PJPT PAKISTAN JOURNAL OF PHYSICAL THERAPY
ISSN NO: 2663-0796 (Print) | ISSN NO: 2663-080X (Online)

Original Article

Positional Release and Manual Pressure Techniques of Tight Hip Flexors on Pain, Range of Motion, Lumbosacral Angle and Disability in Patients with Chronic Low Back Pain

Faiza Altaf[1], Ayesha Iftikhar[2], Aamir Shahzad[3], Maria Riaz[4], Tamjeed Ghaffar[3*], Mehwish Boota[5]

[1]Ibn e Sina Hospital, Multan, Pakistan
[2]Mirpur Institute of Medical Sciences, Mirpur, Azad Jamu Kashmir, Pakistan
[3]Government College University Faisalabad, Faisalabad, Pakistan
[4]Riphah International University, Lahore, Pakistan
[5]Federal Institute of Health Sciences, Lahore, Pakistan

ABSTRACT

Long-term and serious instances of low back problems can result in muscular deconditioning owing to tightness and atrophy as a result of activity limitations. Chronic low backache or dysfunction (CLBD) is a disorder that occurs as a consequence of poor posture, a condition known as spondylosis, spondylolisthesis, recurrent trauma, or instability. **Objective:** Low back pain may lead to muscle degenerative conditions due to spasms and shortening as a result of activity constraints. The objective of the study was to compare the effects of two therapeutic interventions including, Positional Release (PRT) and Manual Pressure Techniques on Pain, Range of Motion, Lumbosacral Angle, and Disability in Chronic Low Back Pain Patients. **Methods:** A randomized clinical experiment was undertaken. Forty six subjects were incorporated using a convenient sampling strategy based on predefined criteria for selection. Patients were distributed at random to one of two experimental groups. Group A was provided PRT, whereas Group B got manual release technique. The NPRS, Oswestry disability questionnaire and inclinometer was used to gauge intensity of pain, impairment and hip ROM. Furthermore, the lumbosacral angle was measured using a radiograph at beginning as well as following a four week follow up. **Results:** With the exception of lumbosacral angle ($p>0.05$), there was a substantial difference in the means of prior to and following treatment values ($p<0.05$) for the NPRS, hip ROM, and Oswestry disability questionnaire in both groups. Between groups comparison revealed a significant disparity ($p<0.05$) in the Oswestry disability questionnaire and NPRS, hip ROM following a period of four weeks of therapy. **Conclusion:** In patients of CLBP, both positional release technique and Manual pressure technique were efficient in alleviating level of pain and promoting hip ROM. Manual pressure technique was found to be superior in terms of increasing hip flexion and extension and reducing pain and disability.

Keywords: Chronic low back pain, Hip flexors, Lumbosacral angle, Manual pressure technique, Positional release technique.

INTRODUCTION

Low backache is a prevalent illness that strikes a significant number of people. If the condition has been persisted for a period of time exceeding three months, it is called chronic. Long-term and serious instances of low back problems can result in muscular deconditioning owing to tightness and atrophy as a result of activity limitations. Chronic low backache or dysfunction (CLBD) is a disorder that occurs as a consequence of poor posture, a condition known as spondylosis, spondylolisthesis, recurrent trauma, or instability. The dysfunctional syndrome is characterized by stiffness and imbalance that causes discomfort before full normal end range motion. Essentially, the syndrome develops as a result of insufficient mobility during a period of soft tissue shortening.[1]

***Corresponding Author:** Tamjeed Ghaffar, **Email:** tamjeedghaffar@gcuf.edu.pk
Received: : February 20, 2024 | **Revised:** July 27, 2024 | **Accepted:** September 08, 2024

Globally, the incidence of LBP is 44.9%, however according to a report about dentist in Pakistan fifty-six percent of dentists are subject to LBP. Low backache risk factors can be both modifiable or not. According to estimates, approximately five percent and ten percent of cases will lead to chronic low back pain (CLBP), which is liable for significant treatment expenses, absence from work, and personal suffering, in addition to being among the most common reasons for people receiving medical attention.[2] Chronic low back pain is an important contributor of developmental disabilities globally. Multiple research investigations aim in order to underscore the data validating the various rehabilitative strategies mentioned for managing it.[3, 4]

