Journal of Bodywork & Movement Therapies 24 (2020) 63–70

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

Myofascial Pain and Treatment

Short-term effect of muscle energy technique and mechanical diagnosis and therapy in sacroiliac joint dysfunction: A pilot randomized clinical trial

Saumya Srivastava [a, **], Dhanesh Kumar K U [a], Harramb Mittal [b, *], Snehil Dixit [c], Aishwarya Nair [a]

[a] Nitte Institute of Physiotherapy, Nitte (deemed to be) University, Mangalore, Karnataka, 575018, India
[b] Department of Trauma and Orthopedics, Kanachur Institute of Medical Sciences, Mangalore, Karnataka, India
[c] Department of Medical Rehabilitation Sciences, King Khalid University, Saudi Arabia

ARTICLE INFO

Article history:
Received 30 April 2019
Received in revised form
2 February 2020
Accepted 17 February 2020

Keywords:
Algometer
Manual therapy
McKenzie
Low back pain
Sacroiliac joint derangement
Dysfunction
Post-isometric relaxation

ABSTRACT

Introduction: Sacroiliac joint dysfunction (SIJD) is a prominent source of pain in low back pain (LBP) patients. Tenderness inferior to the posterior superior iliac spine (PSIS) is an important sign presented in SIJD. Techniques including muscle energy technique (MET) and mechanical diagnosis and therapy (MDT) have shown benefits in SIJD. However, the effects of these treatments on tenderness and pain around the PSIS are yet to be determined.
Aim: Compare and examine the preliminary short-term effect of MET and MDT on tenderness and pain around the PSIS in SIJD.
Methods: Twenty patients, aged between 20 and 65 years and diagnosed with unilateral, sub-acute, or chronic SIJD, were screened for the inclusion criteria and were randomly allocated to the MET or the MDT group. Both the groups received treatment for four sessions over one week. Pain pressure threshold (PPT) and visual analogue scale (VAS) were determined by a blinded assessor on pre- and post-treatment basis.
Results: Although no significant differences were observed following the treatment between the groups, some statistically significant ($p < 0.05$) improvements were observed within each of the groups. No drop-outs and no adverse events were reported.
Conclusion: The findings of the study suggest that both interventions may be equally effective in reducing symptoms around the PSIS. However, due to the small sample size, the results need to be interpreted cautiously. Future studies on larger sample size and long-term follow up are warranted.

1. Introduction

Sacroiliac joint dysfunction (SIJD) is a state of mal-aligned position of the innominate or the pelvic bone, which may or may not produce pain (Laslett, 2008). The prevalence of SIJD ranges approximately from 13% to 30% globally and 16%–17% in Indian patients with low back pain (LBP) (Arab et al., 2009; Srivastava et al., 2018b). SIJD is often an underrated source of LBP (van Leeuwen et al., 2016). During weight-bearing, the asymmetrical load imposed on the tissues of the lumbar and thoracic spine in case of mild dysfunction of the sacroiliac joint (SIJ) can lead to pain (Fryer, 2011). Even though the dysfunction may initially not cause pain, the stress exerted on structures can gradually irritate in the early stages and later increase the hypersensitivity of the nociceptive fibers of the nerve that supplies these structures (Schamberger, 2013). Such abnormal stress may lead to reduced mobility of the structure and render them as a source of increasing pain (Schamberger, 2013). SIJD can be a result of inflammation, trauma, positional faults, hypo-mobility, muscular imbalances, mal-alignment of the pelvis, joint locking, or derangement (Clavel, 2011; Cohen, 2005; Donatelli and Wooden, 2009; Horton and Franz, 2007).

Physiotherapists have a wide range of options in managing SIJD that include electrotherapy, massage, aerobic exercises, bracing, manipulation, mobilization, patient education, and kinesiotaping

* Corresponding author.
** Corresponding author.
E-mail addresses: saumyasri2000@nitte.edu.in (S. Srivastava), dr_harramb@yahoo.co.in (H. Mittal).

https://doi.org/10.1016/j.jbmt.2020.02.017
1360-8592/

(Al-subahi et al., 2017). For decades, manual therapy has been utilized in treating various musculoskeletal conditions (Bialosky et al., 2009; Clar et al., 2014). Manual therapy techniques that are frequently incorporated in the treatment of SIJD include Manipulation, Kinesiotaping, Muscle Energy Technique (MET), McKenzie, Maitland's mobilization and, Mulligan's mobilization (Al-subahi et al., 2017; Alkady et al., 2017; Bindra, 2013; Horton and Franz, 2007; Rana et al., 2009; Srivastava et al., 2018a).

Among the abovementioned techniques, MET is a popular manual therapy used amongst physiotherapists, osteopaths, and medical practitioners. MET is an active treatment procedure which involves the voluntary contraction of the patient's muscle in a precisely controlled direction at varying levels of intensity against a counterforce applied by the therapist (Wilson et al., 2003). It is known to mobilize a restricted joint, increase the length, and strength of the muscle, and reduce edema locally (Wilson et al., 2003). Previous studies have found benefits of MET in LBP due to SIJD (Joshi et al., 2017; Sharma and Sen, 2014). A study compared MET with mobilization in SIJD and found reduction in pain and disability when determined on VAS and Modified Oswestry Disability Index (MODI), respectively (Sharma and Sen, 2014).

