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Compare The Efficacy Of Instrument Through Assisted Soft Tissue Mobilization Over Posterior Meridian Line And Local Back Muscles In Mechanical Low Back Pain

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ABSTRACT

Background: *individuals with mechanical back pain experience pain primarily in their lower back. The pain may radiates to buttocks and thighs. Instrument assisted soft tissue mobilization(IASTM) is a highly advanced method for treating myofascial trigger points, has gained widespread popularity but the application of same over PML and local back muscles is not established.*

Objective: *The study compared the effectiveness of IASTM over posterior meridian line and local back muscles (multifidus, erector spinae, gastrocnemius, hamstrings) in mechanical low back pain.*

Participants and methods: *The study involved 40 individuals with mechanical low back pain who were randomly divided into two groups, with group A receiving IASTM on PML for three treatment sessions for one week and group B receiving IASTM on SM for back pain. 3 days of washout period is given to both the groups. Crossover has been done to both the groups received three treatment session for another week. Outcome variables flexibility, Range of motion (ROM), joint sense proprioception (JSP), visual analogue scale (VAS) were measured at baseline, 2 weeks.*

Results:*The significant improvement was reported in ROM (flexion and extension)after 2 weeks following IASTM in PML and SM groups, but PML showed a greater improvement. After 2 weeks, IASTM on PML showed a significantly greater improvement in VAS, ROM, JSP, flexibility. The repeated measures ANOVA showed a significant interaction effect between time and group for all outcome variables.*

Conclusion: *The study suggests that IASTM on PML may be more effective treatment for chronic low back pain than SM.*

Key words: *Instrument assisted soft tissue mobilization(IASTM), back pain, Range of motion, Joint sense proprioception(JSP)*

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INTRODUCTION

Over the last few decades, musculoskeletal problems have become more frequent around the world. Adults have a 70% chance of developing low back pain at some point in their lives, making back discomfort a significant issue in today's culture. Mechanical dysfunction, which produces abnormal joint movement, is a common cause of back pain, as improper lumbosacral joint mobility inside the joint capsule can limit lumbar movement or induce work-related disability, with significant financial ramifications due to workers compensation. Low back pain or lumbosacral pain is triggered due to combination of overuse, muscle strain, and injury to ligaments, muscles and discs that support the spine.

Proprioception feedback influences movement and positional accuracy, resulting in key somatosensory functions for human postural control. Proprioception encompasses signals received from proprioceptors located in the skin, subcutaneous tissue, muscles, tendons, and joint capsules, commonly known as mechanoreceptors. The muscle spindle a crucial proprioceptor, is stretched during eccentric contraction of muscle, thus generating an action potential on afferent fibres to convey a proprioceptive information to the sensorimotor cortex in the brain

The posterior meridian Line (PML) connects and protects the entire posterior surface of the body like a carapace from the bottom of the foot to the top of the head in two pieces – toes to knees, and knees to brow. When the knees are extended, as in standing, the PML functions as one continuous line of integrated myofascia. Common postural compensation patterns associated with the PML include: ankle dorsiflexion limitation, knee hyperextension, hamstring shortness (substitution for inadequate deep lateral rotators), anterior pelvic shift, sacral nutation, lordosis, extensor widening in thoracic flexion, suboccipital limitation leading to upper cervical hyperextension, anterior shift or rotation of the occiput on the atlas, and eye–spine movement disconnection (Myers, T.W (2013).

Instrument assisted soft tissue mobilization (IASTM) is a technique that allows practitioners to quickly find and treat people who have soft tissue dysfunction. IASTM is a method that is rapidly gaining popularity due to its effectiveness and efficiency while staying non-invasive, yet it does have its own set of indications and limits. IASTM reduces the amount of tension on the practitioner's hand while allowing for deeper penetration to better access fascia and remove limitations. The basic goal of IASTM is to relieve discomfort, increase range of motion, and improve tissue function. M. Haytham et al., IASTM uses unique stainless-steel implements with bevelled edges to help therapists analyse, evaluate, and mobilize soft tissue (Looney et al.2011)

IASTM has been hypothesized to play a neuromodulatory role in controlling pain by stimulating mechanosensitive neurons contained in the treated soft tissues including skin, muscle, and joint capsule. Compared to a clinician's bare hands, the contact area of the IASTM instrument is significantly less, which is thought to lead to increased tensile and compressive stress. The skin deformation may lead to decreased activities of both large and small fibre neurons, which may in turn provide a form of analgesic response.