Muscles responsible for hip flexion play a crucial part in lumbar spine stabilization. Tightened flexors of the hip may trigger lumbar spinal discomfort and, as a result, productivity limitations [5]. Flexors of the hip including rectus femoris and musculus iliopsoas, play an important role in lumbar spine stabilization. Although its stability and physical wellness necessitate an adequate level of tension, tightness in hip flexors increase the likelihood of lower back discomfort.[6]

Tightness of hip flexor can also cause muscular exhaustion, low back discomfort, and disrupt routine motions.[7] The hip flexors include several muscles, which originate on the pelvis, spine or sacrum and insert onto the lower limb. The hip flexors are also under constant tension and can become shortened or tight because of habitual postural positioning which can then also create an anteriorly tilted pelvis and exaggerated lumbar lordosis. Pain in the back is among the top causes of medical leave, and by the age of thirty, almost half of individuals will have had a serious occurrence of backache.[8]

Positional release treatment and manual pressure method are two types of therapeutic approach that are commonly used to alleviate pain and enhance range of mobility. Positional release therapy (PRT) is an extensive body examination and therapeutic approach which employs tender spots and a comfortable posture to reduce the related pathology. The tender point is utilized as an indication, and the comfortable posture is retained. This minimally uncomfortable posture is generally one in which the muscular system is at its most compact length. After 90-seconds, the joint's motion is gradually and passively restored to its position of neutrality. This extended contraction of the muscle reduces both the intraf and extrafusal fibres of muscles.[9]

The Manual pressure technique is a manual therapy approach involves applying slowly increasing force to the MTrPs until seventy percent of the recipient's discomfort is relieved. The amount of pressure was held for a period of sixty seconds and analysed to ensure the same amount of pressure. If the participant claimed that the amount of discomfort had fallen to thirty percent, the examiner gradually raised the pressure in order to return the experienced pain to seventy percent. According to the kind and origin of the distress, the therapy aims at alleviating pain, promoting your standard of life, decreasing Sacro lumbar angle or lordosis, and increasing performance.[10]

The objective of this research was to investigate the implications of positional release and manual pressure technique of flexor muscles of hip on intensity of pain, hip range of motion, lumbosacral angle, and impairment in individuals with chronic LBP. There is a significant gap in the literature regarding how the manual pressure technique and positional release method affect individuals with hip flexor tightness. Bridging this gap would provide important information about the relative benefits and outcomes of positional release and manual pressure techniques with regard to pain management, range of motion enhancement, and lower extremity functioning in this specific sample subset. The findings will enhance clinical decision-making and inform treatment strategies, enabling healthcare professionals to optimize care for individuals with illiopsoas tightness and anterior pelvic tilt. Ultimately, this research will contribute to improved patient outcomes and elevate the quality of musculoskeletal healthcare.

MATERIALS AND METHODS

It was a randomized clinical experiment. Patients in the research were recruited employing a convenient sampling approach and assigned at random to one of two groups by using lottery method. The study setting was DHQ and tertiary hospitals in District Khanewal. After receiving clearance from the research ethics council at Riphah International University, Lahore, the study completed in a period of nine months, from July 2023 to January 2024. This completed study was reported in accordance with the requirements

of Consolidated Standards of reporting trials (CONSORT) statement in Figure 1. Sample size was calculated through Epitool software by using the following values shown in Figure 1. Sample size of 46 (23 in each group) is calculated by attrition rate = 20%. By adding the attrition rate of 20% we get the sample size equal to 46. [11]

Participants were screened as per the inclusion and exclusion criteria which includes both the males & females, age group 25 to 40 yrs [12], atraumatic chronic LBP greater than three months,[12] patients with Anterior pelvic tilt [13] and patients with lumbosacral angle > than 50 degrees.[14] Participants excluded with pregnancy, history of any fracture of vertebra [15], history of any spinal surgery,[15] disc disease, osteoporosis, bone disease and patient unable to give consent.

During the patient's initial visit, an in-depth description of the presenting ailment was collected, as well as an in-depth physical exam and evaluation. Before participating in the trial, patients provided informed permission in writing after completing a subjective assessment. The research contained only suitable individuals who met the eligibility criteria. The aims and methods of the study were described to every single participant throughout the trial, and written permission was acquired. Subjects have the option to decline or withdraw from the research at any point. The information provided by participants was kept strictly secret, and data acquisition was done with the Institutional Review Board's (IRB) permission.

