ORIGINAL ARTICLE

Rheumatology Quarterly

DOI: 10.4274/qrheumatol.galenos.2023.77487
Rheumatology Quarterly 2023;1(3):93-103

EFFECTS OF EXERCISE USING A STRETCHING PLATFORM ON PAIN, PROPRIOCEPTION, BALANCE, AND MOBILITY IN PATIENTS WITH NON-SPECIFIC CHRONIC LOW BACK PAIN

Cansu Ayvaz Kırkaya[1], Gamze Aydın[2], Emine Atıcı[3]

[1]İstanbul Okan University Institute of Graduate Education, Department of Physiotherapy and Rehabilitation, İstanbul, Turkey
[2]Fırat University Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Elazığ, Turkey
[3]İstanbul Okan University Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İstanbul, Turkey

Abstract

Aim: Non-specific chronic low back pain (LBP) is defined as pain lasting more than 3 months, which is the first among musculoskeletal system diseases. This study aimed to examine and compare the effects of exercises applied with a stretching platform in addition to conservative treatment (CT) and CT only on pain, proprioception, balance, and mobility in patients with chronic LBP.

Material and Methods: Fifty five people with chronic LBP were included in the study and randomly divided into 2 groups. Group 1 was included in the CT, and group 2 was included in the exercise program applied with a stretching platform in addition to the CT. Pain intensity with visual analog scale (VAS), proprioception sense with the active re-creation of passive positioning method without extremity support, mobility with modified schober test (MST), hand finger-ground distance measurement (HFGDM) and trunk lateral bending measurement (TLBM), balance level with functional reach test (FRT), functionality with oswestry disability index (ODI), and quality of life (QoL) was assessed with the EuroQol Group 5D-3L.

Results: Statistically significant differences were observed between the results of pain, proprioception, MST, HFGDM and TLBM, FRT, ODI, and EuroQol Group 5D-3L in intragroup evaluations ($p<0.05$). In intergroup analysis, the VAS score during activity and 15° right ankle plantar flexion in proprioception evaluation were superior in group 2 compared with group 1 ($p<0.05$).

Conclusion: It was observed that CT and exercises applied with a stretching platform in the treatment of LBP had positive effects on pain, proprioception, mobility, balance, functionality, and QoL.

Keywords: Low back pain, exercise, balance, proprioception, mobility

INTRODUCTION

Non-specific chronic low back pain (LBP) is defined as pain lasting more than 3 months, which is the first among musculoskeletal system diseases, is located between the lower ribs and the gluteal line, can spread to the lower extremities (1). LBP, with a prevalence of 4-33%, is more common in females over 40 years of age (2,3). LBP that does not go away with rest, pain in the legs, numbness, and weakness, increased temperature in the pain areas, loss of sensation and tenderness, decreased proprioception sense in the lower extremity joints, lumbosacral joint and facet joints are common symptoms in chronic LBP (4).

Address for Correspondence: Gamze Aydın, Fırat University Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Elazığ, Turkey
Phone: +90 537 760 02 56 **E-mail:** gmzetsn@gmail.com **ORCID ID:** orcid.org/0000-0002-4952-2825
Received: 20.06.2023 **Accepted:** 15.08.2023 **Epub Date:** 24.08.2023 **Publication Date:** 29.09.2023

Medical, conservative treatment (CT), and surgical approaches are applied for treating LBP. CT approaches include thermotherapy, electrotherapy, exercise training, back schooling, and patient education (5). Thermotherapy is a treatment approach that generally includes hot applications in the chronic period to reduce pain and spasm (6). Electrotherapy is an application in which electrical currents are used to relieve pain and improve muscle function (7). Exercise training significantly reduces the level of pain and the possibility of recurrence of pain, and increasing flexibility by preventing pain-induced kinesiophobia (8). Patient education informs people about correct posture and ergonomics and offers suggestions that will enable people to cope with pain (9).

The reasons for preferring exercises with a stretching platform in our study are to increase the mobility of the lumbar region, reduce the fear of pain-induced movement, and improve the sense of proprioception and dynamic balance in the joints with the stretching effect that will occur in all joints from the lumbar region to the ankle.

Our primarily aim was to examine and compare the effects of exercises applied with a stretching platform in addition to CT in patients with chronic LBP and only CT on pain and secondarily on proprioception, balance, mobility, functionality and quality of life (QoL).

MATERIAL AND METHODS

Participants

Our study, which was designed as a randomized controlled prospective clinical trial (NCT05726955), was conducted in accordance with the Declaration of Helsinki. Ethics committee approval for this study was obtained from the İstanbul Okan University Ethics Committee with decision number (protocol no: 20.10.2021-14, date: 20.10.2021). The study included 55 participants aged 25-65 years, who had LBP for more than 12 weeks and whose pain intensity was greater than 3 on the 10 cm visual analog scale (VAS). Those who have structural deformity, circulatory disorder, and a disease that will prevent mobility in the columna vertebralis, those who have undergone surgery for the columna vertebralis and lower extremity in the last year, and those diagnosed with vertigo and osteoporosis were not included in the study. All volunteers participating in the study were given an informed consent form, and their signed consent was obtained.

Evaluations of pain, proprioception, mobility, balance, functionality and QoL were performed by a physiotherapist, while treatment programs were performed by another physiotherapist in this study. Physiotherapists were blind to each other. The face-to-face the interview method was used for data collection. A consultation was provided by the researchers when the patients had questions. It took about 30 min to complete all assessments.

