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Title: Effects of Physical Therapy on Pain, Functional Status, Sagittal Spinal Alignment, and Spinal Mobility in Chronic Non-specific Low Back Pain

Authors: Meral Bilgilisoy Filiz[1], Sibel Cubukcu Firat[2]

Institutions: [1]Department of Physical Medicine and Rehabilitation, Health Sciences University, Antalya Training and Research Hospital, Antalya, Turkey

[2]Department of Physical Medicine and Rehabilitation, Akdeniz University School of Medicine, Antalya, Turkey

Correspondence to: Meral Bilgilisoy Filiz, mbilgilisoy@gmail.com
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Abstract

Objective: To investigate the effects of physical therapy (PT) on pain, functional status, sagittal spinal alignment, and spinal mobility in chronic non-specific low back pain (NSLBP).

Materials and methods: The study population consisted of 100 patients with chronic NSLBP. The study group comprised 60 patients to whom a PT program including superficial heat, transcutaneous electrical nerve stimulation, and ultrasound for 10 sessions was assigned. The control group was composed of 40 patients who received no PT. Home exercise programs were applied to both groups. Pain severity was determined using a Visual Analog Scale (VAS), and functional status was evaluated using the Oswestry Disability Index (ODI). Spinal sagittal alignment in regard to lumbosacral, lumbar lordosis, and thoracic kyphosis angles and spinal mobility regarding lumbar and thoracic flexion and extension degrees were assessed using a digital inclinometer. Lumbar flexion was also assessed using the modified lumbar Schober test

(mLST). Evaluations were performed at baseline and after completing the therapy sessions.
Results: There were significant decreases in VAS scores in each group upon therapy completion. However, significant improvements in ODI, mLST, and all inclinometric evaluations in terms of sagittal spinal alignment and spinal mobility were noted only in the study group compared with baseline values (P<0.05).
Conclusion: Despite the short course of treatment, PT was found to have significant positive effects on pain severity, functional status, sagittal spinal alignment, and spinal mobility. PT was determined to be an effective treatment option for chronic NSLBP.
Keywords: Physical medicine and rehabilitation, Low back pain, Spinal mobility, Sagittal spinal alignment

Introduction

Low back pain (LBP) is a significant problem affecting the quality of life and is one of the major causes of loss of workforce in developed countries. The prevalence of lifelong LBP ranges between 59% and 80%, depending on the method of study and the population diversity (1). When symptoms of LBP persist for at least 12 weeks, it is defined as chronic LBP (2). In most cases (>80%), no specific disease or anatomic abnormality can be determined to account for the symptoms of LBP; therefore, it is classified as non-specific LBP (NSLBP) (3). Chronic LBP is the most frequent cause of disability and loss of workforce in productive individuals aged <45 years, resulting in a high economic burden to society (4). Accordingly, the aim of treatment in chronic LBP is to alleviate pain, increase mobility, prevent physical and mental disability and labor loss, and improve quality of life and physical function (5). Various treatment programs have been proposed including medical treatment, physical therapy (PT), massage, manipulation, traction, and therapeutic exercises to achieve these goals, alone or often in combination (6). The relationship between back pain and sagittal spinal alignment and mobility has been investigated in many clinical studies, and it was observed that patients with LBP have altered spinal alignment and mobility (7–9). However, there are limited and conflicting data on the effects of PT on sagittal spinal alignment and spinal motion. Therefore, our objective was to determine the effects of PT on pain, functional status, sagittal spinal alignment, and spinal mobility in NSLBP.

Materials and methods

Subjects

A total of 100 patients with NSLBP who were evaluated at the outpatient clinics of the Department of Physical Medicine and Rehabilitation for >3 months, aged between 18 and 65 years, who were able to attend PT for 10 sessions (5 times/week for 2 weeks), and who were willing to adhere to the protocol were included in the study. Patients with an LBP due to neoplasm, inflammation, or infection and who had indications for urgent surgery (cauda equina syndrome or progressive motor deficit), previous history of spinal surgery, current pregnancy or early postpartum period (6 months), and coexisting medical conditions (severe central or foraminal spinal stenosis; osteoporosis and gross structural abnormalities, such as spondylolisthesis or scoliosis, ankylosing spondylitis, spinal fracture, and spinal tumor) were excluded from the study. Written informed consent was obtained from all patients prior to data collection. The rights of the patients were protected in accordance with the ethical standards of the Declaration of Helsinki.