Positional release technique was provided to Group A. The approach to therapy was estimated to take thirty minutes each session, four times per week for four weeks in the hospital setting. The subjects were examined at the beginning, and at end of the fourth week. Manual pressure technique was employed to Group B. The approach to therapy was estimated to take thirty minutes each session, four times per week for four weeks in the hospital setting.

The subjects were examined at the beginning, and at end of the fourth week. Pain, range of movement, lumbosacral angle, and impairment of function was assessed beforehand and following therapy using the NPRS, radiographs, Inclinometer, and ODI in Group A and Group B. The course of action was projected to take thirty minutes per session, four times each week for a span of four weeks in a hospital setting. The subjects were examined at their starting point and end of the fourth week. Figure 1 shows the consort flow diagram.

The NPRS was implemented to gauge pain level, with Zero representing no pain and ten representing the severe pain. Participants were directed to mark the line to denote their degree of pain.[16] The Oswestry disability questionnaire has been employed to evaluate impairment. It is a legitimate and trustworthy instrument. It consists of ten multiple-choice inquiries on pain in the back, and the individual chooses one statement from a list of 6 which most accurately describes his discomfort. The total potential score for each part is five: if the first sentence is taken into account, the section's score is Zero; if the last sentence has been marked, the section score is five.

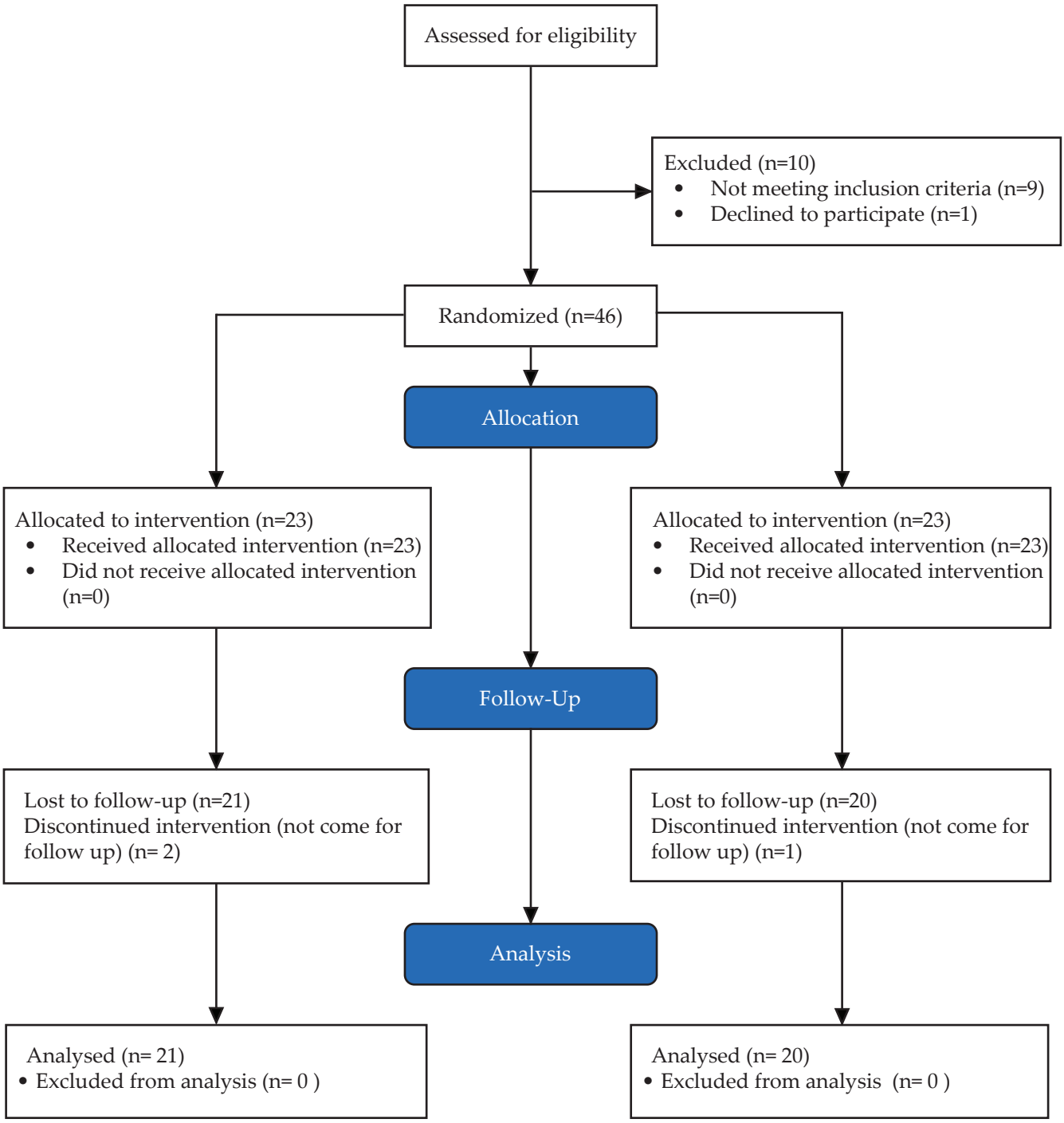
When all ten parts have been accomplished, the score is computed and translated into the form of a percentage. Oswestry scores are classified as follows: - Minimal impairment (0 to 20 percent). - Moderate (between 20 and 40 percent). - Severe (40 to 60 percent). - Impaired (60 to 80 percent). - Individuals typically remain confined to their beds (80 to100 percent).[17] An inclinometer is a device that was utilised for determining hip range of movement, it is a pendulum-based goniometry comprising of a 360-degree scale protractor that has a counter-weighted marker kept in an unchanged vertical place, it is a portable, circular in shape fluid- or air-filled disc, and it can be utilised to assess spinal movements.[18] The lumbosacral angle is created by a line connecting the lower end-plate of the 5th lumbar vertebrae and the upper endplate of the sacral vertebrae is known as the LSA.[19]