Sample Size

The sample size of our study was made using PS Power analysis program. In the analysis, the number of samples was determined as 25 individuals in each group using the values of α=0.05, power: 0.80, minimal clinically important difference: 20 mm (VAS), standard deviation: 24.51. Considering the probability of 10% decrease in the participants, it was determined that 55 people should participate in the study (10).

Randomization

The participants were randomized via the "Research Randomiser" website (11). The numbers obtained because of randomization by entering the number of participants (n=55) and the number of groups (group 1 and group 2) were put into envelopes. Participants were assigned to groups according to the numbers on the envelopes they drew. Randomization was done in secret, blinding the groups and preventing the participants from meeting the other group.

Groups

Group 1 (n=27) were included in a CT program and group 2 (n=28) were included in an exercise training program applied with CT and a stretching platform 3 days a week for 6 weeks. Severity of pain, proprioception, mobility, balance, functionality, and QoL assessments of all participants were performed before and after the treatment. The participation status, assessments, and treatment methods applied to the participants were as shown in the flow diagram below (Figure 1).

Assessments

Demographic data including age, height, body weight, body mass index (BMI), previous diseases, and smoking habits of the participants who participated in the study were evaluated. To evaluate the severity of pain at night, at rest, and during activity, VAS was used, which digitizes the parameter values that cannot be measured numerically by numbering them from 0 to 10, where "0" is no pain and "10" is very severe pain (12).

In the method of actively recreating passive positioning without supporting the extremity, in which a goniometer is used to evaluate the proprioception sense, the extremity was passively moved to the target angle while the participant's eyes were closed, and the participant returned to the starting point after focusing on the position for 10 seconds. The participant tried to

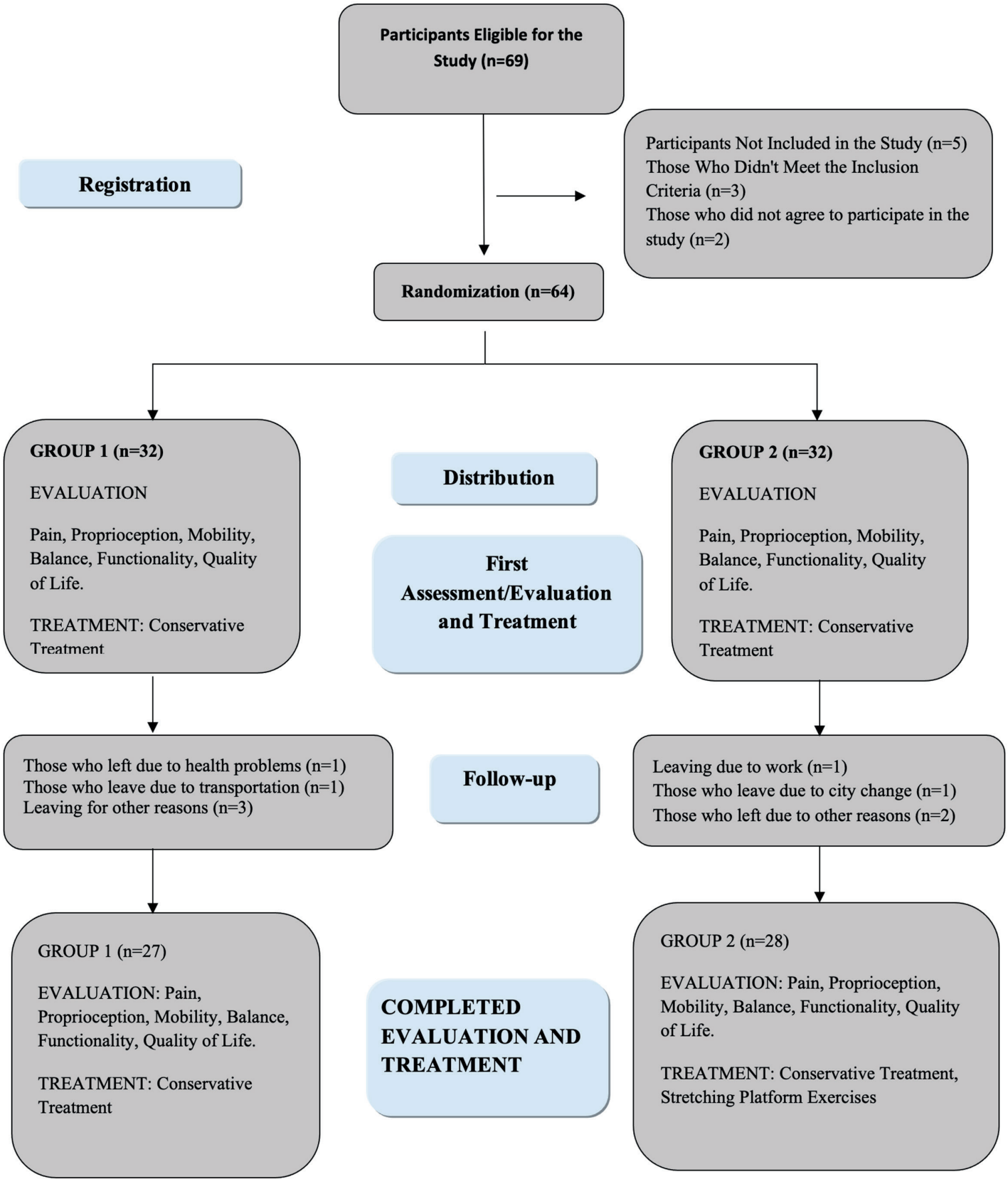

Figure 1. Working flow diagram

find the target angle by actively moving the same extremity, and the difference was recorded as the deviation angle (13).

