ORIGINAL ARTICLE

Effects of instrument assisted soft tissue mobilisation in patients with chronic mechanical low back pain----A randomized control trial

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Abstract

Objective: To determine the effects of instrument-assisted soft tissue mobilisation compared to manual myofascial release in terms of managing pain, improving range of motion, and reducing disability in patients with chronic mechanical low back pain.

Method: The randomised controlled trial was conducted from July 2022 to July 2023 at the Foundation University College of Physical Therapy and Gul's Rehab Clinic, Rawalpindi, Pakistan, and comprised patients of either gender diagnosed with chronic mechanical low back pain. The patients were randomised into group A receiving manual myofascial release, and group B receiving instrument-assisted soft tissue mobilisation using long bar tool. The intervention lasted 9 sessions over 3 weeks. Data was analysed using SPSS 21.

Results: Of the 50 participants 37(74%) were females and 13(26%) were males. The overall mean age was 25.1±6.9 years. There were 25(50%) patients in each group. Pain, lumbar range of motion, and lumbar disability improved significantly in both groups ($p< 0.05$). Intergroup difference was not significant ($p>0.05$).

Conclusion: Manual myofascial release and instrument-assisted soft tissue mobilisation were equally effective in the treatment of chronic mechanical low back pain.

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Introduction

Due to increased industrialisation in the modern era, infliction with mechanical problems is becoming very common globally owing to more and harder work, long hours of duty, and lack of sleep, Among major health consequences, low back pain (LBP) is affecting both males and females at some point in their lives.[1,2]

Chronic mechanical LBP originates from the anatomical structures of spine, intervertebral discs, and surrounding soft tissues, and persists for >12 weeks. It is typically diagnosed based on the combination of clinical evaluation, medical history, and exclusion of other potential causes of back pain.[3]

The thoracolumbar fascia is a dense layer of connective tissue structures that extends over the deep muscles of the back, including the erector spinae, quadratus lumborum and latissimus dorsi, and acts as a biomechanical link between the shoulders and pelvis in providing stability and support to the spine.[4-6] Restricted mobility of thoracolumbar fascia can cause pain, stiffness and dysfunction in the lower back, and may contribute to the chronicity of LBP, compromising physical functions.[7-9]

Myofascial release, a stripping manual therapy technique, is used to restore mobility vis-à-vis fascial restrictions treatment.[10] It is a widely used treatment for chronic LBP and it works by breaking the tissue resistance and by identifying the area of restriction.[11,12] On the other hand, instrument-assisted soft tissue mobilisation uses long bar tool with minimum force application to put less strain on the clinician's hand and to target deeper fascia efficiently and effectively.[13] The instrument-assisted soft tissue mobilisation, also referred to as Graston technique, is currently gaining more popularity in the physical therapy profession. It utilises rigid instruments made of stainless steel of various shapes to detect and treat soft tissue dysfunctions.[10] The Graston tool kit contains 6 instruments that are characterised by short bar, designed to target local areas, and long bar tools for targetting specifically larger areas.

The current study was planned to determine the effects of instrument-assisted soft tissue mobilisation compared to manual myofascial release in terms of managing pain,

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improving range of motion (ROM), and reducing disability in patients with chronic mechanical LBP.

Patients and Methods

The randomised controlled trial (RCT) was conducted from July 2022 to July 2023 at the Foundation University College of Physical Therapy and Gul's Rehab Clinic, Rawalpindi, Pakistan. After approval form the ethics review committee of the Foundation University School of Health Sciences, Rawalpindi, the sample size was calculated using Harvard Sample Size Calculator[14] with minimum detectable difference 0.81 for lumbar flexion ROM, significance level 0.05 and power 0.8. The sample was raised using non-probability purposive sampling technique. Those included were patients of either gender aged 18-50 years with chronic mechanical LBP for >3 months, having Numeric Pain Rating Scale (NPRS) score 5.[15] Informed consent was taken from all the participants. Those not willing to participate were excluded, and so were cases of spinal fracture, spinal surgery, trauma, pregnancy and diagnosed psychiatric disorders.

The patients were randomised using the coin toss method into group A receiving manual myofascial release, and group B receiving instrument-assisted soft tissue mobilisation using long bar tool. The patients were blinded to the intervention they were to receive.

Initial assessment of pain using NPRS, lumbar ROM using gravity-based inclinometer, and lumbar disability using Oswestry Disability Index (ODI) was done at the baseline.[16] In group A, moist heat from the hydrocollator was used for 10 minutes on the lumbar region, followed by manual myofascial release through stripping technique on lumbar region. Direct sustained pressure was applied via fingers, knuckles or elbows, or by using specialised tools, like foam rollers or massage balls. In combination with sustained pressure, stretching and mobilisation techniques were also incorporated to further release tissue restrictions, and the patient's response was monitored. The amount of pressure could be adjusted according to the patient's tolerance level. Afterwards, post-treatment stretching targeting the erector spinae and quadratus lumborum muscle was performed by the participants to gain maximum results.

