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The Impact of Manual Therapy on Pain and Disability among Individuals with Chronic Mechanical Low Back Pain

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Abstract
Aim: The present study investigates the impact of routine therapy on the pain and disability of individuals with chronic mechanical low back pain referring to Rasha Rehabilitation Clinic in Tehran.
Methods: This randomized clinical trial was conducted on 78 individuals referring to Rasha Rehabilitation Clinic in Tehran. Patients were divided into two groups: manual therapy and control. Visual analog scale (VAS) and Oswestry disability questionnaire were used before the intervention, after the intervention, and during the follow-up stages. Data were analyzed in SPSS-26 software.
Results: The results revealed that the mean scores of pain ($P<0.05$, $F=6.273$) and disability ($P<0.05$, $F=5.535$) decreased in the manual therapy group in the post-test and follow-up stages compared to the pre-test stage in both experimental and control groups.
Conclusion: Based on the results of the present study, manual therapy can reduce the pain and disability of individuals with chronic mechanical low back pain.

Keywords: Manual therapy, Pain, disability, Mechanical low back pain, Chronic back pain

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Introduction

Low back pain is one of the most common and costly musculoskeletal pain syndromes [1]. It affects about 75% of individuals in society at some stage of their lives [2] so individuals suffer from low back pain at least once in their lifetime [3]. Its causes are incorrect physical posture during tasks such as sitting and standing, lifting heavy objects [4], high weight [5], sedentary lifestyle in leisure time, high physical activity during work [6], history of smoking [7], changes in muscle activity, postural coordination [8], and psychological factors [9]. It reduces performance and limits activities, including daily tasks, recreational activities, and social participation [10, 11]. In this regard, mechanical low back pain accounts for 90% of LBP, which leads to non-specific back pain (such as cancer, infection, Cauda equina syndrome, spinal stenosis, radiculopathy, and vertebral compression fracture or ankylosing spondylitis) [2]. Additionally, mechanical low back pain refers to the pain caused by the spine, intervertebral discs, or soft tissues around it, and frequent trauma and overuse of a lumbar region are common causes of chronic mechanical low back pain [12]. A longitudinal study revealed that chronic back pain first appears acutely or gradually due to various factors, and if not treated at this stage, it will become chronic pain [13].

Treatments used for patients with mechanical low back pain include the use of pharmacology (acetaminophen[14,12], [14], non-steroidal anti-inflammatory drugs, [12], anticonvulsants [15], opioids, skeletal muscle relaxants [16], [12], topical anesthetics, oral corticosteroids[12], antidepressants[17]), physical treatments ([18], McKenzie method, osteopathic manipulative treatment[19], acupuncture and dry needling [20,21], massage[22]), surgery[12], psychological treatments and other methods (Cognitive behavior therapy (CBT)[23], transcutaneous electrical nerve stimulation [24], [25], Yoga, multidisciplinary rehabilitation[26], and patient education[27]). Despite the benefits of drugs used for mechanical low back pain, the use of these drugs is associated with some limitations. For example, a review study showed that anticonvulsants are ineffective for chronic low back pain patients [28]. The impact of opioids is short-term [15]. Although antidepressants reduce back pain in patients, this reduction is not clinically significant [17]. Moreover, acetaminophen, antidepressants (except duloxetine [Cymbalta]), lidocaine patches, and transcutaneous electrical nerve stimulation are not consistently more effective than placebo in the treatment of chronic low back pain [12, 16, 29, 30, 31, and 32]. Due to the risk associated with these approaches and the lack of sufficient studies, more conservative interventions such as manual therapy are mostly prescribed [33].

Manual therapy is among maneuvers or movement techniques. The usual process of therapy is as follows: moving joints in specific directions and at different speeds to regain movement (mobilization and manipulation), muscle stretching, passive movements, or applying resistance to the movement of a part of the patient's body to improve muscle activity, flexibility, and reduce pain [34]. Studies that have examined the impact of manual therapy on chronic mechanical low back pain have provided conflicting results. Cook et al. [35] indicated that manual therapy significantly affects the treatment of mechanical pain. Lim et al [36] also obtained the same results. However, in a study that investigated the impact of three manual therapy techniques (manual pressure release (MPR), strain counterstrain (SCS), and integrated neuromuscular inhibition technique (INIT)) on LBP, results showed that none of the manual therapy techniques are superior to other techniques [37].

In a systematic review study, Namnaqani et al. [38] compared the McKenzie method and manual therapy for the treatment of chronic back pain. They showed that all studies had confirmed the effectiveness of both methods in the short term. However, in 6 months, the McKenzie treatment performed better than the manual therapy. Generally, many studies have examined the impact of regular therapy on chronic back pain. However, these studies have reported conflicting results [35, 36, 37, and 38]. Hence, the present study investigates the impact of routine therapy on reducing the pain of individuals with chronic mechanical low back pain.