Modified schober test (MST), hand finger-ground distance measurement (HFGDM), and trunk lateral bending measurement (TLBM) were used to evaluate the level of mobility. In the MST, 5 cm below and 10 cm above the line connecting the spinal iliaca posterior superior were marked with the help of a tape measure while the participant was in an upright position. While the participant was performing maximum trunk flexion, the distance between the two points was measured and 15 cm was subtracted from this measurement. If the difference is less than 5 cm, it is MST (+). This result indicates that lumbar region mobility decreases (14,15). In HFGDM, the participant is asked to bend forward and perform maximum flexion while in an upright position. In TLBM, the participant was asked to lean to the side with his arms on both sides of the body, with his shoulder and gluteal region resting against the wall. In both measurements, the distance between the third finger and the ground was measured with the help of a tape measure. Lumbar mobility increases as the distance between the finger and the floor decreases in TLBM and HFGDM (16).

Functional reach test (FRT) was used for balance assessment. The participant was positioned to stand sideways against the wall. The shoulder on the wall was brought to 90° flexion and the elbow to full extension, and the participant was asked to make a fist with the same arm. The alignment of the 3rd metacarpal head was marked on the wall. The participant reached forward with the knees fully extended and the level of the third metacarpal head was marked again. The difference between the two marks was measured using a tape measure. The average value was obtained after 3 trials. The same application was repeated with eyes closed. The greater the difference between the marked points in FRT, the better the balance (17,18).

The oswestry disability index (ODI) was used for functionality assessment. ODI is a scale that evaluates the degree of the loss of function in LBP between "0" and "100" points. As the score in ODI increases, the level of disability increases (19).

The EuroQol Group 5-dimension 3-level (EQ-5D-3L) QoL scale was used for QoL assessment. The 1st item of the parameters evaluated in the 1st part of the scale includes the expressions "no problem", the 2nd item "moderately severe problem" and the 3rd item "very severe problem". In scoring, '11111' represents complete well-being, and '33333' represents coma or death. Section 2 contains VAS, with 100 representing "excellent health" and 0 representing "very poor health" (20).

Treatment Program

All participants included in the study received CT 3 days a week for 6 weeks. CT included a 20-minute hot pack and conventional transcutaneous electrical nerve stimulation and William's flexion exercises applied to the lumbar region. The exercises performed on the stretching platform designed to stretch the lumbar, gluteal, and posterior parts of the lower extremity were applied only to the participants in group 2 for 3 days a week for 6 weeks after Williams flexion exercises (Table 1).

Statistical Analysis

The SPSS statistical package program was used to evaluate the data. For homogeneity of variances, which are prerequisites of parametric tests, "Levene test", the normality assumption "Shapiro-Wilk test", the differences between two independent groups "Student's t-test" and "Mann-Whitney U test", and the differences between the two dependent groups "Paired t-test" and the "Wilcoxon sign test" were used. Relationships between categorical variables were analyzed with Fisher's exact test and chi-square test. In the analysis of frequencies less than 20%,

Table 1. Exercises with stretching platform

Exercises with stretching platform	Purpose of the exercise	How to practice the exercise	Number of repetitions	Duration
1st exercise	Stretching the lumbal, gluteal, posterior part of the lower extremity	Leaning forward on the platform	3	30 sec/repeat
2nd exercise	Increasing the sense of proprioception and balance	Leaning forward on the platform with eyes closed	3	30 sec/repeat
3rd exercise	Stretching the gastrocnemius muscle, strengthening the ankle joint	Lean forward on the platform with the knees in the semiflexed position.	3	30 sec/repeat
4th exercise	Improving balance	Standing on one leg, leaning forward on the platform	3	30 sec/repeat
5th exercise	Strengthening the oblique muscles, stretching the iliotibial band	With right/left trunk rotation, leaning right/left on the platform	3	30 sec/repeat

evaluation was made with the "Monte Carlo simulation method". A $p<0.05$ level was considered statistically significant.

RESULTS

The demographic and clinical characteristics of the participants are shown in Table 2. It was determined that the two groups were similar in terms of demographic and clinical characteristics ($p>0.05$), (Table 2).

In intragroup analysis, a statistically significant decrease was found in VAS scores at rest, night, and activity (Table 3), measurement of right and left TLBM, and a statistically significant increase was found in proprioception (Table 4), measurement of MST, HFGDM, FRT, and eyes-closed FRT (Table 5), ODI (Table 6), EQ-5D-3L, and EQ-5D-3L-GAS ($p<0.05$), (Table 6).