The goal of this study was to compare the efficacy of IASTM on the pain, joint sense proprioception, and lumbar range of motion (ROM) of patients with mechanical low back pain, by treating the complete posterior meridian line and specific muscles in order to elucidate additional information on their effects and identify more efficient treatments that can be used in clinical settings.

MATERIALS AND METHODS

This crossover study included 40 participants from Manav Rachna International Institute of Research and Studies, divided into two groups of 20 (Group A and Group B). Each participant received two IASTM interventions in random order, acting as their own control.

Assessments included flexibility (sit-and-reach test), range of motion (ROM via bubble inclinometer), pain (VAS), and joint sense proprioception (JSP using goniometer). Participants were aged 25–45 and selected via convenience sampling.

Group A first received IASTM on the full posterior meridian line (PML) for 25 minutes over 3 sessions, followed by assessment on Day 4. Group B received IASTM on specific back muscles (SM) for 20 minutes in the same schedule. After a 3-day washout, treatments were crossed over.

Post-intervention assessments were done for ROM, pain, and proprioception. The standardized protocol ensured consistency across all sessions.

STATISTICAL ANALYSIS

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 22 (IBM, USA). The collected data, including variables such as age, height, weight, BMI, and Q angle measurements, were entered into SPSS for statistical analysis. Descriptive statistics, including means and standard deviations, were calculated to summarize the characteristics of the data. To compare the outcome variables between the pre- and post-intervention phases within each arm, an independent t-test was conducted. In Arm 1, the first treatment involved Instrument-Assisted Soft Tissue Mobilization (IASTM) on the posterior meridian line (PML), while the second treatment targeted the specific muscles (SM). In Arm 2, the order of treatments was reversed, with the first treatment focusing on IASTM applied to the specific muscles (SM) and the second treatment targeting the posterior meridian line (PML). In addition a paired t-test was conducted to compare the outcome variables before and after the intervention within each arm. A p-value of less than 0.05 was considered statistically significant.

RESULT

In **Arm 1 (PML followed by SM)**, flexibility improved in both groups but showed no significant difference post-intervention (PML: 38.55 ± 8.15; SM: 39.77 ± 7.06; $p = 0.61$). ROM flexion also showed no significant post-treatment difference (PML: 41.63 ± 7.43; SM: 44.05 ± 8.51; $p = 0.34$), while ROM extension increased similarly in both groups (PML: 14.25 ± 2.79; SM: 14.35 ± 2.6; $p = 0.91$). Joint sense proprioception (JSP) in flexion improved significantly in the PML group post-intervention (PML: 1.5 ± 1.42; SM: 2.53 ± 1.56; $p = 0.04$), whereas JSP in extension and side flexion showed no significant differences. Pain levels (VAS) decreased more in the PML group (Pre: 6.7 ± 1.13 to Post: 2.55 ± 1.05) compared to SM (Pre: 2.85 ± 1.46 to Post: 1.35 ± 1.18; $p < 0.001$).

In **Arm 2 (SM followed by PML)**, post-treatment flexibility was significantly higher in the PML group (45.61 ± 7.15) than SM (35.53 ± 8.65; $p < 0.001$). ROM flexion and extension also showed greater improvements in the PML group (Flexion: 49.53 ± 5.62 vs. 38.39 ± 6.46; Extension: 19.58 ± 3.15 vs. 12.53 ± 2.27; $p < 0.001$). JSP in flexion significantly improved post-treatment in the PML group (1.4 ± 1.27) compared to SM (2.28 ± 1.27; $p = 0.04$), while other JSP measures remained non-significant. VAS scores improved significantly in both, with greater reduction in the PML group (Pre: 4.53 ± 1.17 to Post: 3.21 ± 1.03) compared to SM (Pre: 5.49 ± 1.08 to Post: 4.74 ± 0.87; $p < 0.001$). Overall, IASTM applied to the **posterior meridian line (PML)** led to more consistent and superior outcomes across flexibility, ROM, proprioception, and pain reduction than when applied to **specific muscles (SM)**.