Sixty patients were assigned to the study group and were scheduled for a PT program (PT group). The control group was composed of 40 age- and sex-matched patients and received no PT. The 2-week PT program consisted of ultrasound (US), superficial heating with hot packs, transcutaneous electrical nerve stimulation (TENS) 5 times/week (a total of 10 sessions). Both groups received home-based exercise programs consisting of isometric and isotonic strengthening exercises for the paraspinal and abdominal muscles and stretching exercises for the back extensors, hamstrings, and calf muscles (2). The exercises were demonstrated by a physiotherapist on the first session, and then the patients were provided with written instructions. There were no restrictions against medical treatments that might have been proposed to the patients during the outpatient evaluation. Other cointerventions were not allowed during the treatment period.

PT was performed by two physiotherapists with >5 years of clinical experience. Hot packs were applied to the low back region for 20 min, and continuous US was conducted using a Sonoplus 590 device (Enraf-Nonius; Rotterdam, The Netherlands) operated at 1 MHz frequency and 1.5 W/cm^2 intensity with a 5 cm^2 transducer head. A transmission gel was applied over the paravertebral muscles, and slow, circular movements were made for 6 min. TENS was applied using a 2778 Intelect Mobile Combo device (Chattanooga, TN, USA) for 20 min to the low back area, with a frequency of 110 Hz and an amplitude of 15 mA for 100 ms.

Outcome measures

Patient demographic characteristics, such as age, sex, marital status, educational level, working status, duration of symptoms, and trauma history, were recorded. Each participant underwent a detailed physical examination including reflex, strength, and sensory testing of the lower extremities. Outcome measures were documented at baseline evaluation and repeated after completing PT.

Pain intensity was evaluated using a Visual Analog Scale (VAS; 0 mm: no pain; 100 mm: severe pain).

For determination of disability due to LBP, the Oswestry Disability Index (ODI) was used (10). The ODI is a disease-specific self-administered questionnaire that quantifies the degree of disability and quality of life of patients with LBP. A validated Turkish-language version of the ODI was used in our study (11). It consists of 10 questions related to daily activities and includes the following: experiencing general pain, practicing self-care (e.g., washing and dressing), lifting objects, sitting, standing, walking, sleeping, traveling, engaging in sexual activity if applicable, and participating in social activities. Items are rated on a 6-point scale from 0 to 5, which is then doubled and interpreted as a percentage of the patient-perceived disability; higher scores indicate higher pain-associated disability. ODI is a recommended and widely used outcome measure for LBP as it is able to detect changes in disability over time (12).

Lumbosacral (LSA), lumbar lordosis, and thoracic kyphosis angles were measured using a digital inclinometer (Baseline®; Fabrication Enterprises Inc., White Plains, NY, USA). Participants were asked to stand in a relaxed sagittal spinal alignment with their feet roughly shoulder width apart, hands dangling freely by the side, and head looking forward. The LSA was measured by positioning the inclinometer at L5–S1. The lumbar lordosis and thoracic kyphosis angles were measured at T12–L1 and L5–S1 and C7–T1 and T12–L1, respectively. This technique has been found to be a reliable method for recording lumbar lordosis (13).

Spinal mobility in terms of rough lumbar flexion and extension and rough thoracic flexion and extension measurements were performed using the Baseline digital inclinometer in accordance with the method described in the American Medical Association (AMA) guidelines (14).

Rough lumbar flexion (RLF): First, the inclinometer was placed at the T12–L1 point while the patient was in a neutral upright position without shoes and standing as described earlier. The inclinometer was zeroed at this position. Then, the patient was asked to bend forward as much as

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possible without bending the knees. The inclinometer was positioned at the same point, and the recorded value was noted as the RLF angle.

Rough thoracic flexion (RTF): The inclinometer was placed and zeroed at the C7–T1 point when the patient was in the upright position. The value measured at the same point in the maximum flexion position was determined as the RTF angle.

Rough lumbar extension (RLE): The inclinometer was zeroed at the T12–L1 point in the initial position. The patient was requested to extend maximally. The RLE angle was determined at the same point.

Rough thoracic extension (RTE): The inclinometer was zeroed at the C7–T1 point when the patient was in the upright position. The value measured at the same point in the maximal extension position was determined as the RTE angle.