In intergroup analysis, the improvement in VAS activity and in 15° right ankle plantar flexion proprioception was found

Table 2. Comparison of demographics and clinical characteristics (n=55)

		Participant groups		Test statistics	P
		Group 1 (n=27)	Group 2 (n=28)		
Age		45.26±10.68	44.18±9.53	-0.464	0.643[1]
Height		167.63±9.17	160.61±30.07	-0.649	0.516[1]
Weight		70.93±17.75	78.36±15.73	-1.760	0.078[1]
BMI		25.58±4.24	28.25±5.19	-1.953	0.051[1]
Gender	Female	19 (70%)	18 (64%)	0.231	0.631[2]
	Male	8 (30%)	10 (36%)		
Smoking	Yes	16 (59%)	8 (29%)	4.089	0.053[2]
	No	11 (41%)	20 (71%)		

[1]Mann-Whitney U test (z), [2]Chi-square test, BMI: Body mass index
Summary statistics are given as the mean ± standard for numerical data and number (percentage) for categorical data.

Table 3. Intragroup and intergroups comparison of pain severity (n=55)

		Participant groups		Tİ[†] (group)			Tİ[&] (group x time)		
		Group 1 (n=27)	Group 2 (n=28)	Test statistics	p	ES	Test statistics	p	ES
VAS rest	First	5.30±3.12	4.61±3.35	-0.764	0.445	0.103	-0.234	0.815	0.032
	Last	3.37±2.39	2.75±2.43	-0.981	0.326	0.132			
Tİ[¥] (time)	Test statistics	-4.104	-3.939						
	p	**0.001**	**0.001**						
	ES	0.790	0.744						
VAS activity	First	7.00±2.53	6.64±2.00	-0.605	0.545	0.082	-2.359	0.018	0.318
	Last	5.33±2.15	4.14±1.96	-2.007	**0.045**	0.271			
Tİ[¥] (time)	Test statistics	-4.084	-4.582						
	p	0.001	0.001						
	ES	0.786	0.866						
VAS night	First	3.48±3.15	3.57±3.24	-0.052	0.959	0.007	-1.031	0.303	0.139
	Las	2.59±2.53	2.21±2.45	-0.456	0.648	0.061			
Tİ[¥] (time)	Test statistics	-3.223	-3.541						
	p	**0.001**	**0.001**						
	ES	0.620	0.669						

ES: Effect size, Tİ: Test statistics, First: First measure, Last: Last measure, VAS: Visual analog scale, z: Mann-Whitney U Test, z*: Willcoxon test, [†]Intergroup comparison, [¥]Intra-group comparison, [&]Intergroup difference between first and last scores comparison, summary statistics are given as mean ± standard deviation

Table 4. Intragroup and intergroup comparison of proprioception evaluation results (n=55)

		Participants		Tİ† (group)			Tİ& (group x time)		
		Group 1 (n=27)	Group 2 (n=28)	Test statistics	p	ES	Test statistics	p	ES
60° lumbal flexion	First	19.26±11.41	14.64±14.27	-1.372	0.170	0.185	-0.827	0.408	0.112
	Last	8.89±10.86	5.89±6.53	-0.717	0.473	0.097			
Tİ¥ (time)	Test statistics	-4.203	-3.536						
	p	**0.001**	**0.001**						
	ES	0.809	0.668						
60° hip flexion right	First	17.41±9.24	9.11±9.72	-3.041	0.002	0.410	-1.672	0.095	0.225
	Last	7.41±8.13	2.86±5.84	-2.260	**0.024**	0.305			
Tİ¥ (time)	Test statistics	-3.884	-2.909						
	p	**0.001**	**0.004**						
	ES	0.747	0.550						
60° hip flexion left	First	13.52±8.75	9.82±9.95	-1.501	0.133	0.202	-1.174	0.240	0.158
	Last	5.37±6.03	4.11±7.82	-1.289	0.198	0.174			
Tİ¥ (time)	Test statistics	-3.376	-3.15						
	p	**0.001**	**0.002**						
	ES	0.650	0.595						
30° hip abduction right	First	10.74±6.31	8.57±6.92	-1.258	0.208	0.170	-0.139	0.890	0.019
	Last	5.37±6.49	3.75±5.02	-0.901	0.368	0.121			
Tİ¥ (Time)	Test statistics	-3.020	-2.750						
	p	**0.003**	**0.006**						
	ES	0.581	0.520						
30° hip abduction left	First	10.19±6.58	9.64±8.04	-0.228	0.819	0.031	-0.624	0.532	0.084
	Last	4.81±6.58	3.21±6.27	-0.980	0.327	0.132			
Tİ¥ (time)	Test statistics	-3.228	-3.321						
	p	**0.001**	**0.001**						
	ES	0.621	0.628						
60° knee flexion right	First	21.85±40.65	11.43±12.16	-1.489	0.136	0.201	-1.247	0.213	0.168
	Last	7.04±6.54	6.79±9.05	-0.568	0.570	0.077			
Tİ¥ (time)	Test statistics	-3.237	-2.092						
	p	**0.001**	**0.036**						
	ES	0.623	0.395						
60° knee flexion left	First	10.56±5.77	10.89±11.55	-0.543	0.587	0.073	-0.432	0.666	0.058
	Last	5.74±6.00	6.07±8.32	-0.176	0.860	0.024			
Tİ¥ (time)	Test statistics	-2.714	-2.759						
	p	**0.007**	**0.006**						
	ES	0.522	0.521						
15° ankle plantar flexion-right	First	15.56±5.43	8.39±7.94	-3.610	0.001	0.487	-1.023	0.306	0.138
	Last	13.52±5.15	4.64±5.26	-4.897	**0.001**	0.660			
T/¥ (time)	Test statistics	-2.007	-3.077						
	p	**0.045**	**0.002**						
	ES	0.330	0.581						
15° ankle plantar flexion-left	First	15.93±5.89	7.5±7.64	-4.122	0.001	0.556	-0.592	0.554	0.080
	Last	12.22±4.87	4.82±6.31	-4.118	**0.001**	0.555			
Tİ¥ (time)	Test statistics	-2.843	-2.267						
	p	**0.004**	**0.023**						
	ES	0.547	0.428						