Methods

The statistical population of the study included all individuals with chronic mechanical low back pain referring to Rasha's specialized rehabilitation clinic in Tehran. In the present study, a sample of 78 individuals with chronic mechanical low back pain was selected and randomly allocated to 2 groups. In this regard, 38 individuals were included in the manual therapy group and the control group included 40 individuals with chronic mechanical low back pain sufferers who were given a back pain educational pamphlet. The inclusion criteria of the study included men and women aged 25 to 55, pain in the lower back for at least 6 months, diagnosis by an orthopedic physician, suffering from chronic mechanical low back pain, and not receiving regular therapy before. Exclusion criteria included: a history of spine surgery, drug addiction, and use of sedatives, unwillingness to participate in the study, and pregnancy for women. Visual Analogue Score (VAS) was used in this study to collect data. It is one of the most widely used pain measurement tools in the world. In addition to its validity and reliability, the most important feature of this tool is its ease of use [39].

Visual analog scale (VAS) is scored on a 10 cm scale. Its left side (zero) indicates no pain and the right side (10) indicates the most severe pain. A score of 1-3 indicates mild pain, a score of 4-7 indicates moderate pain and a score of 8-10 indicates severe pain. Oswestry disability questionnaire was also used in this study to collect data. It includes 10 sections with 6 options that assess how individuals perform in daily activities such as sitting, standing, and walking. Each section ranks the level of disability from 0 (optimal performance without feeling pain to 10 (inability to perform activities due to severe pain). The first option (zero) and other options receive a score of 2. In total, the score of each section is 10 and the total disability index is valued between 0 and 100 and expressed as a percentage. The patient self-reports the quality of his performance by completing this questionnaire. The validity of this questionnaire has been reported at an acceptable level in a study conducted by Fairbank & Pynsent [40], and Mousavi et al. [41].

Before allocating the subjects to the groups, the visual analog scale (VAS) and Oswestry disability questionnaire were presented to the subjects, and the patients who received the highest score in this questionnaire were included in the study. Based on the study by Lehtola et al. [42], the sample size included 78 individuals (40 individuals for 2 groups) and due to the possibility of dropout in the samples, 90 individuals were selected based on purposeful sampling. Among these individuals, 82 individuals met the inclusion criteria and were randomly allocated to the experimental and control groups. In the follow-up stage, 1 person from the control group and 3 individuals from the experimental group were excluded from the study. Finally, 40 individuals remained in the control group and 38 individuals in the experimental group. Before presenting the intervention, the questionnaire was completed by the patients. Then, the patients of the manual therapy intervention group received two 1-hour manual therapy sessions every week for 6 weeks. Patients in the control group were also given an educational pamphlet about mechanical low back pain [43]. At the end of the sixth week, VAS and Oswestry disability questionnaires were given to the patients in the manual therapy group and the control group. Like the pretest, these questionnaires were given to the patients again after 2 months.

Manual therapyaThe strain counterstrain (SCS) intervention involved the therapist instructing participants to rate the tenderness of their myofascial trigger point (MTrP) on a verbal scale, in which '0' indicates no tenderness after localization. Then, increasing pressure was applied to the MTrP until it produced a sensation of pressure and pain. At this point, the therapist identified the position of ease. It was defined as the point where pain was reduced by at least 70%. The muscle was often positioned in a shortened or relaxed position to achieve it. The therapist used the patient's perceived tissue tension and reported tissue tenderness to guide them to the appropriate relieving position before slowly and passively returning the muscle to a neutral position. This position was maintained for 90 seconds, and the same maneuver was repeated three to five times per treatment session, with a 30-second rest interval [37, 44].

Data analysis method

In this study, statistical methods of mean, standard deviations, graphs, and tables were used for descriptive data, and Multivariate Repeated Measure Analysis of Variance was used for inferential statistics.