Statistical Analysis

To enter and evaluate data, SPSS version 26 was utilized. A significance criterion of p=0.05 was adopted to establish the statistical significance. Descriptive statistics, such as pie charts, frequency tables, and bar graphs are utilized to explain assessments done within and across groups over a period of time. Prior to doing inferential analysis, the data's normality was determined to decide if parametric or non-parametric tests should be used. This comprehensive examination of statistical methodologies improved the study's accuracy and validity, allowing for meaningful interpretation and firm conclusions.

Figure 1. CONSORT flow diagram

RESULTS



The gender representation of the subjects in the research revealed that 47.8% of the individuals who took part were males and 52.2% comprised of females. Figure 2 showed the history of back pain symptoms, the data showed that out of 46%, 47.8% had the back pain with the history between 3-6 months and 2.2% had it from 15 months or above. The mean of history of back symptoms was 7.04 ± 2.74 months.

The normality result on outcome measures was determined by the Shapiro Wilks testing, the Oswestry disability questionnaire and NPRS contradict the presumptions relating to normality. As a consequence, non-parametric analyses were utilized for analyzing data of the NPRS as well as the Oswestry disability questionnaire. Wilcoxon Signed-Rank Test had been applied for within group analysis, while Mann-Whitney U Test was

employed for b/w group comparison. Because the hip ROM and Lumbosacral angle were discovered to conform to a normality distribution, parametric tests were utilized for analyzing the data of the B/L hip ROM and Lumbosacral angle. Paired Samples t-test was the method of choice for within-group evaluation, while Independent Samples t-test was executed for b/w group comparisons. The threshold of significance was set at 0.05. The Wilcoxon Signed-Rank statistics and data description for patients in both groups A and B of the NPRS and Oswestry disability questionnaire are shown in Table 1. The statistical details and Paired Samples t-test of Hip ROM for individuals in groups A & B are indicated in table 2 .

The following is an analysis of the NPRS and Oswestry disability questionnaire data from the Mann-Whitney U Test b/w groups' comparison (Table 3).

The t-test statistics for independent samples for hip range of motion and lumbosacral angle is demonstrated hereunder (Table 4).