ES: Effect size, Tİ: Test statistics, First: First measure, Last: Last measure, z: Mann-Whitney U Test, z*: Willcoxon test, †Intergroup comparison, ¥Intra-group comparison, &Intergroup difference between first and last scores comparison, summary statistics are given as mean ± standard deviation

to be superior in group 2 compared to the group 1 ($p<0.05$), (Tables 3, 4). The improvement of 60° right hip flexion and 15° left ankle plantar flexion proprioception and TLBM were found to be superior in group 1 compared with group 2 ($p<0.05$), (Tables 4, 5).

DISCUSSION

In this study, we examined and compared the effects of exercises applied with a stretching platform in addition to CT and only CT in patients with LBP on pain, proprioception, balance, mobility, functionality and QoL.

Table 5. Intragroup and intergroup comparison of the mobility and balance evaluation results (n=55)

		Participants		Tİ† (group)			Tİ& (group x time)		
		Group 1 (n=27)	Group 2 (n=28)	Test statistics	p	ES	Test statistics	p	ES
Modified schober test	First	5.00±0.72	5.00±1.16	-0.465	0.642	0.063	-1.045	0.296	0.141
	Last	5.44±0.66	5.59±0.98	-0.788	0.431	0.106			
Tİ¥ (time)	Test statistics	-3.630	-3.581						
	p	**0.001**	**0.001**						
	ES	0.699	0.677						
Hand finger ground distance measurement	First	16.15±11.52	12.86±8.29	-1.104	0.269	0.149	-0.287	0.774	0.039
	Last	13.61±9.27	10.43±9.77	-1.412	0.158	0.190			
Tİ¥ (time)	Test statistics	-2.716	-2.093						
	p	**0.007**	**0.036**						
	ES	0.523	0.396						
Trunk lateral bending measurement right	First	38.37±10.79	45.16±9.08	-2.429	0.015	0.328	-0.838	0.402	0.113
	Last	32.30±9.94	39.07±11.63	-2.275	**0.023**	0.307			
Tİ¥ (time)	Test statistics	-4.374	-3.922						
	p	**0.001**	**0.001**						
	ES	0.842	0.741						
Trunk lateral bending measurement left	First	37.39±10.39	45.50±8.93	-2.942	0.003	0.397	-0.051	0.960	0.007
	Last	32.52±9.11	39.63±11.42	-2.435	**0.015**	0.328			
Tİ¥ (time)	Test statistics	-4.158	-3.135						
	p	**0.001**	**0.002**						
	ES	0.800	0.592						
Functional reach test	First	27.04±10.67	27.88±10.52	-0.379	0.704	0.051	-1.342	0.180	0.181
	Last	30.17±11.20	32.98±10.51	-1.315	0.189	0.177			
Tİ¥(time)	Test statistics	-3.416	-3.452						
	p	**0.001**	**0.001**						
	ES	0.657	0.652						
Eyes closed functional reach test	First	25.63±13.05	26.29±12.55	-0.076	0.940	0.010	-1.947	0.045	0.249
	Last	28.43±11.99	30.96±12.80	-0.708	0.479	0.095			
Tİ¥ (time)	Test statistics	-3.487	-3.229						
	p	**0.001**	**0.001**						
	ES	0.671	0.610						

ES: Effect size, Tİ: Test statistics, First: First measure, Last: Last measure, z: Mann-Whitney U test, z*: Willcoxon test, †Intergroup comparison, ¥Intra-group comparison, &Intergroup difference between first and last scores comparison, summary statistics are given as mean ± standard deviation

Table 6. Intragroup and intergroup comparison of the functionality and quality of life evaluation results (n=55)

		Participants		Tİ† (group)			Tİ& (group x time)		
		Group 1 (n=27)	Group 2 (n=28)	Test statistics	p	ES	Test statistics	p	ES
Oswestry disability index	First	46.67±19.94	41.93±14.48	-0.742	0.458	0.100	-1.066	0.283	0.142
	Last	36.00±17.51	28.86±12.71	-1.501	0.133	0.183			
Tİ¥ (time)	Test statistics	-4.336	-4.474						
	p	**0.001**	**0.001**						
	ES	0.834	0.846						
EQ-5D-3L	First	0.44±0.32	0.51±0.26	-0.591	0.554	0.080	-0.357	0.721	0.048
	Last	0.60±0.20	0.66±0.18	-1.220	0.223	0.164			
Tİ¥ (time)	Test statistics	-3.299	-3.504						
	p	**0.001**	**0.001**						
	ES	0.635	0.662						
EQ-5D-3L-GAS	First	76.30±16.0	72.86±19.22	-0.453	0.650	0.061	-0.291	0.771	0.039
	Last	83.30±13.30	80.00±16.33	-0.557	0.578	0.075			
Tİ¥ (time)	Test statistics	-3.275	-3.087						
	p	**0.001**	**0.002**						
	ES	0.630	0.583						