Mechanical Diagnosis and Therapy (MDT) is popularly known as McKenzie exercise and is a well-recognized manual therapy technique, which was initially developed to treat conditions related to the spine. The method employs repeated movements in the assessment and management of dysfunction of the spine or the extremities. MDT assessment breaks down dysfunction of the patient into derangement, dysfunction, postural syndrome, or other categories. Derangement is one of the most common syndromes and is defined as a state of disturbance in the normal resting position of the affected joint surfaces. It could be caused by the displacement of an articular tissue, which can produce pain and potentially lead to an asymmetrical alignment of the joint (McKenzie and May 2003). Using the principles of McKenzie, the assessment of SIJD is carried out by performing the active anterior or posterior rotation of the innominate on the painful side. Patients with the derangement syndrome exhibit a directional preference (i.e., movement of innominate in a particular direction exacerbates or alleviates the symptoms). The movement that reduces the symptoms becomes the treatment of choice for the patient (McKenzie and May 2003). MDT has been found favorable in treating LBP resulting from the pathology of the lumbar and SIJ (Horton and Franz, 2007; Lam et al., 2018). A case report found MDT to be an effective approach in addressing derangement in SIJD (Horton and Franz, 2007).

Generally, in clinical practice, the examination and diagnosis of SIJD are conducted by applying both motion-palpation and pain provocation tests. Cibulka and Koldehoff in 1999 found that a cluster of three positive tests out of four tests of symmetry and movement (i.e., heights of the posterior superior iliac spine (PSIS), standing flexion test, prone knee flexion test, and supine to long sitting test) can be helpful in the diagnosis of SIJD. The sensitivity and the specificity of the aforementioned tests were found to be 0.82 and 0.88, respectively (Cibulka and Koldehoff, 1999). In another study, Laslett et al., in 2005 demonstrated that a reliable diagnosis of SIJ pain could be established when two out of four pain provocation tests (i.e., compression, distraction, sacral thrust, and thigh thrust test) are positive. They reported a specificity of 0.78 and a sensitivity of 0.88 for the tests (Laslett et al., 2005). Various studies have insisted on utilizing a cluster of tests instead of depending on a single test for diagnosing SIJD (Byrd et al., 2017; Fryer, 2011, 2000; Peace and Fryer, 2004). The likelihood and reliability of the diagnosis of SIJD can be improved by combining motion-palpation and pain provocation tests (Byrd et al., 2017; Fryer, 2011, 2000; Peace and Fryer, 2004).

A typical clinical sign is demonstrated by patients with SIJD wherein they use their index finger to point the focal location of tenderness and pain around the PSIS (Fortin and Falco, 1997). Tenderness inferior to the PSIS is one of the most prominent signs that can lead to the diagnosis of SIJD (Petersen et al., 2017; van Leeuwen et al., 2016). A finger pressure test is traditionally used to examine the tenderness around the PSIS. However, this method is dubious for interpretation, as the pressure exercised by the finger cannot be standardized. Pain Pressure Threshold (PPT) is the level at which a non-painful pressure stimulus develops into a noxious pain sensation. Algometer is a tool with moderate to good reliability (ICC 0.60–0.82), which objectively quantifies the tenderness or PPT of the SIJ (van Leeuwen et al., 2016).

Prior studies have primarily focused on the overall pain and disability caused globally by SIJD. Despite the sign of tenderness around the PSIS being considered as a crucial test in diagnosing SIJD, no studies to date have been conducted to determine the impact of treatment, specifically around the PSIS in SIJD. Accordingly, the present study aims to compare and obtain preliminary evidence of the short-term effect of MET and MDT on tenderness and pain around the PSIS in SIJD.

2. Materials and methods

The pilot randomized clinical trial was conducted between March 2016 and June 2016 at the department of physiotherapy of a tertiary care hospital in Mangalore, India. The study was approved by the central ethical committee of Nitte (Deemed to be) University. The trial was registered in ctri.nic.in with the registration number: CTRI/2016/11/007501.

2.1. Participants

Forty-five patients with unilateral backache were screened by a specialized physician for the presence of SIJD and were referred to the physiotherapy outpatient department. To be eligible for inclusion, patients had to (1) be between 20 and 65 years old; present with (2) subacute or chronic symptoms; (3) pain below L5 level; (4) pain around PSIS; (5) asymmetric level of iliac crest; (6) two out of four positive tests of pain provocation (i.e., distraction, compression, thigh thrust and sacral thrust test) (Laslett et al., 2005); (7) three out of four positive tests of motion-palpation (i.e., test of height of PSIS, standing flexion, prone knee flexion and supine to long sitting test) (Cibulka and Koldehoff, 1999); and (8) patients should exhibit the directional preference during MDT assessment.