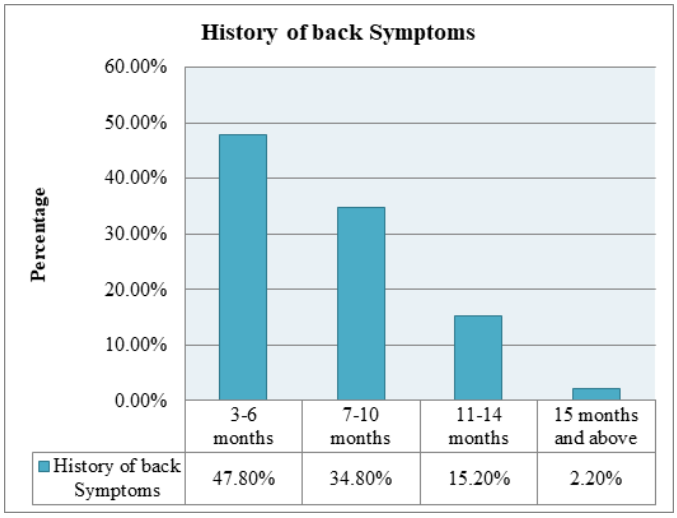


Figure 2. History of back symptoms

Table 1. Within-group interpretation of NPRS and disability (Wilcoxon Signed-Rank Test)

Groups	Time duration	Mean	Std.	Median	p-value
Positional release technique (Group-A)	NPRS before first session	5.21	1.16	5.00	<0.001
	NPRS after four weeks	2.19	1.36	2.00	
Manual Pressure technique (Group-B)	NPRS before first session	4.86	0.96	5.00	<0.001
	NPRS after four weeks	1.30	1.08	1.00	
Positional release technique (Group A)	Disability score at baseline	43.65	10.29	44.00	<0.001
	Disability score after 4 weeks	18.80	6.75	19.00	
Manual Pressure technique (Group B)	Disability score at baseline	45.69	9.18	48.00	<0.001
	Disability score after 4 weeks	13.15	5.35	13.50	

Table 2. Hip ROM and lumbosacral angle within-group evaluation (Paired Samples t-test)

Groups	Time	Mean	Std.	p-value
Positional release technique (Group A)	Right flex at baseline	61.82	6.85	<0.001
	Right flex after 4 weeks	70.52	6.01	
	Left flex at baseline	60.47	4.37	<0.001
	Left flex after 4 weeks	70.38	4.59	
	Right ext at baseline	13.08	2.35	<0.001
	Right ext after 4 weeks	17.71	1.67	
	Left ext at baseline	13.21	2.41	<0.001
	Left ext after 4 weeks	17.61	1.56	
Manual pressure technique (Group B)	Right flex at baseline	61.43	4.86	<0.001
	Right flex after 4 weeks	74.65	5.039	
	Left flex at baseline	58.56	4.88	<0.001
	Left flex after 4 weeks	74.45	4.57	
	Right ext at baseline	14.30	3.08	<0.001
	Right ext after 4 weeks	21.20	2.62	
	Left ext at baseline	14.34	2.83	<0.001
	Left ext after 4 weeks	20.40	2.52	
Positional release technique (Group A)	Lumbosacral angle at baseline	36.86	7.19	0.131
	Lumbosacral angle 4 weeks	35.90	6.51	
Manual pressure technique (Group B)	Lumbosacral angle at baseline	36.17	6.75	0.097
	Lumbosacral angle 4 weeks	35.90	7.06	

Table 3. Between group comparison of NPRS and ODI (Mann Whitney test)

Statistics	NPRS before 1st session	NPRS after 4 weeks
Mann-Whitney U	229.500	130.00
Wilcoxon W	505.500	340.00
Z-value	-0.770	-2.149
p-value	0.441	0.032
	ODI before 1st session	**ODI after 4 weeks**
Mann-Whitney U	221.500	106.00
Wilcoxon W	497.500	316.00
Z-value	-1.00	-2.719
p-value	0.317	0.007

Table 4. Hip ROM and lumbosacral angle between group comparisons (Independent Samples t-test)