Lumbar flexion range of motion (ROM) was also determined using the modified lumbar Schober test (mLST), which has been shown to be a valid and reliable method (15). The patients were asked to remain in a neutral upright position without shoes and to stand with feet at hip width; 5 cm below and 10 cm above the lumbosacral junction (total distance of 15 cm) was marked. The patients were then asked to bend forward maximally without bending the knees. The distance between the marks was remeasured, and the increase was the measure of flexion. All measurements were made at baseline and repeated upon completion of the PT treatment.

Statistical analysis

Statistical analyses were performed using the SPSS version 11.5 software (SPSS Inc., Chicago, IL, USA). Continuous variables were defined as mean±standard deviation for parametric tests and median and range (minimum–maximum) for non-parametric tests. The chi-square test was used for comparison of categorical variables. The Shapiro–Wilk test was used to test for normality in the analysis of the differences between the values of the two groups. The Student's t-test was used for parameters showing normal distribution, and the Mann–Whitney U test was used for those with non-normal distribution. A significance level of 5% ($P<0.05$) was used for all tests.

Results

One hundred patients (PT group, n=60 and control group, n=40) with a mean age of 52.4±13.7 years were included in the study. No patients had any treatment adherence issues, and there was no exitus during the study period. Eighty-two percent of the participants were female, and the mean symptom duration was 8.6±9.7 years. Table 1 shows the patients' complete demographic and clinical features. There were no statistically significant differences between the groups in terms of age, sex, body mass index, symptom duration, or working status (P>0.05) (Table 1). ODI, VAS, mLST, and inclinometric evaluation parameters, except LSA, lumbar lordosis, and RLE, were similar between the groups at baseline (P>0.05). LSA and lumbar lordosis angle were significantly higher (27.48±7.66 vs 22.6±9.22, P=0.05 for LSA and 35.05±10.82 vs 29.62±9.73, P=0.02 for lumbar lordosis), and RLE was significantly lower (20.68±6.85 vs 25.85±9.36, P=0.004) in the PT group at baseline than in the control group (Tables 2–3).

After completing the PT sessions, VAS scores were significantly decreased in both groups (P=0.001 in the PT group and P=0.037 in the control group) (Table 2). However, significant improvements in ODI and mLST were observed in the PT group only (P=0.001 for ODI and P=0.026 for mLST in the PT group; P>0.05 for both variables in the control group) (Table 2). Moreover, there were significant improvements in all inclinometric assessments (LSA, lumbar lordosis, and thoracic kyphosis, RLF, RTF, RLE, and RTE) in the PT group (P=0.011, 0.021, 0.001, 0.001, 0.001, 0.001, and 0.001, respectively); these assessments remained statistically unchanged in the control group (P>0.05) (Table 3).

Discussion

Our results show that PT effectively reduced pain, disability, and postural aberrations and increased spinal mobility. Pain was also significantly reduced in the control group; however, no significant differences were observed among the controls regarding disability, sagittal spinal alignment, and spinal mobility.

Posture is defined as the relative order of the body parts (16). Cervical lordosis, thoracic kyphosis, and lumbar lordosis are the major components of the physiological curvatures of the spine in the sagittal plane. Aberrations in these curvatures may lead to deviations from the ideal posture. Incorrect posture leads to excessive load on the joints and inadequate tension in the soft tissues, resulting in pain and functional loss (17). Therefore, in the clinical evaluation of patients with LBP, sagittal spinal alignment is considered as an essential part of the physical examination. However, there is no consensus on the methods of examination of posture changes, and there is also a wide range of conclusions regarding problems identified in patients with LBP. The evaluation of sagittal spinal alignment and spinal movements is more complicated than that of peripheral joints, and various measurement methods have been developed. Evaluations based on direct radiographs are accepted as the gold standard, but owing to disadvantages, such as radiation exposure and time requirement, external measurement methods are generally preferred in everyday practice (13, 18). In the present study, a digital inclinometer, which is a cost-effective, non-invasive and reliable method recommended by the AMA, was preferred for the measurement of sagittal spinal alignment and spinal mobility (7, 13).

Different PT modalities have been shown to be effective at achieving the goals of treatment in chronic NSLBP (5). Thermal stimulus generated by hot packs decreases muscle tone and spasm by increasing the elasticity of the collagenous tissue and decreasing the activity of muscle spindles (19, 20). Analgesic currents, such as TENS, are commonly used for pain inhibition in NSLBP because they inhibit afferent sensory neurons at the dorsal horn of the spinal cord and close the pain gate, leading to pain relief (21).