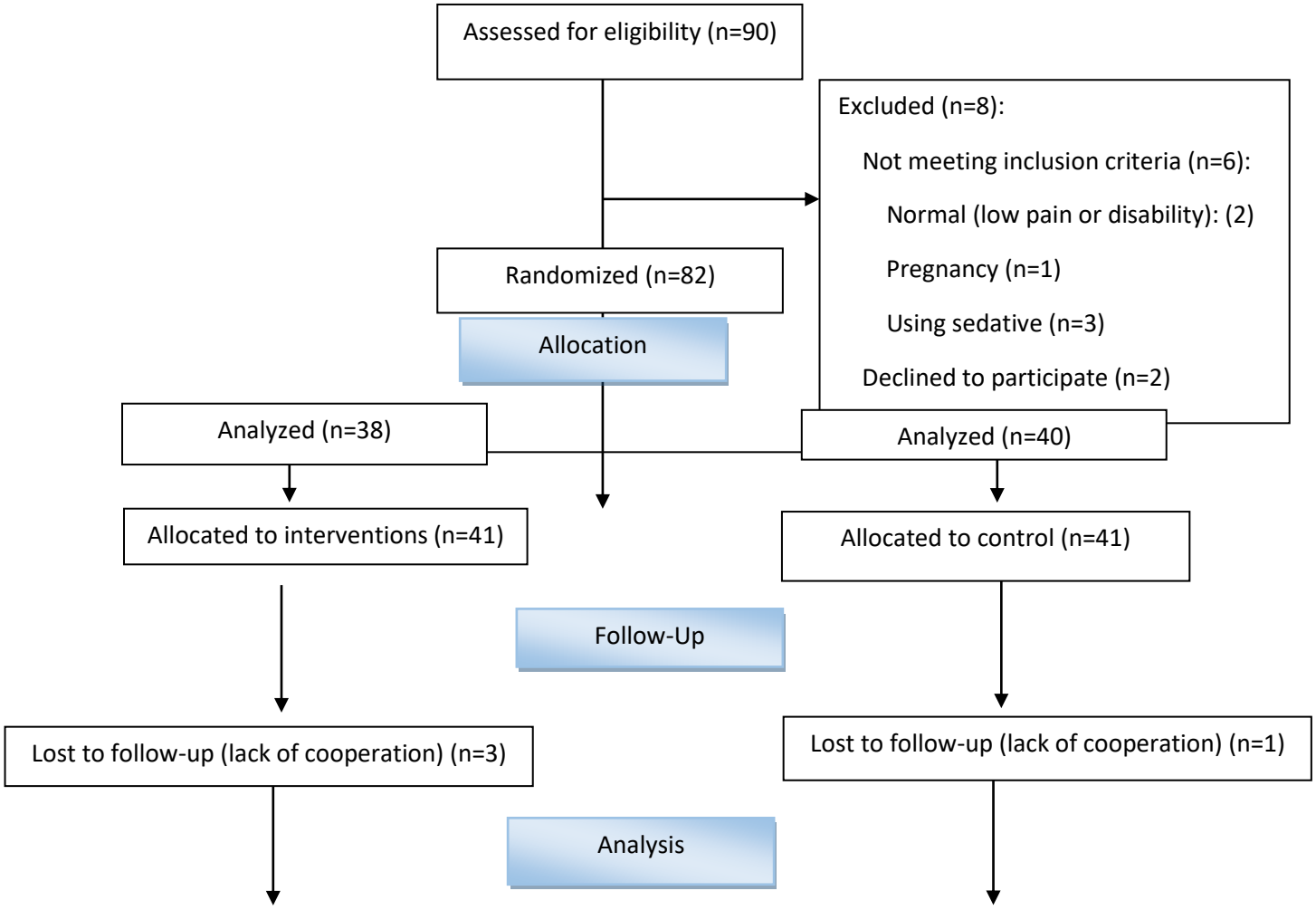

Diagram 1: Random allocation of samples in two experimental and control groups

Results

The results revealed that the two experimental and control groups were homogeneous in terms of demographic variables such as age, sex, marital status, education, and employment status. Its details are summarized in Table 1.

Table 1: Demographic and medical information of the patient (chi-square tests)

variable	levels	group		Chi-Square	p
		control	experimental		
age	26-35	14	17	1.578	0.454
	36-45	17	11		
	46-55	9	10		
sex	Female	20	22	0.489	0.48
	male	20	16		
Marital status	married	24	25	0.280	0.597
	single	16	13		
Employment status	employed	25	18	1.804	0.17
	unemployed	15	20		
education	Diploma	12	17	1.912	0.59

	B.S	18	14		
	M.S	9	6		
	Ph.D.	1	1		

The mean and standard deviation of pain during the pretest, posttest, and follow-up stages were 6.1 (2.03), 3.94 (1.78), 4.52 (2.901), respectively, in the experimental group, and 5.9 (2.09), 5.72 (2.09), 5.97 (2.57), respectively, in the control group. The mean and standard deviation of disability during the pretest, posttest, and follow-up stages were 53 (10.02), 42.84 (8.52), and 45.71 (14.109) respectively, in the experimental group and 52.35 (10.63), 51.7 (10.88), and 52.45 (12.91), respectively, in the control group. A summary of them is present in Table 2. As shown in Table 3, the existing correlation between the studied variables is homogeneous since observed F related to this test is not statistically significant at the p<.050 level. Therefore, the assumption of homogeneity of the covariance matrix has been fulfilled.