Variables	Groups	Mean	Std.	p-value
Right hip flex at baseline	Group A	61.82	6.85	0.824
	Group B	61.43	4.86	
Right hip flex after 4 weeks	Group A	70.52	6.01	0.023
	Group B	74.65	5.03	
Left hip flex at baseline	Group A	60.47	4.37	0.169
	Group B	58.56	4.88	
Left hip flex after 4 weeks	Group A	70.38	4.59	0.007
	Group B	74.45	4.57	
Right hip ext at baseline	Group A	13.08	2.35	0.139
	Group B	14.30	3.08	
Right hip ext after 4 weeks	Group A	17.71	1.67	0.000
	Group B	21.20	2.62	
Left hip ext at baseline	Group A	13.21	2.41	0.153
	Group B	14.34	2.83	
Left hip ext after 4 weeks	Group A	17.61	1.56	0.000
	Group B	20.40	2.52	
Lumbosacral angle at baseline	Group A	36.86	7.19	0.73
	Group B	36.17	6.75	
Lumbosacral angle after 4 weeks	Group A	35.90	6.51	0.99
	Group B	35.90	47.06	

DISCUSSION

Findings of the trials demonstrated that both positional release therapy and manual pressure technique had beneficial in improving pain, hip range of motion and disability, but manual pressure technique showed more statistical significant improvement in alleviation of pain on NPRS, disability on Oswestry disability questionnaire and hip range of motion. But no substantial difference was observed in lumbosacral angle at pre and post treatment values in group A receiving positional release technique as well as in group B receiving manual pressure technique.

In support to the findings of present study, Al-Shawabka *et al.* (2013) studied the implications of positional release approach (PRT) and manual pressure release technique (MPR) on upper trapezium muscle TrPs.[20] The study found that MPR is far more successful than PRT in lowering discomfort and enhancing neck mobility in short periods of time. Additional research needs to be conducted to assess long lasting effects of each therapy. In present study instead of immediate effect, follow up was taken for 4 weeks and effects of both techniques were assessed and compared in patients of CLBP. Similar results were seen in the present study, and manual pressure technique was found to be more effective in pain alleviation, improvement in range of motion and reduction of disability.

In opposition to the present investigation, Dayanr *et al.* (2020) evaluating the beneficial effects of Strain counterstrain (SCS) therapy, manual pressure release technique (MPR) and integrated NM inhibition technique (INIT) in the amelioration of persistent nonspecific LBP.[21] The study comprised 48 people with CNLBP. Additionally to the MPR subgroup, SCS subgroup, and INIT subgroup along with treatments technique, individuals

went through typical home exercise routine for a total of twelve sessions. SCS or INIT may give somewhat superior relief in pain during exercise, MTrP deactivation, and impairment associated to pain in CNLBP. [21] However in present study two treatment groups were compared and manual pressure technique showed superior effects in pain and disability reduction as well as improvement in hip mobility in patients of Chronic-LBP.

The PRT has been demonstrated to be advantageous in reducing pain and impairment while simultaneously improving hip mobility and movement in the present research. PRT has been shown in numerous trials to have good benefits. Wong *et al*. (2004) employed an arbitrary number of forty-nine adults with bilaterally hip sensitive spots to study the reliability, validity, and usefulness of SCS.[22] After employing strain counter stain, investigators detected an enormous pain decrease in both groups of muscles at the end of intervention. Collin *et al.* (2007) reports on a 14-year-old boy with an ankle sprain of grade two and the advantages of PRT's analgesic impact in increasing function. After two months, overall pain was reduced by 2 points on a NPRS and tenderness was reduced by ten out of thirteen painful spots.[23] This sensation of analgesia was thought to be clinically important, indicating the need for further research.

Eisenhart *et al.* (2003) performed an analysis aimed at evaluating the beneficial effects of osteopathic manual treatment (OMT), which comprises myofacial release, muscle stretching, and positioning release, among individuals suffering from abrupt ankle sprains. Following OMT therapy, subjects in the OMT experimental group experienced substantial reductions in swelling, pain, and a propensity to improved range of mobility. [24] In an experiment conducted by Mohamed *et al.* (2017), the people who had ongoing lower back disorders exhibited a substantial drop in their pain score on the VAS following just one PRT session.[25] SCS appears to be successful in lowering palpation discomfort and muscular pain due to TrPs, according to several studies, however disability may not be reduced.[26] The immediate impacts of SCS intervention on quantitatively sensory measures at the lower back digitally delicate regions were examined in a randomised controlled investigation, and the findings indicated that SCS treatment raised PPT.[27] In present study position release technique was compared with manual pressure release. Both techniques were observed to be successful in back disability and pain reduction and increasing hip ROM but superior effects of manual pressure technique was observed in this study.