ES: Effect size, Tİ: Test statistics, First: First measure, Last: Last measure, z: Mann-Whitney U test, z*: Willcoxon test †Intergroup comparison, ¥Intra-group comparison, &Intergroup difference between first and last scores comparison, summary statistics are given as mean ± standard deviation, EQ-5D-3L: EuroQol Group 5-dimension 3-level

In previous studies, when the demographic characteristics of people with chronic LBP are examined, it is seen that the probability of chronic LBP is higher in people aged 40 and over, females, and people with a BMI of 25 kg/m^2 and above (21,22). In our study, the mean age of chronic LBP was 45.26±10.68 years in group 1 and 44.18±9.53 years in group 2. The mean BMI value was found to be 25.58±4.24 kg/m^2 in group 1 and 28.25±5.19 kg/m^2 in group 2. In addition, it was found that chronic LBP was more common in females compared to males with a rate of 70% in group 1 and 64% in group 2.

VAS is generally used for pain assessment in chronic LBP because of its easy application. In addition, in pain assessment, evaluating the pain according to its course during the day and its severity at rest and activity enables faster solutions to be developed by determining the causes of chronic LBP. In the studies conducted and in our study, it was determined that pain was felt most during activity in chronic LBP, while night pain was felt the least (23-25). We think that the reason why night pains are less is the decrease in the load on the bones, joints, ligaments and intervertebral disk in the column vertebralis compared to standing and sitting positions while lying down. When studies conducted to reduce pain and improve function in chronic LBP were examined, it was found that only stretching exercises were not effective on pain compared to other exercise training (26-29). In our study, the exercise program applied with a stretching platform was not found to be superior to the CT program in reducing the level of pain, and it was found that CT and exercises applied with a stretching platform were effective in reducing the pain score in chronic LBP. We think that the exercises performed with the stretching platform cause extra stretching in the calf group muscles, providing relaxation of the lower kinetic chain and relaxation of the lumbar region muscles, that the person feels less pain during the activity, and that our study may contribute to the literature thanks to this effect provided by the stretching platform.

There is a positive correlation between decreased proprioception sense and the loss of balance and function in people with chronic LBP (30). For this reason, the ability of exercise approaches to accelerate the proprioceptive response by improving the sensitivity of the spinocerebellar and dorsal lateral-medial lemniscal pathways is used (31). There is no study in the literature on the effect of stretching exercises on proprioception in people with chronic LBP. In our study, it was found that CT and exercises applied with a stretching platform improved the sense of proprioception in people with chronic LBP. We think that in addition to the stretching effect of the exercises and flexion

exercises performed with the stretching platform on the lumbar region and lower extremity muscles, the forward bending exercises with the eyes closed and the knees semi-flexed on the stretching platform increase the sense of joint position and the sense of joint movement in the joints of the lower extremity and lumbar region. It improves the sense of proprioception.

It is stated in previous studies that pain causes avoidance of movement in people with chronic LBP and therefore negatively affects mobility; therefore, adding different exercise approaches to exercise training programs for people with chronic LBP reduces pain levels as well as contributes to mobility and balance (10,26,32-35). In our study, MST, HFGDM, and TLBM methods were used to evaluate the mobility levels of people with chronic LBP. According to the data we have obtained, results that will contribute to the improvement of the level of mobility have emerged in both groups in MST, HFGDM, and TLBM methods. We think that the reason for this situation is that the exercises applied with the stretching platform and flexion exercises create a stretching effect on the lumbar and lower extremity muscles, and the hot pack application in the lumbar region causes an increase in the mobility of the lumbar region by relaxing the non-contractile tissues.

In people with chronic LBP, pain negatively affects balance and mobility. In general, exercise approaches positively affect balance by increasing the sense of joint position (31). When the studies in the literature are examined, it is seen that stretching exercises contribute the most to the development of balance among exercise approaches. However, we understand that only periods of 30 s or less improve balance, and therefore, the most important factor in the effect of stretching exercises on balance is the duration of stretching (32,35-37). According to the data we obtained in our study, FRT with eyes open and FRT with eyes closed increased in both groups, showing that the balance level of the participants improved. This result shows that forward bending exercises with one foot and eyes closed and the modified straightening exercise, which is one of the flexion exercises, applied with a stretching platform are directly effective in increasing the FRT scores. In addition, it is thought that the stretching effect of the exercises applied with the stretching platform and the stretching exercise applied to the hamstring muscle, which is one of the flexion exercises, on the lumbar region and lower extremity muscles triggers the development of balance by increasing the sense of joint position and joint movement.

In a study examining the functionality level of 225 people with LBP, it was reported that ODI is a reliable scale that evaluates chronic LBP in a multidimensional way (38). In our study, an increase in functionality was achieved in both groups according to ODI scores. This result suggests that exercises applied with a stretching platform are as effective as CT in improving the level of functionality in chronic LBP. We think that the stretching effect of the exercises applied with the stretching platform on the muscles of the lower extremities and lumbar region, as well as the stretching exercise for the hamstring muscle in the flexion exercises and the modified straightening exercise, and the diversification of these exercises by bending forward and sideways, standing on one leg, eyes closed, increased the functionality of the participants. Our study can contribute to the literature in this respect.