Patients were excluded if they were presented with (1) midline or bilateral back pain, (2) lumbar disc-related pain, (3) pain above L5 level, and (4) radiculopathy. Screening of the lumbar spine was conducted by McKenzie assessment of the spine. Patients were also excluded if they reported (5) lumbar stenosis, (6) listhesis, (7) true limb length discrepancy, (8) scoliosis, (9) SIJD in pregnant females, (10) systemic illness like rheumatoid arthritis or ankylosis spondylitis, (11) hip or lower limb pathology or fracture, and (12) hospitalization due to severe trauma. Written consent was obtained from all eligible patients. The patients also stated that they were not undergoing any other treatment during the conduct of the present study. Patients were allowed to continue their prescribed medications.

2.2. Randomization

A permuted block randomization plan was developed from www.randomization.com by a therapist who was not involved in the present study. The allocation was concealed by using the Sequentially Numbered Opaque Sealed Envelope (SNOSE) method. Eligible patients were assigned to the treatment groups (MET or MDT). The blueprint of the study is displayed in the Consolidated Standards of Reporting Trials (CONSORT) flow chart (see Fig. 1).

2.3. Intervention

All interventions were delivered by a certified manual therapist with six years of experience in LBP and pelvic dysfunctions, and certification in MDT Level A (Lumbar spine), certified by the McKenzie Institute, India. Patients in both groups received four treatment sessions over one week.

2.4. Muscle energy technique (MET)

The patients were treated for either anterior or posterior rotated innominate which was identified by performing motion-palpation tests (i.e., the test of the height of PSIS, standing flexion, prone knee flexion and supine to long sitting test) during the preliminary screening.

Technique for anterior innominate: The therapist stood on the side of the anterior rotated innominate of the patient lying in supine. The hip and knee of the affected side were flexed until the barrier (i.e., the very first sign of perceived resistance, much before any discomfort is reported) was felt. The patient was then instructed to extend the hip isometrically against the therapist's shoulder for 7 s (see Fig. 2a).

Technique for posterior innominate: The patient was laid in a supine position, and the therapist stood on the side of the posterior rotated innominate. The affected side's leg was placed outside the couch, and the hip was pushed by the therapist into the extension to achieve a barrier. The patient was then instructed to flex the hip isometrically against the therapist's palm placed over distal femur for 7 s (see Fig. 2b).

2.5. Mechanical diagnosis and therapy (MDT)

The patients in the MDT group received either repeated anterior or posterior rotation of the innominate according to their directional preference on the painful side.

Anterior rotation of innominate: The patient maintained a lunge position with the painful side's knee on the ground, and the other leg placed forward. The patient was then instructed to shift the body weight forward onto the front (unaffected) leg to cause end-range hip extension on the painful side for ten repetitions (see Fig. 3a).

Posterior rotation of innominate: The patient was positioned in supine lying with the painful side's hip and knee kept in the bent position. The patient was then instructed to lift the same leg actively and with the help of both hands pull the knee towards the chest to cause end-range hip and knee flexion on the painful side for ten repetitions (see Fig. 3b).