Alternatively, Birmingham *et al*. (2004) presents an investigation to assess the influence of PRT approach on adaptability of hamstring. The popliteal angle was measured during maximum active knee extension while sitting before and after each procedure to determine hamstring flexibility. A blindfolded assessor used a common protractor to evaluate popliteal angles on digital pictures. According to the findings, the PRT approach is ineffective for increasing knee extension in healthy patients with lower hamstring flexibility.[28] Lewis *et al*. (2011) state that for individuals with severe LBP, the Strain counter-strain with exercising had no additional pain-relieving effects than exercising alone.[29] In present study PRT and manual pressure technique was applied on hip flexor muscles and both techniques improved pain, disability and ROM. However, both techniques do not produce any significant effects on lumbosacral angle in patients with CLBP.

This trial had a short sample size of forty six patients. Patients were recruited for data collection from only District head quarter and tertiary hospitals in Khanewal. There was no control of researcher on other variables like involvement of patients in additional intervention, or taking any self-medication, which may affect the outcomes of the study. Time and money constraints were two additional study limitations. To increase the applicability of findings, more study with larger numbers of participants and in diverse locations or cities is recommended. Triple blinded RCT ought to be considered in future investigations, which may further reduce the biasness. Future research should include long-term follow-ups to determine the lasting impacts of these interventions. It is suggested that medical professionals should adopt these strategies into clinical practice to improve therapeutic outcomes for CLBP patients.

CONCLUSION

In conclusion, both positional release technique and manual pressure technique was found to be beneficial in improving back pain, hip range of motion and back disability, but manual pressure technique showed more statistical significant improvement in alleviation of pain on NPRS, disability on Oswestry disability questionnaire and hip range of motion. But, no substantial difference was seen in lumbosacral angle at pre and post

treatment values in group A receiving positional release technique as well as in group B receiving manual pressure technique.

DECLARATIONS

Conflicts of Interest: There is no competing interest.

Financial support: No funding was received for this study.

Authors' Contribution: FA: Conception & design, **AI, AS:** Acquisition of data, **MR:** Data analysis and interpretation, **TG:** Critical review for intellectual content, proofreading and final approval, **MB:** Drafting of manuscript

REFERENCES

1. Thomas P. Team physician. Key Topics in Sports Medicine. 2006:285.
2. Balagué F, Mannion AF, Pellisé F, Cedraschi C. Non-specific low back pain. The Lancet. 2012;379(9814):482-91.
3. Hasanpour-Dehkordi A, Dehghani A, Solati K. A comparison of the effects of Pilates and McKenzie training on pain and general health in men with chronic low back pain: a randomized trial. Iranian Journal of Public Health. 2017;23(1):36-40.
4. Wells C, Kolt GS, Marshall P, Hill B, Bialocerkowski A. The effectiveness of Pilates exercise in people with chronic low back pain: a systematic review. PLOS ONE. 2014;9(7):1-14.
5. Juker D, McGill S, Kropf P, Steffen T. Quantitative intramuscular myoelectric activity of lumbar portions of psoas and the abdominal wall during a wide variety of tasks. Medicine and Science in Sports and Exercise. 1998;30(2):301-10.
6. Avrahami D, Potvin JR. The clinical and biomechanical effects of fascial-muscular lengthening therapy on tight hip flexor patients with and without low back pain. The Journal of the Canadian Chiropractic Association. 2014;58(4):444-55.
7. Aslan HIY, Buddhadev HH, Suprak DN, San Juan JG. Acute effects of two hip flexor stretching techniques on knee joint position sense and balance. International Journal of Sports Physical Therapy. 2018;13(5):846-59.
8. Hoy D, Brooks P, Blyth F, Buchbinder R. The epidemiology of low back pain. Best Practice & Research Clinical Rheumatology. 2010;24(6):769-81.
9. Deyo RA, Von Korff M, Duhrkoop D. Opioids for low back pain. British Medical Journal. 2015;1-13.
10. Ibraheem EE, Mohamed AE. Conventional therapy versus positional release technique in the treatment of chronic low back dysfunction. International Journal of Physiotherapy Research. 2017;5(5):2325-31.
11. Kang JA, Chun MH, Choi SJ, Chang MC, Yi YG. Effects of mirror therapy using a tablet PC on central facial paresis in stroke patients. Annals of rehabilitation medicine. 2017;41(3):347-53.
12. Seif HE, Alenazi A, Hassan SM, Kachanathu SJ, Hafez AR. The effect of stretching hamstring, gastrocnemius, iliopsoas and back muscles on pain and functional activities in patients with chronic low back pain: a randomized clinical trial. Open Journal of Therapy and Rehabilitation. 2015;3(4):139-45.
13. Schache AG, Blanch PD, Murphy AT. Relation of anterior pelvic tilt during running to clinical and kinematic measures of hip extension. British Journal of Sports Medicine. 2000;34(4):279-83.
14. Barrey C, Jund J, Noseda O, Roussouly P. Sagittal balance of the pelvis-spine complex and lumbar degenerative diseases: a comparative study about 85 cases. European Spine Journal. 2007;16(9):1459-67.
15. Esola MA, McClure PW, Fitzgerald GK, Siegler S. Analysis of lumbar spine and hip motion during forward bending in subjects with and without a history of low back pain. Spine. 1996;21(1):71-8.
16. Childs JD, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. Spine. 2005;30(11):1331-4.
17. Chiarotto A, Maxwell LJ, Terwee CB, Wells GA, Tugwell P, Ostelo RW. Roland-Morris Disability Questionnaire and Oswestry Disability Index: which has better measurement properties for measuring physical functioning in nonspecific low back pain? Systematic review and meta-analysis. Physical Therapy. 2016;96(10):1620-37.
18. Van Blommestein AS, MaCrae S, Lewis J, Morrissey M. Reliability of measuring thoracic kyphosis angle,