TABLE 4.1 INDEPENDENT T-TEST

Independent t test comparing the Pre vs Pre and Post vs Post between PML and SM in Arm 1							
Arm 1 (PML-SM)	**PML**	**SM**	**T**	**p**	**Cohen's d**	**95% CI**	
Outcome Measures						**Lower**	**Upper**
Flexibility Pre	31.93±8.38	35.4±7.09	-1.42	0.17	-0.45	-1.07	0.18
Flexibility Post	38.55±8.15	39.77±7.06	-0.51	0.61	-0.16	-0.78	0.46
ROM Flexion Pre	34.25±7.11	39±8.52	-1.91	0.06	-0.61	-1.24	0.03
ROM Flexion Post	41.63±7.43	44.05±8.51	-0.96	0.34	-0.3	-0.93	0.32
ROM Extension Pre	10.2±3.38	12.6±2.76	-2.46	**0.02**	-0.78	-1.42	-0.13
ROM Extension Post	14.25±2.79	14.35±2.6	-0.12	0.91	-0.04	-0.66	0.58

JSP Flexion Pre	3.08±2.23	2.05±4.63	0.9	0.37	0.28	-0.34	0.91
JSP Flexion Post	1.5±1.42	2.53±1.56	-2.18	**0.04**	-0.69	-1.32	-0.05
JSP Extension Pre	5.48±3.63	3±1.67	2.78	**< .001**	0.88	0.22	1.52
JSP Extension Post	2.88±2.25	2±1.58	1.44	0.16	0.45	-0.18	1.08
JSP Side Flexion Pre	2.33±1.82	1.87±2.2	0.73	0.47	0.23	-0.39	0.85
JSP Side Flexion Post	2.02±1.76	1.63±1.29	0.79	0.44	0.25	-0.38	0.87
VAS Pre	6.7±1.13	2.85±1.46	9.33	**< .001**	2.95	2.03	3.85
VAS Post	2.55±1.05	1.35±1.18	3.39	**< .001**	1.07	0.4	1.73

Independent t test comparing the Pre vs Pre and Post vs Post between SM and PML in Arm 2							
Arm 2 (SM-PML)	**SM**	**PML**	**T**	**p**	**Cohen's d**	**95% CI**	
Outcome Measures						**Lower**	**Upper**
Flexibility Pre	32.34±5.72	37.87±6.52	2.78	**< .001**	0.9	0.23	1.56
Flexibility Post	35.53±8.65	45.61±7.15	3.91	**< .001**	1.27	0.56	1.96
ROM Flexion Pre	35.53±7.24	39.53±7.65	1.66	0.11	0.54	-0.11	1.18
ROM Flexion Post	38.39±6.46	49.53±5.62	5.66	**< .001**	1.84	1.06	2.59
ROM Extension Pre	10.95±2.63	13.84±2.48	3.49	**< .001**	1.13	0.44	1.81
ROM Extension Post	12.53±2.27	19.58±3.15	7.92	**< .001**	2.57	1.69	3.43
JSP Flexion Pre	3.07±1.5	2.54±1.79	-0.98	0.33	-0.32	-0.96	0.32
JSP Flexion Post	2.28±1.27	1.4±1.27	-2.13	**0.04**	-0.69	-1.34	-0.03
JSP Extension Pre	2.86±1.64	2.56±1.69	-0.55	0.59	-0.18	-0.81	0.46
JSP Extension Post	2.02±1.53	1.44±1.29	-1.26	0.21	-0.41	-1.05	0.24
JSP Side Flexion Pre	2.4±1.69	1.87±1.48	-1.03	0.31	-0.33	-0.97	0.31
JSP Side Flexion Post	1.76±1.52	1.02±0.98	-1.78	0.08	-0.58	-1.22	0.08
VAS Pre	5.49±1.08	4.53±1.17	-2.64	**0.01**	-0.86	-1.52	-0.19
VAS Post	4.74±0.87	3.21±1.03	-4.93	**< .001**	-1.6	-2.32	-0.86

Paired t-test

Arm 1 (PML–SM)