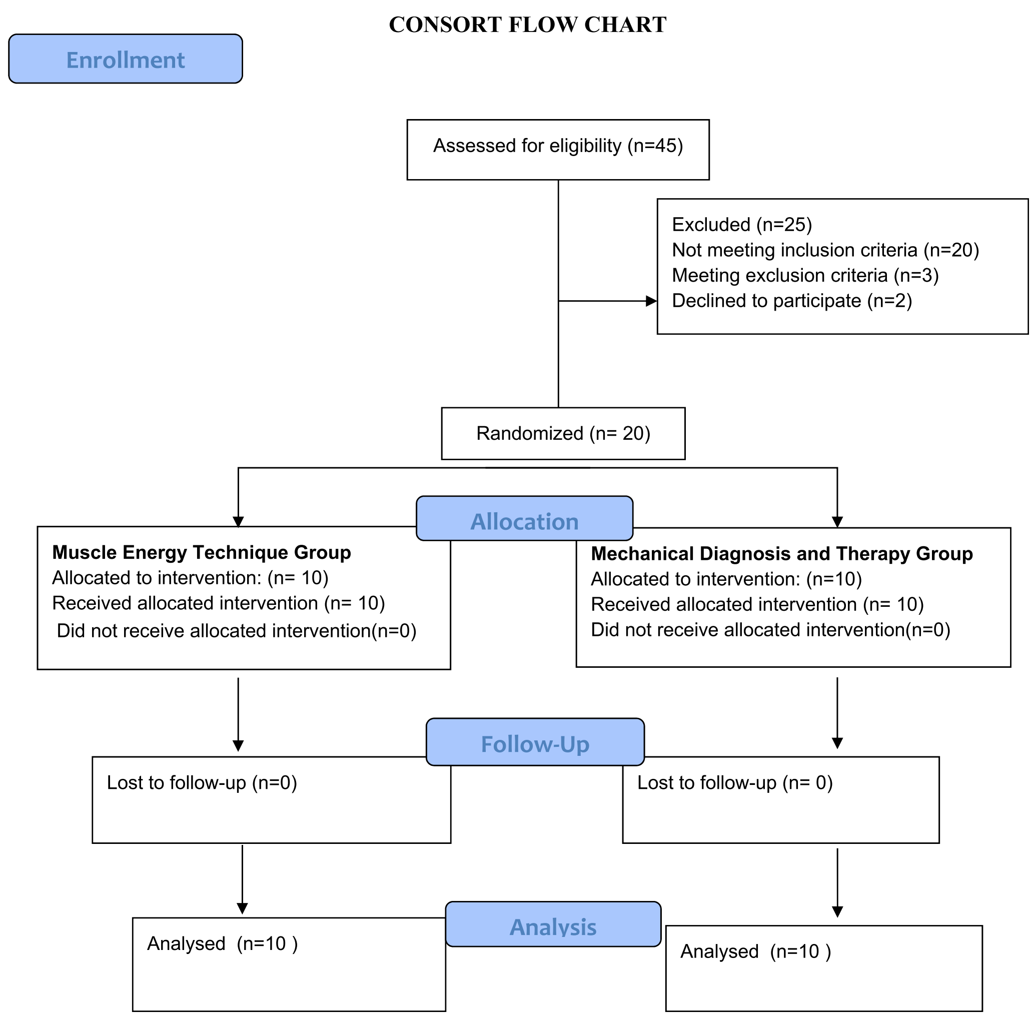

Fig. 1. CONSORT flow diagram of the study.

Fig. 2a. MET for correcting Anterior innominate- Therapist applies force by pushing the thigh on the painful side towards the patient's chest while the patient applies an equal and opposite force towards the therapist's shoulder (indicated by the double-sided arrow).

Fig. 2b. MET for correcting Posterior innominate- Therapist applying a downward force on the distal thigh of the painful side while the patient resists with an equal and opposite force in the upward direction (indicated by the double-sided arrow).

Fig. 3a. Anterior rotation of innominate: 1) Starting position **2)** Patient shifts the weight forward (indicated by the arrow) onto the non-painful side to cause hip extension on the painful side. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Fig. 3b. Posterior rotation of innominate- The patient actively performs end-range hip and knee flexion (indicated by the arrow) to the chest on the painful side.

MDT group patients were advised to repeat the exercises after every 2 or 3 h, for three to five times a day. However, no measures were taken to assess their compliance.

Both MET and MDT groups received three repetitions within a gap of 1 min. The total duration taken in administering both the techniques was 5–10 min.

2.6. Outcomes

The outcome measures were assessed by a researcher who was unaware of the treatment received by the patients. PPT and VAS parameters were recorded before the intervention and at the end of the fourth session.

PPT is an objective tool used to quantify tenderness. The instrument devised for this purpose is algometer. The patients maintained a prone position, while the therapist exerted an axial force by placing the probe of the algometer 1 cm inferior to the PSIS, for assessing the tenderness of PSIS as a whole. Patients were asked to report the first pain perceived on force application. This procedure was repeated three times with a duration of 1 min between each attempt, and the mean was considered as the final score. The force measurements were recorded in Newton. The VAS was used to assess the overall pain perception. It consists of a 10 cm line, where 0 signifies no pain and 10 signifies the worst pain. Patients were required to mark a point on the line to indicate the severity of their current pain.

2.7. Data analysis

All statistical analyses were completed using the Statistical Package for Social Science (SPSS) version 16.0. The level of significance (p) of <0.05 was considered to be statistically significant, with a 95% confidence interval. Sandvik et al., in 1996 proposed using minimum twenty subjects for a pilot study (Sandvik et al., 1996). The sample size of the present study was 10 in each group. Data normality was tested using the Shapiro-Wilk test. Mann-Whitney U test was used to compare the age between the groups. Fisher's exact test was used to analyze and compare the gender distribution, side, and type of dysfunction between the groups. As the data was not normally distributed, the analysis was done by using nonparametric tests. Within the group, the analysis was done by comparing pre- and post-values using the Wilcoxon Signed-Rank test. The analysis was done between the groups using the Mann-Whitney *U* test.

Table 1
Baseline characteristics of patients in MET and MDT group.

VARIABLES	MET GROUP	MDT GROUP	P VALUE
AGE (year) MEAN (±SD)	31.80 (8.62)	41.20 (12.07)	0.06
GENDER (MALE/FEMALE)	4/6	4/6	0.67
SIDE (LEFT/RIGHT)	2/8	4/6	0.63
ANTERIOR/POSTERIORINNOMINATE	6/4	6/4	0.67
PPT (Newton) MEAN (±SD)	20.20 (9.33)	13.08 (7.46)	0.14
VAS (cm) MEAN (±SD)	8.34 (0.89)	6.91 (1.74)	0.05

PPT: Pain Pressure Threshold; VAS: Visual Analogue Scale; MET: Muscle Energy Technique; MDT: Mechanical Diagnosis and Therapy.

3. Results

A total number of 45 patients with LBP were screened. Of 22 potentially eligible patients who fulfilled the inclusion criteria, 20 (91%) SIJD patients were recruited with a recruitment rate of approximately 5 patients per month and randomized to either the MET group or the MDT group. Two patients were not willing to participate due to the distance required to travel for the study treatment. No patients were lost to follow-up. All of the 20 patients completed the scheduled four sessions of intervention. No adverse events were reported during the study.