In group B, moist heat using a hydrocollator pack for 10 minutes on lumbar region was done, followed by instrument-assisted soft tissue mobilisation for 5-7 minutes using Graston (G6) long bar tool with gentle horizontal strokes at an angle of 45 degrees over the targetting lumbar myofascial tissue to break tissue adhesions. The intensity and direction of the strokes could be adjusted according to patient's level of tolerance. The session lasted till the tissue response got better and smoother. Post-treatment stretching, consisting of 2-3 sets of 10 repetitions, of the erector spinae and quadratus lumborum muscles was conducted. Icing was recommended in case of bruising or itching.

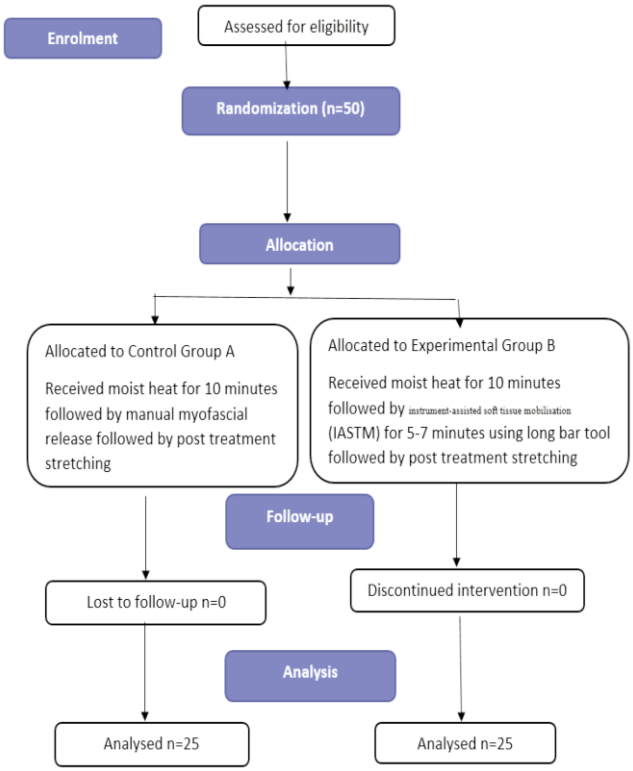

Figure: Consolidated Standards of Reporting Trails (CONSORT) diagram

The intervention lasted 9 sessions over 3 weeks, conducted on alternate days (3 sessions per week on alternate days). Final assessment of pain, lumbar ROM, and lumbar disability was done at the end of week 3. (Figure: Consort Diagram).

Data was analysed using SPSS 21. Data was expressed as mean ± standard deviation, or as frequencies and percentages, as appropriate. Data normality was assessed using Kolmogorov-Smirnov test. For data that was normally distributed, independent sample t test was used, whereas, data not normally distributed, Man Whitney U test was applied. $P<0.05$ was considered significant.

Results

Of the 50 participants 37(74%) were females and 13(26%) were males. The overall mean age was 25.1±6.9 years. There were 25(50%) patients in each group. Of the total participants, 9(18%) were married (Table 1).

The data was non-normally distributed (Table 2) except

Table-1: Demographic and descriptive data.

Variables	Averages
Continuous Variables	(Mean±SD)
Age (years)	25.1±6.9
Weight (Kilograms)	61.6±13
Height (centimeters)	161.8±9.6
Categorical Variables	**(Frequency/Percentage)**
Duration of Pain	3-5months: n=22
	6-12 months: n=9
	>12 months: n= 19
Gender Distribution	Male: n=13 (26%)
	Female: n=37(74%)
Marital Status	Married: n=9 (18%)
	Unmarried: n=41 (82%)
Occupation	Students: n=29 (58%)
	Physiotherapist: n=13 (26%)
	Office Workers: n=5 (10%)
	Housewife: n=3 (6%)

SD: Standard deviation.

Table-2: Normality analysis

Variable	Kolmogorov-Smirnov		Kolmogorov-Smirnov	
	Statistic	Sig.	Statistic	Sig.
	Manual		Instrumental	
Age (years)	.333	.000	.270	.000
Height (in cm)	.202	.010	.132	.200
Weight (Kg)	.215	.004	.139	.200
The intensity of pain before treatment	.288	.000	.236	.001
The intensity of pain t after treatmen	.192	.0182	.248	.000
Lumbar ROM in Flexion (baseline)	.230	.001	.240	.001
Lumbar ROM in Flexion (after treatment)	.202	.010	.229	.002
Lumbar ROM in Extension (baseline)	.442	.000	.437	.000
Lumbar ROM in Extension (after treatment)	.357	.000	.316	.000
ODI value after treatment	.188	.023	.191	.019

ROM: Range of motion, ODI: Oswestry Disability Index

the ODI value at baseline (Table 3).

Intergroup difference was not significant (p>0.05) except ODI value post-treatment (Table 4). However, intragroup analysis showed a statistically significant difference

Table-3: Normality analysis

Variable	Kolmogorov-Smirnov		Kolmogorov-Smirnov	
	Statistic	Sig.	Statistic	Sig.
	Manual		Instrumental	
ODI value at baseline	.149	155	.149 .	124

ODI: Oswestry Disability Index.