Both PML and SM groups showed significant post-intervention improvements. Flexibility increased in PML from 31.92 ± 8.37 to 38.55 ± 8.14, and in SM from 35.4 ± 7.09 to 39.77 ± 7.06 (p < 0.001). ROM flexion improved in PML (34.25 ± 7.11 to 41.62 ± 7.43) and SM (39.0 ± 8.52 to 44.05 ± 8.5), while ROM extension rose in PML (10.2 ± 3.38 to 14.25 ± 2.78) and SM (12.6 ± 2.76 to 14.35 ± 2.6) (p < 0.001 for all). JSP flexion and extension improved significantly in PML (3.08 ± 2.23 to 1.5 ± 1.41; 5.48 ± 3.63 to 2.88 ± 2.24) and extension in SM (2.99 ± 1.67 to 2.00 ± 1.58), with no change in side flexion. Pain (VAS) reduced in PML from 6.7 ± 1.12 to 2.55 ± 1.05, and in SM from 2.85 ± 1.46 to 1.35 ± 1.18 (p < 0.001).

Arm 2 (SM–PML)

In the SM group, flexibility improved non-significantly (32.34 ± 5.72 to 35.52 ± 8.65), while the PML group showed a significant gain (37.86 ± 6.51 to 45.6 ± 7.15, $p < 0.001$). ROM extension improved in SM (10.95 ± 2.63 to 12.53 ± 2.27), and both flexion and extension improved in PML (39.53 ± 7.64 to 49.52 ± 5.62; 13.84 ± 2.47 to 19.58 ± 3.15, $p < 0.001$). JSP flexion improved in both SM (3.07 ± 1.49 to 2.28 ± 1.26) and PML (2.54 ± 1.78 to 1.4 ± 1.27), with side flexion improving only in PML (1.87 ± 1.47 to 1.01 ± 0.97). VAS scores dropped in SM (5.49 ± 1.07 to 4.74 ± 0.87) and PML (4.52 ± 1.17 to 3.21 ± 1.03, $p < 0.001$).

TABLE 4.2 PAIRED T-TEST

Paired t test between Pre and Post measurement of outcome variables in Arm 1 and Arm 2										
Arm 1 (PML-SM)	**PML**					**SM**				
Outcome Measures	**Pre**	**Post**	**MD**	**t**	**P**	**Pre**	**Post**	**MD**	**T**	**p**
Flexibility	31.92±8.37	38.55±8.14	-6.63	-15.90	**p<0.001**	35.4±7.09	39.77±7.06	-4.38	-14.43	**p<0.001**
ROM Flexion	34.25±7.11	41.62±7.43	-7.38	-12.05	**p<0.001**	39±8.52	44.05±8.5	-5.05	-17.15	**p<0.001**
ROM Extension	10.2±3.38	14.25±2.78	-4.05	-10.28	**p<0.001**	12.6±2.76	14.35±2.6	-1.75	-9.95	**p<0.001**
JSP Flexion	3.08±2.23	1.5±1.41	1.58	3.91	**p<0.001**	2.04±4.62	2.53±1.56	-0.48	-0.41	0.69
JSP Extension	5.48±3.63	2.88±2.24	2.60	4.49	**p<0.001**	2.99±1.67	2.00±1.58	1.00	3.27	**p<0.001**
JSP Side Flexion	2.33±1.82	2.01±1.75	0.32	0.72	0.48	1.86±2.19	1.63±1.28	0.23	0.49	0.63
VAS	6.7±1.12	2.55±1.05	4.15	31.61	**p<0.001**	2.85±1.46	1.35±1.18	1.50	8.82	**p<0.001**

Arm 2 (SM-PML)	SM					PML				
Outcome Measures	**Pre**	**Post**	**MD**	**t**	**P**	**Pre**	**Post**	**MD**	**T**	**p**
Flexibility	32.34±5.72	35.52±8.65	-3.18	-1.43	0.17	37.86±6.51	45.6±7.15	-7.74	-3.30	**p<0.001**
ROM Flexion	35.53±7.24	38.39±6.46	-2.87	-1.51	0.15	39.53±7.64	49.52±5.62	-10.00	-5.02	**p<0.001**
ROM Extension	10.95±2.63	12.53±2.27	-1.58	-8.22	**p<0.001**	13.84±2.47	19.58±3.15	-5.74	-8.19	**p<0.001**
JSP Flexion	3.07±1.49	2.28±1.26	0.79	3.38	**p<0.001**	2.54±1.78	1.4±1.27	1.14	5.12	**p<0.001**
JSP Extension	2.85±1.64	2.01±1.52	0.84	1.55	0.14	2.56±1.69	1.43±1.29	1.12	2.00	**0.06**
JSP Side Flexion	2.4±1.68	1.75±1.51	0.65	1.08	**0.30**	1.87±1.47	1.01±0.97	0.85	4.84	**p<0.001**
VAS	5.49±1.07	4.74±0.87	0.75	4.48	**p<0.001**	4.52±1.17	3.21±1.03	1.32	6.48	**p<0.001**