The baseline characteristics of patients assigned to both the groups at the beginning of the study are presented in Table 1. No significant differences were observed in the baseline parameters. Mann-Whitney U test showed no significant difference ($p>0.05$) in age (Table 1). Fisher's exact test reported a non-significant difference in ($p > 0.05$) gender distribution, side, and type of dysfunction between both the groups (Table 1). A Wilcoxon Signed-Rank test showed that post-intervention scores of PPT were significantly higher than the pre-intervention PPT in MET group ($Z = 2.52$, $p < 0.05$) and MDT group ($Z = 2.80$, $p < 0.05$) (Table 2). A Wilcoxon Signed-Rank test indicated that there was a significant difference between pre- and post- VAS scores in MET group ($Z = 2.53$, $p < 0.05$) and MDT group ($Z = 2.70$, $p < 0.05$) (Table 2). A Mann-Whitney *U* test showed that there was no significant difference between the two groups after intervention in the outcome measures PPT ($U = 0.265$, $p > 0.05$) and VAS ($U = 0.191$, $p > 0.05$) (Table 3).

4. Discussion

SIJD is a widely accepted cause of LBP. However, a standard treatment technique is still lacking (Kamali et al., 2019). The present pilot randomized clinical trial was conducted to explore preliminary evidence of the short-term effect of MET and MDT on patients with SIJD. The outcome measures used were PPT and VAS. The results of the present study suggest that both MET, and MDT may be effective in reducing tenderness (PPT) and pain (VAS) around the PSIS in SIJD after four treatment sessions. Bindra in 2013 compared MET with conventional physiotherapy, on patients with chronic LBP due to SIJD. The study reported significant

Table 2
Comparison of PPT and VAS within the groups before and after the intervention.

VARIABLES	GROUP	PRE/POST	MEAN (±SD)	MEDIAN	IQR		P VALUE	EFFECT SIZE
					LOWER LIMIT	UPPER LIMIT		
PPT (Newton)	MET	PRE	20.20 (9.33)	19.50	11.01	27.13	0.01*	0.49
		POST	31.09 (12.65)#	28.36	21.24	45.22		
	MDT	PRE	13.08 (7.46)	15.95	4.13	17.97	0.01*	0.83
		POST	22.23 (7.96)#	20.20	17.95	29.57		
VAS (cm)	MET	PRE	8.34 (0.89)	8.30	7.47	9.05	0.01*	0.75
		POST	4.09 (3.24)**	3.75	1.87	5.60		
	MDT	PRE	6.91 (1.74)	7.25	5.00	8.40	0.01*	0.71
		POST	2.42 (2.37)**	2.35	0.00	5.02		

PPT: Pain Pressure Threshold; VAS: Visual Analogue Scale; MET: Muscle Energy Technique; MDT: Mechanical Diagnosis and Therapy; IQR: Inter quartile range; *P < 0.05 denotes significant difference; #increase in PPT scores signifies improvement and vice versa; **decrease in VAS scores signifies improvement and vice versa.

Table 3
Comparison of PPT and VAS between the groups.

VARIABLES	GROUP	MEAN DIFFERENCE (±S.D)	MEDIAN CHANGE	IQR CHANGE		P VALUE	EFFECT SIZE
				LOWER LIMIT	UPPER LIMIT		
PPT (Newton)	MET	10.90 (11.6)	−9.35	−13.57	−1.05	0.79	0.011
	MDT	9.20 (4.5)	−9.30	−12.70	−6.05		
VAS (cm)	MET	4.3 (2.6)	4.10	2.95	6.36	0.85	0.002
	MDT	4.5(3.0)	4.95	2.67	6.07		

PPT: Pain Pressure Threshold; VAS: Visual Analogue Scale; MET: Muscle Energy Technique; MDT: Mechanical Diagnosis and Therapy; IQR: Inter quartile range.

improvement ($p < 0.01$) in VAS and disability scale in both intervention groups, following six treatment sessions. Sharma and Sen in 2014 compared the effect of MET with the mobilization technique on VAS and disability scale. The study concluded that both interventions were equally effective in reducing pain and disability. We also demonstrated a reduction in VAS in accordance with the abovementioned studies.

A typical muscle imbalance pattern is seen in patients with SIJD. Tightness develops in lower extremity muscles including the iliopsoas, quadratus lumborum, piriformis, gluteus maximus, hamstrings, and tensor fascia latae, and weakness occurs in gluteus maximus, oblique abdominals, multifidus, and vastus medialis oblique (Slipman et al., 2001). Hypo-mobility or locking is one of the most frequent causes of the mal-aligned position of SIJ (Brolinson et al., 2003). The following sequence of events is hypothesized. Tight muscles can potentially lock the joint in an abnormal position and restrict the motion of the SIJ. With time, the mal-aligned position of the innominate exerts stress on the structures surrounding the joint. This may further irritate the nociceptors of the nerve supplying these structures, thereby producing pain. Tight hamstrings or gluteus maximus and iliopsoas or rectus femoris lock the innominate in posterior or anterior rotation, respectively (Schamberger, 2013).