Table 4: Intergroup analysis of outcome variables.

Variable	Time of Assessment	Manual Median (IQR)	Instrumental Median (IQR)	P value
Pain				
The intensity of pain before treatment		6 (2)	6 (2)	0.911
The intensity of pain after treatment		2(2)	3(4)	0.859
Lumbar ROM				
Lumbar Flexion at baseline		30 (10)	40 (10)	.074
Lumbar Flexion after treatment		50 (10)	50 (20)	.632
Lumbar Extension at baseline		10 (.00)	10 (.00)	.68
Lumbar Extension after treatment		20 (10)	20 (10)	.59
ODI for Lumbar disability	ODI value at baseline (Mean±SD)	11.08 ±5.07	11.48 ± 3.86	.755
Variable	**Time of Assessment**	**Manual Median (IQR)**	**Instrumental Median (IQR)**	**P value**
ODI for Lumbar disability	ODI value after treatment	2 (4)	2 (7)	P<0.001

ODI: Oswestry Disability Index, IQR: Interquartile range, SD: Standard deviation.

Table-5: Intragroup comparison of outcome variables.

Variable	Group	Baseline value Median (IQR)	Post-treatment value Median (IQR)	P value
Pain	Manual	6(2)	2(2)	P<0.001
	Instrumental	6(2)	3(4)	P<0.001
Lumbar ROM	Manual	30(10)	50(10)	P<0.001
(Flexion)	Instrumental	40(10)	50(20)	P<0.001
Lumbar ROM	Manual	10(.00)	20(10)	P<0.001
(Extension)	Instrumental	10(.00)	20(10)	P<0.001
ODI for Lumbar	Manual	11(5.5)	2(4)	P<0.001
disability	Instrumental	11(3.8)	2(7)	P<0.001

ODI: Oswestry Disability Index, IQR: Interquartile range.

(p<0.001) in both groups (Table 5).

Discussion

The current study highlighted the effects of instrument-assisted soft tissue mobilisation in terms of pain, ROM, and lumbar disability in patients with chronic mechanical LBP. Other studies either utilised pain and disability, or pain and ROM as outcome variables.[17] The current

findings suggested that the intergroup difference was not significant except ODI value post-treatment, which was in accordance with earlier findings.[10] Instrument-assisted soft tissue mobilisation provides long-term improvement in terms of disability. This emerging technique also provides improvement in pain and function in <3 months when combined with an exercise programme.[18,19] Another study suggested that instrument-assisted soft tissue mobilisation is a simple and practical technique for decreasing pain, and improving ROM in musculoskeletal (MSK) conditions.[20]

Furthermore, intragroup analysis showed a statistically significant difference ($p<0.001$) in both groups in the current study. However, utilising an instrument instead of hands provide more mechanical advantage and less strain on the clinician's hand.[10]

Instrument-assisted soft tissue mobilisation, currently becoming more popular in the physical therapy profession, is relatively a new technique based on traditional Chinese techniques that use different stainless-steel tools in order to mobilise scar tissue and break tissue adhesions. The Chinese traditional technique based on an alternative of transverse friction massage, aids in improving tissue mobility and flexibility by improving blood flow and nutrient supply to the tissues, thus resulting in better movement patterns, thereby resolving chronic back pain symptoms.[21, 22]

The comprehensive approach consisting of a thorough assessment, exercise and other interventions provided a significant improvement in patient status in an earlier study.[13]

It is essential to highlight the fact that any kind of instrument used to mobilise scar tissue aids healthcare professionals in breaking tissue adhesions in relatively short time. Therefore, the use of instruments in manual therapy can help therapists in treating a large number of patients within a short span of time compared to the traditional hands-on techniques.

Conversely, a pilot study concluded the that a single use of instrument-assisted soft tissue mobilisation was insufficient to produce statistically significant difference in a single leg hop (SLH) distance. Also, a clinically minimal difference was observed in a score of Global Rating of Change Scale.[23]

A quasi-experimental study also reported that the use of instrument-assisted soft tissue mobilisation did not provide additional effects in terms of managing pain intensity.[24]

The current study has limitations of a small sample size and a short-term follow-up of 3 weeks which was clinically insignificant. Besides, the current study treated only fascial restrictions and targeted biomechanical parameters alone. Future studies should focus on the group of muscles involved in chronic mechanical LBP with more quantifiable and objective measurement methods, incorporating broader variable comparisons, comparison using other soft tissue techniques, and exploration of interconnected medical, systemic, environmental and psychosocial factors.

Conclusion

Manual and instrument-assisted soft tissue mobilisation were equally effective in treating patients of chronic mechanical LBP in terms of pain, lumbar ROM, and lumbar disability. This might have been due to the fact that both the techniques released fascial restrictions equally.

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AUTHORS' CONTRIBUTIONS:

SG: Concept, design, data analysis, interpretation, drafting, revision, final approval and agreement to be accountable for all aspects of the work.

SB, NMK, ZS, HQA: Concept, design, data acquisition, analysis, interpretation, revision, final approval and agreement to be accountable for all aspects of the work.