The efficacy of US, a deep heating modality that reduces muscle spasm and increases connective tissue elasticity, has been shown to be efficacious in LBP treatment (5, 22). In the present study, patients in the study group underwent 10 sessions of a PT program consisting of superficial heating (hot pack), analgesic current (TENS), and deep heating (US). Upon completion of the PT sessions, significant improvements were recorded in the sagittal spinal alignment in terms of LSA, lumbar lordosis, and thoracic kyphosis. It was also observed that the treatment applied only to the lumbar paravertebral region positively affected the thoracic spine. Although no studies, to our knowledge, have investigated the direct effects of PT on sagittal spinal alignment, it is assumed that positive influences on sagittal spinal alignment can be attributed to the positive effects of PT on pain and muscle tone.

In patients with LBP, shortness and weakness may occur in the soft tissues because they are not used within the ultimate limits of the muscles and ligaments. This may result in decreased flexibility and limitation of the functional ROM of the spine, resulting in increased disability (23). For these reasons, one of the goals of treatment is to increase mobility. Improvement in pain and disability by PT in LBP has been shown in previous studies (5, 20, 21, 24); however, there are limited data about its effects on spinal mobility. Although a few studies have investigated the effects of PT on spinal mobility, it may be considered that there will also be a positive influence on mobility, as well as pain and disability, by improving pain and functional status and enhancing soft tissue elasticity. In the study by Koldaş Doğan et al. (5), 60 patients were randomized into one of three treatment groups, and the effects of the treatments on pain, spinal mobility, disability, psychological status, and aerobic capacity were investigated. The first group received aerobic exercises and a home exercise program, the second group received PT and a home exercise program, and the third group received a home exercise program only. At the end of the study, there was a significant decrease in pain levels in all groups, whereas there were significant decreases in psychological status and disability only in the second group treated with PT. However, the authors found no significant difference in spinal mobility in any of the groups (5). In another study, 118 patients with radicular back pain were randomized to supine or prone mechanical traction therapy in addition to PT including TENS, hot pack, and US, or only PT. The patients were evaluated in terms of pain, disability, and spinal mobility, and it was found that patients in all three groups had significantly improved in all outcome parameters including spinal mobility after completing treatment, with superiority for the prone traction group (24). Doğan et al. (25) investigated the effects of PT and additional balneotherapy on pain, disability, and spinal mobility in 60 patients with chronic LBP. Spinal mobility was evaluated using LST and lateral flexion measurements. At the end of the study, although there were significant improvements in all parameters in both groups, improvements in the group treated with balneotherapy were significantly better. In the present study, significant reductions in pain and disability levels and significant improvements in sagittal spinal alignment and spinal mobility were achieved by PT. There was also a significant improvement in pain levels in the control group. It is established that NSLBP symptoms can resolve spontaneously with time. Furthermore, home-based exercises and medical treatments that might be recommended to patients during outpatient clinic evaluations may have contributed to pain reduction. However, in the case of disability, sagittal spinal alignment, and spinal mobility, which are important treatment goals, significant improvements were achieved only in the PT group. Despite the short course of treatment, the results of the present study confirm the beneficial effects of PT on soft tissue elasticity.

Our study has several limitations owing to its non-randomized nature. First, no placebo was applied to the control group. To be able to draw firm conclusions about the efficacy of PT, a placebo-controlled trial should be designed. However, sham or placebo applications are not always possible owing to the nature of most PT modalities. Second, the short follow-up period limits our results to the short term only. Finally, the medications that might have been prescribed to the patients, their period of use and at which doses, and the adherence of the patients to the exercise schedule were not recorded. Therefore, the possible contribution of the medications and exercises on the outcome parameters could not be estimated.

In conclusion, despite certain limitations and short treatment duration, the results of the present study revealed that PT had significant effects on pain, sagittal spinal alignment, disability, and spinal mobility in patients with chronic NSLBP. Further randomized controlled long-term studies are needed to confirm these results.