In the present study, MET was provided for tight hamstrings or gluteus maximus or iliopsoas or rectus femoris. The MET technique produces reflex muscle relaxation after an isometric contraction. Following MET administration, the tightness of the muscles could have been relieved, and the aberrant position of the innominate would have been corrected and subsequently improving the symptoms. A randomized controlled trial compared MET with G.D Maitland's mobilization in SIJD for six sessions. The study concluded that VAS was significantly improved in the MET group (Rana et al., 2009). Another pilot clinical trial demonstrated an immediate improvement (single session) in VAS after applying MET to hamstrings and iliopsoas muscle in patients with lumbopelvic pain (Selkow et al., 2009). The results of our study are in accordance with the aforementioned studies. MET also helps in reducing tenderness and pain according to the Pain Gate Control theory (Fryer, 2000). The mechanoreceptor afferent information carried by the large diameter axons inhibit the nociceptor afferents at the dorsal horn, thereby helping in suppressing the pain symptoms (Fryer, 2000). A recent study by ElGendy et al., 2017 compared thrust manipulation with MET in mechanical LBP and found an immediate significant increase in PPT values and decrease in VAS in both groups after a single session of intervention. Accordingly, our present study also demonstrated an increase in PPT values and a decrease in VAS after the administration of MET. However, our study was specifically conducted on patients with LBP due to SIJD. Similar to our present findings, a case report by Srivastava et al., in 2017 also reported a significant increase in PPT, decrease in VAS and disability in SIJD after four sessions of MET (Srivastava et al., 2017).

Derangement is one of the causative factors leading to SIJD (Donatelli and Wooden, 2009). Both internal and external derangements can lead to SIJD. Internal derangement can occur suddenly in any of the articulating surfaces. However, internal derangement observed in the SIJ is different from that occurring in cervical and lumbar regions and is merely due to the absence of nucleus pulposus gel. Internal derangement in SIJ could be due to the impingement of the synovial membrane or articular cartilage. This could be one of the causes of pain and locking (McKenzie and May 2000). Other factors that could lead to internal derangement are formation and entrapment of loose bodies or intra-articular adhesions (Donatelli and Wooden, 2009). Horton and Franz in 2007 hypothesized in their case study that the MDT technique helps in displacing the entrapped debris during repeated movements; thus reducing pain and improving the mobility of the SIJ. In accordance with the abovementioned hypothesis (Horton and Franz, 2007), we also believe that repeated anterior or posterior rotation of the innominate could have reduced the derangement by displacing the obstructing loose bodies or intra-articular adhesions. The findings from our study are also in agreement with a previously conducted research which found significant improvement in PPT and VAS following MDT in SIJ pain patients (Srivastava et al., 2018a).

There is limited conceptual evidence of MDT's effect on the musculofascial system (Szulc et al., 2015). However, a clinical trial reported an immediate improvement in hamstrings length following McKenzie's knee to chest exercise (Dhargalkar et al., 2017). We also speculate that there was a resolution of tight hamstrings or iliopsoas while performing repeated movements, consequently unlocking the joint (improving its mobility) and resulting in the correction of the dysfunction.

The current pilot clinical trial also gives evidence of excellent recruitment (91%) and adherence rates. Both MET and MDT required minimal assistance from the therapist.

In accordance with previous studies (Schenk et al., 2014; Selkow et al., 2009; Shah and Kage, 2016), we found that both techniques took less time to administer (5–10 min). Since no adverse effects were reported by the patients, the interventions can be safely prescribed. The present study lays down a base for a larger clinical trial.

4.1. Limitations

The potential pitfalls of the present study are the low sample size and the lack of long term follow up to determine the effect of MET and MDT in patients with SIJD. Due to the small sample size, the baseline VAS and age between the groups are approaching a significant difference, which may have impacted the results. Also, this study did not collect information on adherence to the home exercise program in the MDT group. Including MDT assessment during the preliminary screening (regardless of the treatment groups) could have favored the recovery of MDT group. This could have been a potential bias as MDT is the same system of evaluation and treatment.

4.2. Future scope

Future studies can incorporate a placebo-controlled group to analyze the true effect of both the treatment approaches in SIJD. Additionally, studies with larger sample size and long-term follow up are warranted. There is no consistency in the literature regarding the optimal number of sessions, frequency and duration for administering MET and MDT; future studies can standardise these parameters.

5. Conclusion

The results of the clinical pilot study suggest that MET and MDT had similar positive short-term outcomes. The techniques may significantly reduce tenderness and pain around the PSIS in SIJD patients after four sessions. Considering that this is a pilot randomized clinical study, the results are promising, however a randomized clinical trial should be performed with a larger sample size to validate the efficacy of the interventions.

6. Clinical relevance

- The current study will guide practitioners in replicating the techniques and help in providing appropriate treatment for SIJD.
- A relatively small number of sessions of MET and MDT interventions may result in significant improvement in symptoms in SIJD patients.
- Both the techniques take less time to administer (5–10 min) and when indicated, can be achieved without causing further harm to the patients.

Funding

None

Declaration of competing interest

Authors report no conflict of interest.

CRediT authorship contribution statement

Saumya Srivastava: Conceptualization, Methodology, Writing - original draft, Writing - review & editing. **Dhanesh Kumar K U:** Conceptualization, Methodology, Supervision. **Harramb Mittal:** Data curation, Visualization, Writing - original draft, Writing - review & editing. **Snehil Dixit:** Software. **Aishwarya Nair:** Writing - review & editing.