Table 4 shows that the error variance is homogeneous in the studied groups since the observed F related to this test is not statistically significant at the p<0.05 level in the studied variables. Therefore, the assumption of homogeneity of error variance has also been fulfilled. Based on Table 5, the assumption of equality of covariances has been fulfilled (P>0.05). Since the primary assumptions of the repeated measure variance analysis (Box's M, Levene, and Mauchly's test of sphericity) have been fulfilled, to analyze the data related to this study and answer the hypothesis, the Sphericity test was used. Its results are shown in Table 6. Based on the results of multiple repeated analysis of variance of pain scores (Table 6), the impact of time (P<0.05, F=7.769) and the interaction impact of groups and time are significant (P<0.05, F=6.273). These results indicate that pain scores change at different levels of pretest, posttest, and follow-up times.

Moreover, the results of disability scores indicated that the impact of time (P<0.05, F=6.723) and the interaction impact of groups and time were significant (P<0.05, F=5.535). These results indicate that disability scores change at different levels of pretest, posttest, and follow-up times. To identify these changes, the LSD test was used. Its results are summarized in Table 7 and Diagrams 2 and 3. They indicate a significant difference between pretest, posttest, and follow-up stages regarding pain and disability scores (P<0.05). However, no significant difference was observed between posttest and follow-up stages in pain and disability. The results also indicate that the manual therapy significantly reduced pain and disability in the experimental group compared to the control group (P<0.05), as shown in Table 8. To identify these changes, the LSD test was used, which is summarized in Table 9 and Diagrams 4 and 5. Also, the interaction impact of group and time revealed that the manual therapy can significantly reduce pain and disability scores in the experimental group compared to the control group in the posttest and follow-up stages compared to the pretest stage (F=6.273, P<0.05), (F=5.535, P<0.05). Its details are shown in Figures 6 and 7.

Table2: Descriptive Statics

	group	Mean	Std. Deviation	N
Pretest pain	control group	5.9000	2.09762	40
	experimental group	6.1053	2.03735	38
	Total	6.0000	2.05761	78
Posttest pain	control group	5.7250	2.09991	40
	experimental group	3.9474	1.78503	38
	Total	4.8590	2.13642	78
Fallow-up pain	control group	5.9750	2.57689	40
	experimental group	4.5263	2.90141	38
	Total	5.2692	2.81772	78
Pretest disability	control group	52.3500	10.63509	40
	experimental group	53.0000	10.02699	38
	Total	52.6667	10.28132	78
Posttest disability	control group	51.7000	10.88212	40
	experimental group	42.8421	8.52509	38
	Total	47.3846	10.71257	78
Follow-up disability	control group	52.4500	12.91382	40
	experimental group	45.7105	14.10943	38
	Total	49.1667	13.84273	78

Table 3: The results of Box's M test

Box's M	F	df1	df2	sig
33.668	1.468	21	21121.804	0.077

Table4: Levene's Test of Equality of Error Variances

		Levene Statistic	df1	df2	Sig.
Pretest pain	Based on Mean	.063	1	76	.802
Posttest pain	Based on Mean	2.827	1	76	.097
Follow-up pain	Based on Mean	2.56	1	76	.114
Pretest disability	Based on Mean	.322	1	76	.572
Posttest disability	Based on Mean	3.736	1	76	.057
Follow-up disability	Based on Mean	1.69	1	76	.198

Table5: Mauchly's Test of Sphericity

Within Subjects Impact	Measure	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon		
						Greenhouse-Geisser	Huynh-Feldt	Lower-bound
time	pain	.941	4.573	2	.102	.944	.980	.500
	disability	.952	3.653	2	.161	.955	.991	.500

Table6: Tests of Within-Subjects Impacts

Source	measure	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta squared
time	Pain	54.508	2	27.254	7.76	.001	.093
	disability	1179.573	2	589.786	6.723	.002	.081
time * group	Pain	44.013	2	22.006	6.273	.002	.076
	disability	971.060	2	485.530	5.535	.005	.068
Error(time)	Pain	533.210	152	3.508			
	disability	13333.804	152	87.722			