lumbar lordosis angle and straight leg raise with an inclinometer. Open Spine Journal. 2012;4:10-15.

19. Esmailiejah AA, Qoreishy M, Keipourfard A, Babaei S. Changes in lumbosacral angles in patients with chronic low back pain: a prospective study. American Journal of Medical Case Reports. 2017;5:163-5.

20. Al-Shawabka SA, Shenouda M, Balbaa AA. Positional release technique versus manual pressure release on the upper trapezius muscle in patients with myofascial pain dysfunction syndrome. Bulletin of the Faculty of Physical Therapy, Cairo University. 2013;18(1):55-63.

21. Dayanır IO, Birinci T, Kaya Mutlu E, Akcetin MA, Akdemir AO. Comparison of three manual therapy techniques as trigger point therapy for chronic nonspecific low back pain: a randomized controlled pilot trial. The Journal of Alternative and Complementary Medicine. 2020;26(4):291-9.

22. Wong CK, Schauer C. Reliability, validity and effectiveness of strain counterstrain techniques. Journal of Manual & Manipulative Therapy. 2004;12(2):107-12.

23. Collins CK. Physical therapy management of complex regional pain syndrome I in a 14-year-old patient using strain counterstrain: a case report. Journal of Manual & Manipulative Therapy. 2007;15(1):25-41.

24. Eisenhart AW, Gaeta TJ, Yens DP. Osteopathic manipulative treatment in the emergency department for patients with acute ankle injuries. Journal of Osteopathic Medicine. 2003;103(9):417-21.

25. Mohamed R, Ahmed H, Ali M. Positional release versus myofascial release technique in chronic low back dysfunction. International Journal of ChemTech Research. 2017;10(2):496-522.

26. Wong CK, Abraham T, Karimi P, Ow-Wing C. Strain counterstrain technique to decrease tender point palpation pain compared to control conditions: a systematic review with meta-analysis. Journal of Bodywork and Movement Therapies. 2014;18(2):165-73.

27. Lewis C, Khan A, Souvlis T, Sterling M. A randomised controlled study examining the short-term effects of Strain–Counterstrain treatment on quantitative sensory measures at digitally tender points in the low back. Manual Therapy. 2010;15(6):536-41.

28. Birmingham TB, Kramer J, Lumsden J, Obright KD, Kramer JF. Effect of a positional release therapy technique on hamstring flexibility. Physiotherapy Canada. 2004;56(3):165-70.

29. Lewis C, Souvlis T, Sterling M. Strain-Counterstrain therapy combined with exercise is not more effective than exercise alone on pain and disability in people with acute low back pain: a randomised trial. Journal of Physiotherapy. 2011;57(2):91-8.