In the literature, it is seen that the use of the two scales together in chronic LBP yields more objective findings since the EQ-5D-3L scale is valid and reliable for QoL assessment and has a strong correlation with ODI (39-42). This result suggests that exercises applied on the stretching platform are as effective as CT in improving the QoL of people with chronic LBP. However, in the literature, there is no QoL assessment with the EQ-5D-3L scale for treating chronic LBP. In our study, an increase was observed in the QoL VAS score in both groups. This result suggests that exercises applied on the stretching platform are as effective as CT in improving the QoL of people with chronic LBP.

Study Limitations

The limiting factors of the study were the inability to examine the long-term effects of exercises due to the Coronavirus disease-2019 pandemic and the inability to use objective measurement methods because of existing clinical opportunities.

CONCLUSION

It was concluded that CT and exercises applied with a stretching platform in addition to CT in patients with chronic LBP reduce pain and increase proprioception, mobility, balance, functionality, and QoL. Since there is no consensus on the content of the exercises performed on the stretching platform, the duration of application, and the nature of passive or dynamic stretching, there is a need for studies that objectively evaluate the effectiveness of different types of exercise training using this exercise support and examine the long-term results.

Ethics

Ethics Committee Approval: Ethics committee approval for this study was obtained from the İstanbul Okan University Ethics Committee with decision number (protocol no: 20.10.2021-14, date: 20.10.2021).

Informed Consent: All volunteers participating in the study were given an informed consent form, and their signed consent was obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: G.A., E.A., Concept: C.A.K., G.A., E.A., Design: C.A.K., G.A., Data Collection or Processing: C.A.K., G.A., Analysis or Interpretation: G.A., E.A., Literature Search: C.A.K., G.A., E.A., Writing: C.A.K., G.A., E.A.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study received no financial support.

REFERENCES

1. Hartvigsen J, Hancock MJ, Kongsted A, et al. What low back pain is and why we need to pay attention. Lancet 2018;391:2356-67.
2. Russo M, Deckers K, Eldabe S, et al. Muscle Control and Non-specific Chronic Low Back Pain. Neuromodulation 2018;21:1-9.
3. Bejia I, Younes M, Jamila HB, et al. Prevalence and factors associated to low back pain among hospital staff. Joint Bone Spine 2005;72:254-9.
4. Urits I, Burshtein A, Sharma M, et al. Low Back Pain, a Comprehensive Review: Pathophysiology, Diagnosis, and Treatment. Curr Pain Headache Rep 2019;23:23.
5. Rainville J, Nguyen R, Suri P. Effective Conservative Treatment for Chronic Low Back Pain. Semin Spine Surg 2009;21:257-63.
6. Bredow J, Bloess K, Oppermann J, Boese CK, Löhrer L, Eysel P. Conservative treatment of nonspecific, chronic low back pain: Evidence of the efficacy - a systematic literature review. Orthopade 2016;45:573-8.
7. Hillman SK, Delforge G. The use of physical agents in rehabilitation of athletic injuries. Clin Sports Med 1985;4:431-8.
8. Hayden JA, Ellis J, Ogilvie R, Malmivaara A, van Tulder MW. Exercise therapy for chronic low back pain. Cochrane Database Syst Rev 2021;9:CD009790.
9. Foster NE, Anema JR, Cherkin D, et al. Prevention and treatment of low back pain: evidence, challenges, and promising directions. Lancet 2018;391:2368-83.
10. Shamsi M, Mirzaei M, Shahsavari S, Safari A, Saeb M. Modeling the effect of static stretching and strengthening exercise in lengthened position on balance in low back pain subject with shortened hamstring: a randomized controlled clinical trial. BMC Musculoskelet Disord 2020;21:809.
11. Urbaniak GC, Plous S. Research randomizer. 1997.
12. Myles PS, Troedel S, Boquest M, Reeves M. The pain visual analog scale: is it linear or nonlinear? Anesth Analg 1999;89:1517-20.
13. Hillier S, Immink M, Thewlis D. Assessing Proprioception: A Systematic Review of Possibilities. Neurorehabil Neural Repair 2015;29:933-49.
14. Tousignant M, Poulin L, Marchand S, Viau A, Place C. The Modified-Modified Schober Test for range of motion assessment of lumbar flexion in patients with low back pain: a study of criterion validity, intra- and inter-rater reliability and minimum metrically detectable change. Disabil Rehabil 2005;27:553-9.
15. Yılmaz Ö, Eroğlu Küçük P, Yurdakul FG, et al. Comparing Physical Therapy Accompanying Exercise with Only Exercise Treatments in Patients with Chronic Mechanical Low Back Pain. Turk J Osteoporos 2015;21:73-8.
16. Suh JH, Kim H, Jung GP, Ko JY, Ryu JS. The effect of lumbar stabilization and walking exercises on chronic low back pain: A randomized controlled trial. Medicine (Baltimore) 2019;98:e16173.
17. Duncan PW, Weiner DK, Chandler J, Studenski S. Functional reach: a new clinical measure of balance. J Gerontol 1990;45(6):M192-7.
18. Haksever B, Düzgün İ, Yüce D, Baltacı G. Effects of Balance Board Training on Dynamic, Static Balance and Functionality on Healthy Subjects. Gazi Journal of Health Sciences 2017;2:40-9.
19. Vianin M. Psychometric properties and clinical usefulness of the Oswestry Disability Index. J Chiropr Med 2008;7:161-3.
20. Ravens-Sieberer U, Wille N, Badia X, et al. Feasibility, reliability, and validity of the EQ-5D-Y: results from a multinational study. Qual Life Res 2010;19:887-97.
21. Brady SRE, Urquhart DM, Hussain SM, et al. High baseline fat mass, but not lean tissue mass, is associated with high intensity low back pain and disability in community-based adults. Arthritis Res Ther 2019;21:165.
22. Akyol B, Arslan C, Colak C. The effect of callisthenic exercises on pain threshold, pain severity and muscle strength on sedentary women diagnosed with upper extremity and low back pain. J Turgut Ozal Med Cent 2016;23:29-35.
23. Wettstein M, Eich W, Bieber C, Tesarz J. Pain Intensity, Disability, and Quality of Life in Patients with Chronic Low Back Pain: Does Age Matter? Pain Med 2019;20:464-75.
24. Showalter CR, Rivett DA, Jones MA. Acute exacerbation of chronic low back pain with right-leg numbness in a crop farmer. In Clinical reasoning in musculoskeletal practice. Elsevier 2018;2:504-25.
25. Comachio J, Magalhães MO, Campos Carvalho E Silva APM, Marques AP. A cross-sectional study of associations between kinesiophobia, pain, disability, and quality of life in patients with chronic low back pain. Adv Rheumatol 2018;58:8.
26. Pourahmadi M, Hesarikia H, Keshtkar A, et al. Effectiveness of Slump Stretching on Low Back Pain: A Systematic Review and Meta-analysis. Pain Med 2019;20:378-96.
27. Sherman KJ, Cherkin DC, Wellman RD, et al. A randomized trial comparing yoga, stretching, and a self-care book for chronic low back pain. Arch Intern Med 2011;171:2019-26.
28. Lawand P, Lombardi Júnior I, Jones A, Sardim C, Ribeiro LH, Natour J. Effect of a muscle stretching program using the global postural reeducation method for patients with chronic low back pain: A randomized controlled trial. Joint Bone Spine 2015;82:272-7.
29. França FR, Burke TN, Caffaro RR, Ramos LA, Marques AP. Effects of muscular stretching and segmental stabilization on functional disability