Table7: Pairwise Comparisons

Measure	(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
pain	Pretest	Posttest	1.166*	.269	.000	.631	1.702
		Follow-up	.752*	.332	.026	.091	1.413
	Posttest	Pretest	-1.166*	.269	.000	-1.702	-.631
		Follow-up	-.414	.296	.165	-1.004	.175
	Follow-up	Pretest	-.752*	.332	.026	-1.413	-.091
		Posttest	.414	.296	.165	-.175	1.004
disability	Pretest	Posttest	5.404*	1.366	.000	2.684	8.124
		Follow-up	3.595*	1.645	.032	.318	6.871
	Posttest	Pretest	-5.404*	1.366	.000	-8.124	-2.684

		Follow-up	-1.809	1.477	.224	-4.751	1.133
	Follow-up	Pretest	-3.595*	1.645	.032	-6.871	-.318
		Posttest	1.809	1.477	.224	-1.133	4.751

*The mean difference is significant at the .05 level.

Table 8: Tests of Between-Subjects Impacts

Source	Measure	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	pain	6726.225	1	6726.225	783.693	.000	.912
	disability	577050.274	1	577050.274	2745.370	.000	.973
group	pain	59.285	1	59.285	6.907	.010	.083
	disability	1451.300	1	1451.300	6.905	.010	.083
Error	pain	652.288	76	8.583			
	disability	15974.465	76	210.190			

Table9: Pairwise Comparisons

Measure	(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
pain	control group	experimental group	1.007*	.383	.010	.244	1.770
	experimental group	control group	-1.007*	.383	.010	-1.770	-.244
disability	control group	experimental group	4.982*	1.896	.010	1.206	8.759
	experimental group	control group	-4.982*	1.896	.010	-8.759	-1.206

*The mean difference is significant at the .05 level.

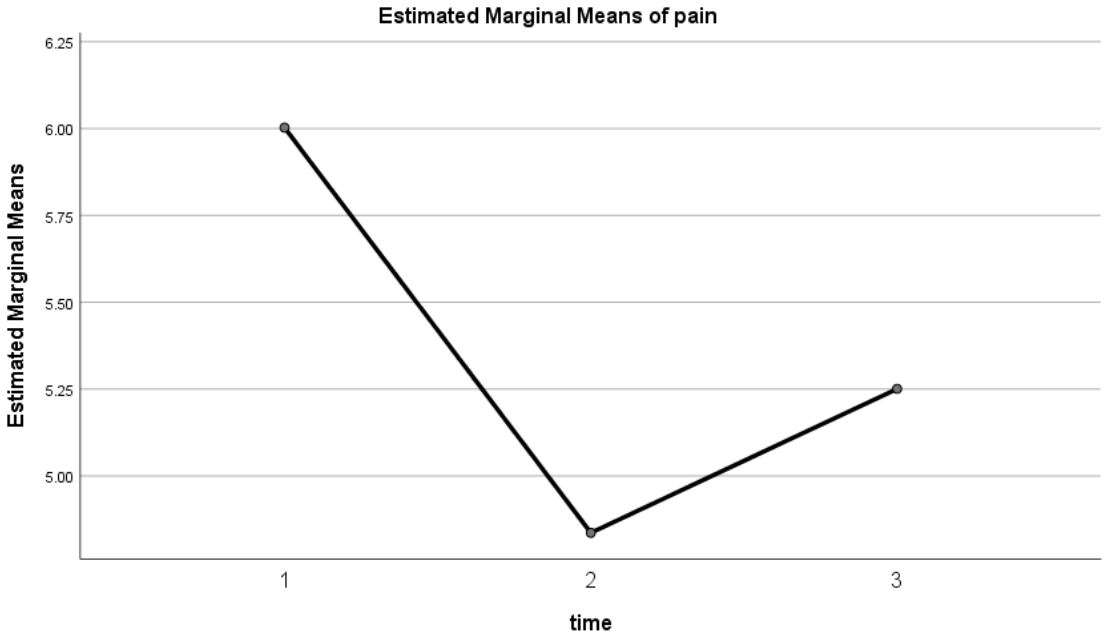

Diagram 2: The impact of manual therapy on pain reduction in pre-test, post-test, and follow-up stages

