain and increase the range of lumbar spine motion specifically on the sagittal plane (22). However, all of these previous observations have been done in the absence of the control group. Therefore, it is difficult to conclude that the reported changes were individually the result of backward walking.

The biomechanics of the side walking or backward walking in parameters of step length, step duration, knee and hip joint range of motion differ from forward walking (23, 24). Changes in the frequency of the step affect the kinematic and the kinetics of the joints (25). Changes in joint kinematic and kinetic may affect the relative muscle activity during a task. For example, a decrease in dynamic stability during backward walking may make a more difficult challenge for postural stability (26, 27). Therefore, it seems that walking and functional exercise with application of various kinematic, kinetic and muscular patterns can have an effect on the postural control reactions in patients with chronic low back pain (25-27).

Generally, functional exercise seems to be effective in reducing pain and disability and improving the postural control reactions in chronic low back pain patients. Therefore, it is necessary to combine these types of exercises in the rehabilitation program of chronic nonspecific low back pain patients.

Conclusion

Based on the results of the present study, walking exercise improved postural stability in subjects with chronic nonspecific LBP. The present study indicated the importance of task exercise or functional exercise in controlling posture reactions in individuals with chronic nonspecific LBP, especially in specific stages of function such as single-leg standing or transitional phases of walking. Therefore, we suggest that walking exercise should also be considered in rehabilitation programs for subjects with chronic nonspecific LBP in addition to routine exercises.

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Conflict of interest: None

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Ethics statement: None

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