DISCUSSION

Rehabilitating musculoskeletal disorders using soft tissue techniques is a contemporary therapeutic approach. All of these therapeutic procedures, including classical massage, treatment of myofascial trigger points, transverse friction, and active release techniques, as well as novel myofascial release techniques with the hands or IASTM Tools, have been linked to an improvement in range of motion and functional enhancement of the patient primarily in terms of peripheral joint range of motion.

This study aimed to study the effects of IASTM on PML and SM of back, trunk ROM, and joint sense proprioception in mechanical low back ache patients. Specifically, the purpose of this study was to determine whether there is a functional interface between the myofascial structures of the line that is likely to impact the functional capacity of distant anatomical structures.

The cumulative effect of the Ergon® IASTM Technique application on flexibility adaptations over 2 weeks, which corresponds to the duration of a typical musculoskeletal rehabilitation program, was one of the novel aspects of this study. The flexion and extension range of motion improved in group receiving IASTM on PML as compared to other group. The finding is supported by the findings of Gerogrery C. et al stating the improved range of motion of lumbar, after application of IASTM. Maria S. et al. (2020) also compared three soft tissue therapies, such as IASTM, foam rolling, and stretching, on the hip adduction range of motion and conclude that the IASTM technique is more effective than foam rolling and stretching at the application site.

After 2 weeks of application on IASTM in 2 different ways both the groups have shown improvement in flexion, extension but IASTM when applied on PML shown better improvement as with a higher proportion of mild pain and range of motion and a lower proportion of moderate and severe pain in group A compared to group B. Jeong-Hoon Lee et.al has also found that IASTM technique is useful for increasing the range of motion and decreasing pain for patients in low back pain.

Specifically, IASTM may improve range of motion and joint mechanics, decrease muscle tension and spasm, and increase blood flow and tissue oxygenation. Research has also suggested that IASTM may stimulate the nervous system and promote the release of endogenous opioids, such as endorphins, which can provide pain relief and improve mood. In addition, IASTM may stimulate the production of growth factors and cytokines, which can enhance tissue repair and regeneration.

The back pain in mechanical low back ache patients was significantly better in both the groups after 2 weeks of treatment with IASTM but the group where the IASTM was applied over the PML improved better as compared to other group. The pain reduction might be due stimulating the release of endogenous opioids, such as endorphins, which can provide pain relief and improve mood. IASTM may stimulate the nervous system and promote the release of endogenous opioids, which can reduce pain sensation and promote a sense of well-being.

The findings of the present study are IASTM on entire posterior meridian line produced better results with respect to pain, joint sense proprioception, range of motion and flexibility of lumbar spine. IASTM is a newly advance technique for soft tissue mobilization to relieve myofascial adhesions, borders, tightness, fibrous nodule and scar tissue more effectively and can reach the tissues deeper in the body where the hands are not capable of reaching that effectively. Tafa et. al(2019) claimed that application of the technique on the superficial back myofascial line, which found that the Ergon IASTM treatment of both upper and lower part of the PML led to a significant increase in hamstring flexibility after four sessions spread over four weeks.

CONCLUSION

The study used a crossover design to compare IASTM on the posterior meridian line (PML) and specific muscle (SM). In Arm 1, both groups showed similar improvements in flexibility and ROM flexion, but the PML group had significantly better joint position sense (JSP) in flexion. In Arm 2**,** the PML group showed significantly greater gains in flexibility, ROM flexion, and extension than the SM group. JSP in side flexion remained unchanged in both arms. Overall, PML treatment was more effective than SM in improving flexibility and ROM.

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