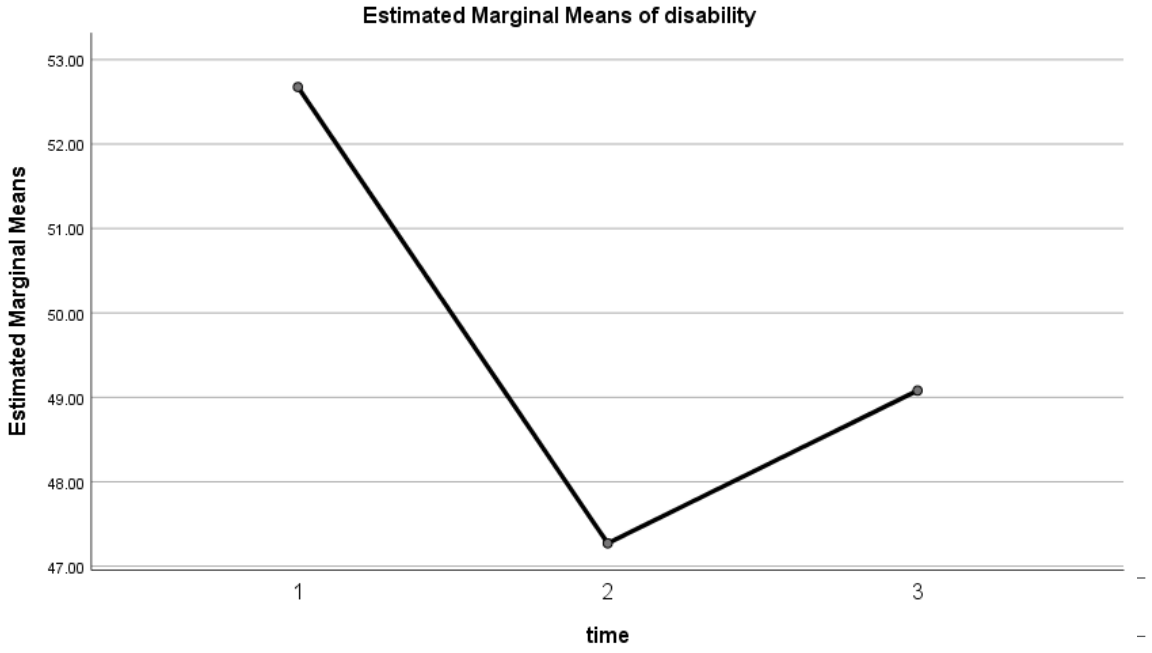

Diagram 3: The impact of manual therapy on disability in pre-test, post-test, and follow-up

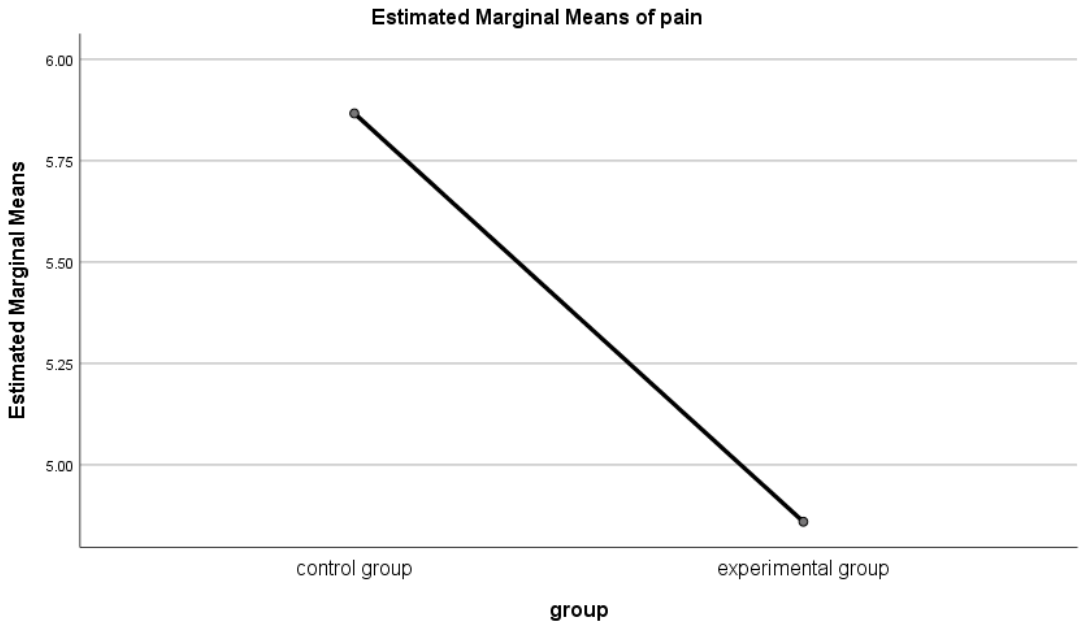

Diagram 4: The impact of manual therapy on reducing pain in two experimental and control groups