Acknowledgements

We sincerely thank all the patients who participated in the study.

References

Al-subahi, M., Alayat, M., Alshehri, M.A., Helal, O., Alhasan, H., Alalawi, A., Takrouni, A., Alfaqeh, A., 2017. The effectiveness of physiotherapy interventions for sacroiliac joint dysfunction: a systematic review. J. Phys. Ther. Sci. 29, 1689–1694. https://doi.org/10.1589/jpts.29.1689.

Alkady, M.S., Kamel, M.R., AbuTaleb, E., Lasheen, Y., Alshaarawy, A.F., 2017. Efficacy of Mulligan mobilization versus Muscle energy technique in chronic sacroiliac joint dysfunction. Int. J. Physiother. 4, 311–318.

Arab, A.M., Abdollahi, I., Joghataei, M.T., Golafshani, Z., Kazemnejad, A., 2009. Inter- and intra-examiner reliability of single and composites of selected motion palpation and pain provocation tests for sacroiliac joint. Man. Ther. 14, 213–221. https://doi.org/10.1016/j.math.2008.02.004.

Bialosky, J.E., Bishop, M.D., Price, D.D., Robinson, M.E., George, S.Z., 2009. The mechanisms of manual therapy in the treatment of musculoskeletal pain: a comprehensive model. Man. Ther. 14, 531–538. https://doi.org/10.1016/j.math.2008.09.001.

Bindra, S., 2013. A study on the efficacy of muscle energy technique as compared to conventional therapy on lumbar spine range of motion in chronic low back pain of sacroiliac origin. Hum. Biol. Rev. 2, 336–348.

Brolinson, P.G., Kozar, A.J., Cibor, G., 2003. Sacroiliac joint dysfunction in athletes. Curr. Sports Med. Rep. 2, 47–56. https://doi.org/10.1249/00149619-200302000-00009.

Byrd, E., May, S., Marsden, J., 2017. The sacroiliac Joint: a survey of the current practice in the United Kingdom. Physiotherapy 103, e26. https://doi.org/10.1016/j.physio.2017.11.184.

Cibulka, M.T., Koldehoff, R., 1999. Clinical Usefulness of a cluster of sacroiliac joint tests in patients with and without low back pain. J. Orthop. Sports Phys. Ther. 29, 83–92. https://doi.org/10.2519/jospt.1999.29.2.83.

Clar, C., Tsertsvadze, A., Court, R., Hundt, G.L., Clarke, A., Sutcliffe, P., 2014. Clinical effectiveness of manual therapy for the management of musculoskeletal and non-musculoskeletal conditions: systematic review and update of UK evidence report. Chiropr. Man. Ther. 22, 1–34. https://doi:10.1186/2045-709X-22-12.

Clavel, A.L., 2011. Sacroiliac joint dysfunction: from a simple pain in the butt to integrated care for complex low back pain. Tech. Reg. Anesth. Pain Manag. 15, 40–50. https://doi.org/10.1053/j.trap.2011.06.002.

Cohen, S.P., 2005. Sacroiliac Joint Pain : a comprehensive review of anatomy, diagnosis, and treatment. Anesth. Analg. 101, 1440–1453. https://doi.org/10.1213/01.ANE.0000180831.60169.EA.

Dhargalkar, P., Kulkarni, A., Ghodey, S., 2017. Added effect of muscle energy technique for improving functional ability in patients with chronic nonspecific low back pain. Int. J. Physiother Res. 5, 2082–2087. https://doi.org/10.16965/ijpr.2017.144.

Donatelli, A.R., Wooden, J.M., 2009. Orthopaedic Physical Therapy. Churchill Livingstone, Edinburgh.

ElGendy, M.H., Karkousha, R.N., Hassan, A.S.E., Mourad, R.R., 2017. Thrust manipulation versus muscle energy technique on somatic dysfunction in mechanical low back pain patients. Int. J. Physiother Res. 5, 2379–2384. https://doi.org/10.16965/ijpr.2017.213.

Fortin, J.D., Falco, F.J., 1997. The fortin finger test: an indicator of sacroiliac pain. Am. J. Orthoped. 26, 477–480.

Fryer, G., 2011. Muscle energy technique: an evidence-informed approach. Int. J. Osteopath. Med. 14, 3–9. https://doi.org/10.1016/j.ijosm.2010.04.004.

Fryer, G., 2000. Muscle energy concepts: a need for change. J. Osteopath. Med. 3, 54–59.

Horton, S.J., Franz, A., 2007. Mechanical diagnosis and therapy approach to assessment and treatment of derangement of the sacro-iliac joint. Man. Ther. 12, 126–132. https://doi.org/10.1016/j.math.2006.06.001.

Joshi, R., Rathi, M., Khandare, S., Palekar, T.J., 2017. Effect of muscle energy technique on pain and function in patients with sacroiliac dysfunction. Int. J. Sci. Res. Educ. 5, 6502–6506. https://doi.org/10.18535/ijsre/v5i06.01.