and pain in patients with chronic low back pain: a randomized, controlled trial. J Manipulative Physiol Ther 2012;35:279-85.

30. Clark NC, Röijezon U, Treleaven J. Proprioception in musculoskeletal rehabilitation. Part 2: Clinical assessment and intervention. Man Ther 2015;20:378-87.
31. Ashton-Miller JA, Wojtys EM, Huston LJ, Fry-Welch D. Can proprioception really be improved by exercises? Knee Surg Sports Traumatol Arthrosc 2001;9:128-36.
32. Park KN, Kwon OY, Yi CH, et al. Effects of Motor Control Exercise Vs Muscle Stretching Exercise on Reducing Compensatory Lumbopelvic Motions and Low Back Pain: A Randomized Trial. J Manipulative Physiol Ther 2016;39:576-85.
33. Shamsi M, Shahsavari S, Safari A, Mirzaei M. A randomized clinical trial for the effect of static stretching and strengthening exercise on pelvic tilt angle in LBP patients. J Bodyw Mov Ther 2020;24:15-20.
34. Cini A, de Vasconcelos GS, Lima CS. Acute effect of different time periods of passive static stretching on the hamstring flexibility. J Back Musculoskelet Rehabil 2017;30:241-6.
35. Behm DG, Chaouachi A. A review of the acute effects of static and dynamic stretching on performance. Eur J Appl Physiol 2011;111:2633-51.
36. Costa PB, Grave BS, Whitehurst M, Jacobs PL. The acute effects of different durations of static stretching on dynamic balance performance J Strength Cond Res 2009;23:141-7.
37. Handrakis JP, Southard VN, Abreu JM, et al. Static stretching does not impair performance in active middle-aged adults. J Strength Cond Res 2010;24:825-30.
38. Lee CP, Fu TS, Liu CY, Hung CI. Psychometric evaluation of the Oswestry Disability Index in patients with chronic low back pain: factor and Mokken analyses. Health Qual Life Outcomes 2017;15:192.
39. Pellekooren S, Ben ÂJ, Bosmans JE, et al. Can EQ-5D-3L utility values of low back pain patients be validly predicted by the Oswestry Disability Index for use in cost-effectiveness analyses? Qual Life Res 2022;31:2153-65.
40. Poder TG, Carrier N. Predicting EQ-5D-5L Utility Scores from the Oswestry Disability Index and Roland-Morris Disability Questionnaire for Low Back Pain. J Pain Res 2020;13:623-31.
41. Ye Z, Sun L, Wang Q. A head-to-head comparison of EQ-5D-5 L and SF-6D in Chinese patients with low back pain. Health Qual Life Outcomes 2019;17:57.
42. Obradovic M, Lal A, Liedgens H. Validity and responsiveness of EuroQol-5 dimension (EQ-5D) versus Short Form-6 dimension (SF-6D) questionnaire in chronic pain. Health Qual Life Outcomes 2013;11:110.