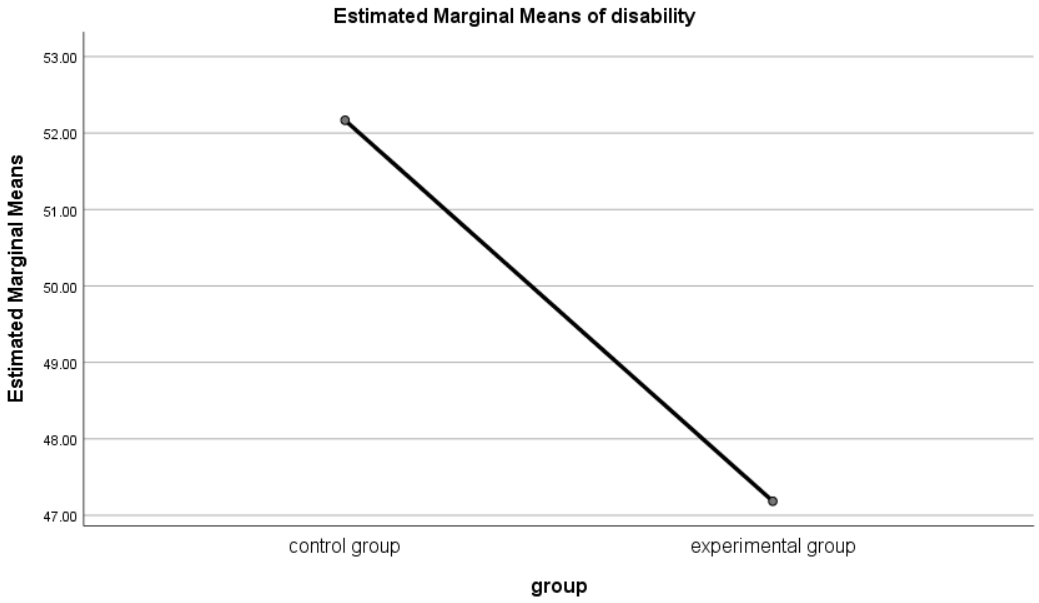

Diagram 5: The impact of manual therapy on disability in two experimental and control groups