References:

1. Gilgil E, Kacar C, Butun B, et al. Prevalence of low back pain in a developing urban setting. Spine. 2005 May 1;30(9):1093-8. PubMed PMID: 15864165.
2. Magalhaes MO, Muzi LH, Comachio J, et al. The short-term effects of graded activity versus physiotherapy in patients with chronic low back pain: A randomized controlled trial. Manual therapy. 2015 Aug;20(4):603-9. PubMed PMID: 25749499.
3. Dewitte V, De Pauw R, De Meulemeester K, et al. Clinical classification criteria for nonspecific low back pain: A Delphi-survey of clinical experts. Musculoskeletal science & practice. 2018 Jan 8;34:66-76. PubMed PMID: 29367122.
4. Manek NJ, MacGregor AJ. Epidemiology of back disorders: prevalence, risk factors, and prognosis. Current opinion in rheumatology. 2005 Mar;17(2):134-40. PubMed PMID: 15711224.
5. Koldas Dogan S, Sonel Tur B, Kurtais Y, Atay MB. Comparison of three different approaches in the treatment of chronic low back pain. Clinical rheumatology. 2008 Jul;27(7):873-81. PubMed PMID: 18188660.
6. van Middelkoop M, Rubinstein SM, Kuijpers T, et al. A systematic review on the effectiveness of physical and rehabilitation interventions for chronic non-specific low back pain. European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society. 2011 Jan;20(1):19-39. PubMed PMID: 20640863. Pubmed Central PMCID: 3036018.
7. Ng JK, Richardson CA, Kippers V, Parnianpour M. Comparison of lumbar range of movement and lumbar lordosis in back pain patients and matched controls. Journal of rehabilitation medicine. 2002 May;34(3):109-13. PubMed PMID: 12395937.
8. Tuzun C, Yorulmaz I, Cindas A, Vatan S. Low back pain and posture. Clinical rheumatology. 1999;18(4):308-12. PubMed PMID: 10468171.
9. Sorensen CJ, Norton BJ, Callaghan JP, Hwang CT, Van Dillen LR. Is lumbar lordosis related to low back pain development during prolonged standing? Manual therapy. 2015 Aug;20(4):553-7. PubMed PMID: 25637464. Pubmed Central PMCID: 4469524.
10. Fairbank JC, Pynsent PB. The Oswestry Disability Index. Spine. 2000 Nov 15;25(22):2940-52; discussion 52. PubMed PMID: 11074683.

11. Yakut E, Duger T, Oksuz C, et al. Validation of the Turkish version of the Oswestry Disability Index for patients with low back pain. Spine. 2004 Mar 1;29(5):581-5; discussion 5. PubMed PMID: 15129077.
12. Frost H, Lamb SE, Stewart-Brown S. Responsiveness of a patient specific outcome measure compared with the Oswestry Disability Index v2.1 and Roland and Morris Disability Questionnaire for patients with subacute and chronic low back pain. Spine. 2008 Oct 15;33(22):2450-7; discussion 8. PubMed PMID: 18824951.
13. Ng JK, Kippers V, Richardson CA, Parnianpour M. Range of motion and lordosis of the lumbar spine: reliability of measurement and normative values. Spine. 2001 Jan 1;26(1):53-60. PubMed PMID: 11148646.
14. American Medical Association. Guidelines to the Evaluation of Permanent Impairment. Chicago, IL1993
15. Robinson HS, Mengshoel AM. Assessments of lumbar flexion range of motion: intertester reliability and concurrent validity of 2 commonly used clinical tests. Spine. 2014 Feb 15;39(4):E270-5. PubMed PMID: 24253798.
16. Czaprowski D, Stolinski L, Tyrakowski M, Kozinoga M, Kotwicki T. Non-structural misalignments of body posture in the sagittal plane. Scoliosis and spinal disorders. 2018;13:6. PubMed PMID: 29516039. Pubmed Central PMCID: 5836359.
17. Christie HJ, Kumar S, Warren SA. Postural aberrations in low back pain. Archives of physical medicine and rehabilitation. 1995 Mar;76(3):218-24. PubMed PMID: 7717811.
18. Hsu CJ, Chang YW, Chou WY, Chiou CP, Chang WN, Wong CY. Measurement of spinal range of motion in healthy individuals using an electromagnetic tracking device. Journal of neurosurgery Spine. 2008 Feb;8(2):135-42. PubMed PMID: 18248285.
19. Patel S, Friede T, Froud R, Evans DW, Underwood M. Systematic review of randomized controlled trials of clinical prediction rules for physical therapy in low back pain. Spine. 2013 Apr 20;38(9):762-9. PubMed PMID: 23132535.
20. Ansari NN, Naghdi S, Naseri N, et al. Effect of therapeutic infra-red in patients with non-specific low back pain: a pilot study. Journal of bodywork and movement therapies. 2014 Jan;18(1):75-81. PubMed PMID: 24411153.
21. Jauregui JJ, Cherian JJ, Gwam CU, et al. A Meta-Analysis of Transcutaneous Electrical Nerve Stimulation for Chronic Low Back Pain. Surgical technology international. 2016 Apr;28:296-302. PubMed PMID: 27042787.
22. Poitras S, Brosseau L. Evidence-informed management of chronic low back pain with transcutaneous electrical nerve stimulation, interferential current, electrical muscle stimulation, ultrasound, and thermotherapy. The spine journal : official journal of the North American Spine Society. 2008 Jan-Feb;8(1):226-33. PubMed PMID: 18164470.
23. Malliou P, Gioftsidou A, Beneka A, Godolias G. Measurements and evaluations in low back pain patients. Scandinavian journal of medicine & science in sports. 2006 Aug;16(4):219-30. PubMed PMID: 16895526.
24. Bilgilisoy Filiz M, Kilic Z, Uckun A, Cakir T, Koldas Dogan S, Toraman NF. Mechanical Traction for Lumbar Radicular Pain: Supine or Prone? A Randomized Controlled Trial. American journal of physical medicine & rehabilitation. 2018 Jan 5. PubMed PMID: 29309314.
25. Dogan M, Sahin O, Elden H, Hayta E, Kaptanoglu E. Additional therapeutic effect of balneotherapy in low back pain. Southern medical journal. 2011 Aug;104(8):574-8. PubMed PMID: 21886066.

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Table 1. Demographic characteristics of the patients.

	PT group (n=60)	Control group (n=40)	P
Age (year)	54.3±12.9	49.9±13.1	0.074
Sex, n (female/male)	51/9	31/9	0.587
BMI (kg/m^2)	29.5±4.2	28.8±5.2	0.637
Symptom duration (months)	19.7±23.6	14.5±18.7	0.531
Working status, n (%)			
Employed	6 (10)	9 (22.5)	0.132
Retired	14 (23.3)	5 (12.5)	
Housewife	40 (66.7)	25 (62.5)	

PT, physical therapy; BMI, body mass index.

Table 2. Comparison of VAS, ODI, and mLST values of PT and control groups at the beginning and end of the study.

		PT group (n=60)	Control group (n=40)	P
VAS	First assessment	6.53±2.03	6.16±2.05	0.286
	Second assessment	4.85±1.89	5.40±2.91	0.296
	First–second assessment P	**0.001**	**0.037**	
ODI	First assessment	41.46±20.68	32.77±18.45	0.055
	Second assessment	33.57±18.71	29.99±17.71	0.340
	First–second assessment P	**0.001**	0.196	
mLST	First assessment	14.24±2.19	14.01±1.38	0.070
	Second assessment	14.63±1.20	14.03±1.18	**0.011**
	First–second assessment P	**0.026**	**0**.842	

PT, physical therapy; ODI, Oswestry Disability Index; VAS, Visual Analog Scale; mLST, modified lumbar Schober test.

Table 3. Comparison of inclinometric assessments of PT and control groups at the beginning and end

of the study.

		PT group (n=60)	Control group (n=40)	P
Lumbosacral angle	First assessment	27.48±7.66	22.6±9.22	**0.05**
	Second assessment	26.11±7.44	21.0±9.13	**0.003**
	First–second assessment P	**0.011**	0.49	
Lumbar lordosis	First assessment	35.05±10.82	29.62±9.73	**0.02**
	Second assessment	33.91±8.33	30.72±10.10	0.089
	First–second assessment P	**0.021**	0.088	
Thoracic kyphosis	First assessment	44.91±7.68	44.75±6.83	0.092
	Second assessment	42.61±15.45	44.02±10.93	**0.019**
	First–second assessment P	**0.001**	0.387	
Rough lumbar flexion	First assessment	88.98±20.38	95.82±27.75	0.660
	Second assessment	96.71±19.77	96.50±24.75	0.785
	First–second assessment P	**0.001**	0.839	
Rough thoracic flexion	First assessment	112.16±25.59	114.50±24.41	0.163
	Second assessment	117.65±17.06	111.87±28.55	0.569
	First–second assessment P	**0.001**	0.319	
Rough lumbar extension	First assessment	20.68±6.85	25.85±9.36	**0.004**
	Second assessment	27.55±8.86	27.92±8.54	0.083
	First–second assessment P	**0.001**	0.142	
Rough thoracic	First assessment	36.80±12.86	40.52±12.60	0.132
	Second assessment	48.31±13.97	38.80±12.24	**0.001**

extension	First–second assessment P	**0.001**	0.367

PT, physical therapy.