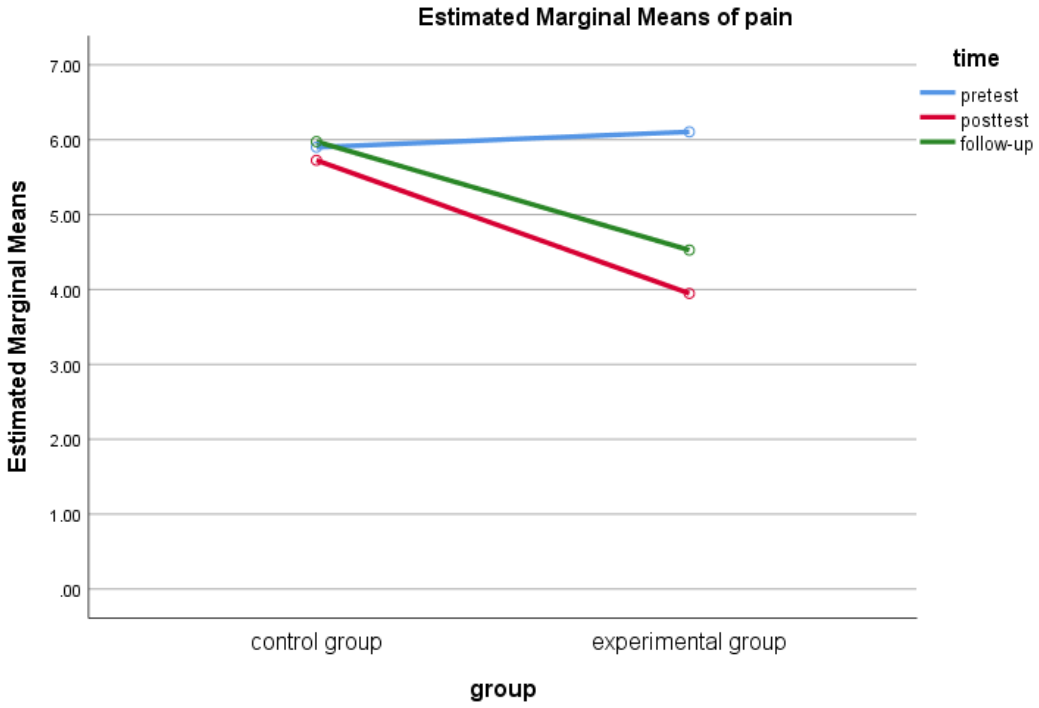

Diagram 6: Interactive impact of group and time in reducing pain scores

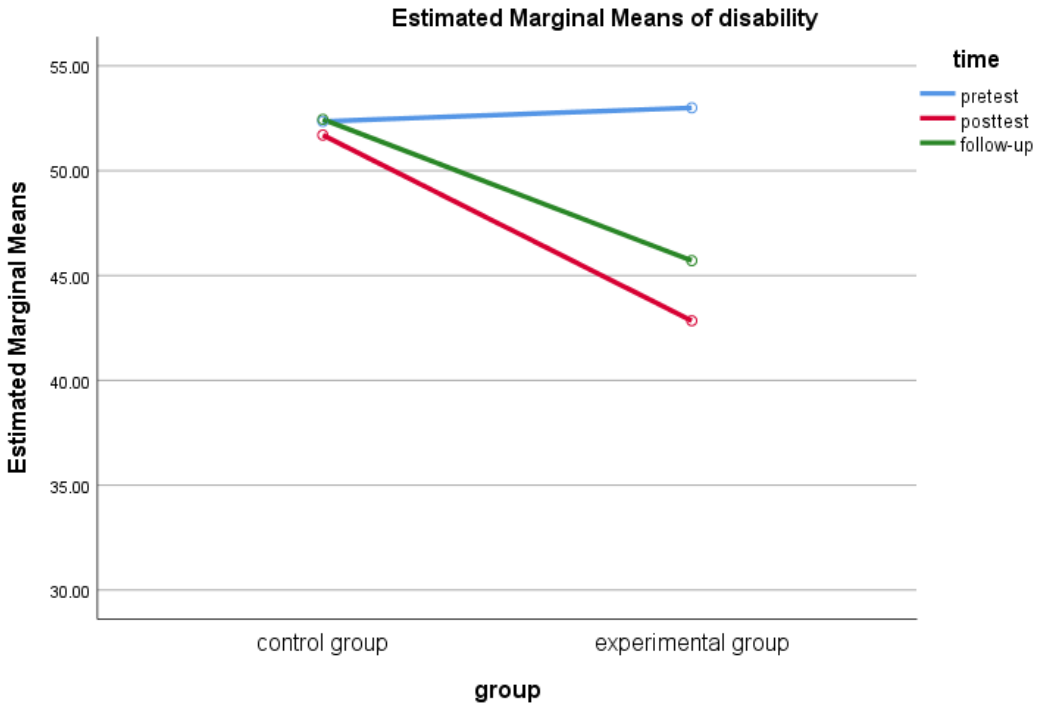

Diagram 7: Interactive impact of group and time on disability

Discussion

The results of the present study showed that manual therapy is effective in reducing pain in individuals with chronic mechanical low back pain. The results revealed that pain and disability scores in the post-test and follow-up stages decreased significantly in the experimental group than in the control group. Several studies have reported that manual therapy can reduce pain and disability in individuals [38, 45, 46, 47, and 48]. A study revealed that manual therapy was more effective than exercise therapy in reducing pain and disability, so 67% of subjects in the manual therapy group could return to their job after two months [45]. A systematic review showed that different methods of manual therapy can be effective in reducing chronic mechanical low back pain [46]. Some other systematic reviews have also

shown the impact of manual therapy in reducing pain and disability [38, 47]. Namnaqani et al. [38] compared the McKenzie method and manual therapy and showed that subjects of both groups showed a significant recovery 2 to 3 months after treatment. However, manual therapy showed better performance in this stage. After 6 months, McKenzie's method had better performance. After 12 months, they showed the same effects. Another study compared the effect of manual therapy and spinal stabilization exercise in patients with chronic mechanical low back pain and its results revealed that both methods had the same effects on the quality of life of the patients. However, manual therapy was more effective in reducing pain and improving performance parameters [48]. Another study showed that manual therapy is more cost-effective than being active for low back and neck [49]. In explaining these results, it can be stated that mechanical stimulus causes movement in the motor parts of the spine in the course of therapy; it can improve segmental movement, reduce local tissue inflammatory factors, and facilitate local muscle control [50, 51]. In manual therapy, the therapist provides input to the nervous system to change the output from the brain (such as pain). The goal of the therapist is to reduce the input of pain to the system and thus moderate the pain experience [52].

Research limitations

The primary limitation of the present study was the lack of measurement of biological indicators due to hardware limitations. Hence, the variables were investigated in the form of self-reports, and they can be affected by psychological and biased characteristics. Also, psychological factors affecting pain in the treatment process were not investigated in the present study. Moreover, the sample size in the present study was small, which may affect the results.

Conclusion

The results of the present study show that manual therapy can reduce pain and disability in individuals with chronic mechanical low back pain. Manual therapy techniques have been shown to have analgesic impacts that can help reduce pain and improve performance. Therefore, specialists can use this treatment to reduce pain and functional disability of individuals with chronic mechanical low back pain.

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