Kamali, F., Zamanlou, M., Ghanbari, A., Alipour, A., Bervis, S., 2019. Comparison of manipulation and stabilization exercises in patients with sacroiliac joint dysfunction patients: a randomized clinical trial. J. Bodyw. Mov. Ther. 23, 177–182. https://doi.org/10.1016/j.jbmt.2018.01.014.

Lam, O.T., Strenger, D.M., Chan-Fee, M., Pham, P.T., Preuss, R.A., Robbins, S.M., 2018. Effectiveness of the McKenzie method of mechanical diagnosis and therapy for treating low back pain: literature review with meta-analysis. J. Orthop. Sports Phys. Ther. 48, 476–490. https://doi.org/10.2519/jospt.2018.7562.

Laslett, M., 2008. Evidence-based diagnosis and treatment of the painful sacroiliac joint. J. Man. Manip. Ther. 16, 142–152. https://doi.org/10.1179/jmt.2008.16.3.142.

Laslett, M., Aprill, C.N., McDonald, B., Young, S.B., 2005. Diagnosis of sacroiliac joint pain: validity of individual provocation tests and composites of tests. Man. Ther. 10, 207–218. https://doi.org/10.1016/j.math.2005.01.003.

McKenzie, R., May, S., 2003. The Lumbar Spine Mechanical Diagnosis & Therapy. Spinal Publications, New Zealand.

McKenzie, R., May, S., 2000. The Human Extremities: Mechanical Diagnosis and Therapy. Spinal Publications, New Zealand.

Peace, S., Fryer, G., 2004. Methods used by members of the Australian osteopathic profession to assess the sacroiliac joint. J. Osteopath. Med. 7, 26–33.

Petersen, T., Laslett, M., Juhl, C., 2017. Clinical classification in low back pain: best-evidence diagnostic rules based on systematic reviews. BMC Muscoskel. Disord. 18, 1–23. https://doi.org/10.1186/s12891-017-1549-6.

Rana, K., Bansal, N., Savita, 2009. Comparative analysis on efficacy of G. D. Maitland's concept of mobilization & muscle energy energy technique in treating sacroiliac joint dysfunction. Indian J. Physiother Occup. Ther. 3, 18–21. https://doi.org/10.1016/j.physio.2011.04.002.

Sandvik, L., Erikssen, J., Mowinckel, P., Rodland, E.A., 1996. A method for determining the size of internal pilot studies. Stat. Med. 15, 1587–1590.

Schamberger, W., 2013. The Malalignment Syndrome. Churchill Livingston, Edinburgh.

Schenk, R.J., MacDiarmid, A., Rousselle, J., 2014. The effects of muscle energy technique on lumbar range of motion. J. Man. Manip. Ther. 5, 179–183. https://doi.org/10.1179/jmt.1997.5.4.179.

Selkow, N.M., Grindstaff, T.L., Cross, K.M., Pugh, K., Hertel, J., Saliba, S., 2009. Short-term effect of muscle energy technique on pain in individuals with non-specific lumbopelvic pain: a Pilot Study. J. Man. Manip. Ther. 17, 14E. https://doi.org/

10.1179/jmt.2009.17.1.14E.
Shah, S.G., Kage, V., 2016. Effect of seven sessions of posterior- to-anterior spinal mobilisation versus prone press-ups in non-specific low back pain – randomized clinical trial. J. Clin. Diagn. Res. 10 https://doi.org/10.7860/JCDR/2016/15898.7485. YC10–YC13.
Sharma, D., Sen, S., 2014. Effects of muscle energy technique on pain and disability in subjects with SI joint dysfunction. Int. J. Physiother Res. 2, 305–311.
Slipman, C.W., Whyte 2nd, W.S., Chow, D.W., Chou, L., Lenrow, D., Ellen, M., 2001. Sacroiliac joint syndrome. Pain Physician 4, 143–152.
Srivastava, S., Kumar, D.K., Mittal, H., 2017. Effect of Muscle Energy Technique on Upslip and Inflare Dysfunction of Sacroiliac Joint: A Case Report. Indian J. Physiother Occup. Ther. 11, 190–194.
Srivastava, S., Kumar, D.K., Mittal, H., Dixit, S., 2018a. Short-term effect of "mechanical diagnosis and therapy" in the management of sacroiliac joint pain. J. Clin. Diagn. Res. 12, 1–4. https://doi.org/10.7860/JCDR/2018/36200.12020.
Srivastava, S., Singh, A., Kumar, D.K., Mittal, H., 2018b. Prevalence of sacroiliac joint dysfunction among Indian low back pain patients. Indian J. Physiother Occup. Ther. 12, 20–23.
Szulc, P., Wendt, M., Waszak, M., Tomczak, M., Cieślik, K., Trzaska, T., 2015. Impact of McKenzie method therapy enriched by muscular energy techniques on subjective and objective parameters related to spine function in patients with chronic low back pain. Med. Sci. Mon. Int. Med. J. Exp. Clin. Res. : Int. Med. J. Exp. Clin. Res. 21, 2918–2932. https://doi.org/10.12659/MSM.894261.
van Leeuwen, R.J., Szadek, K., de vet, H., Zuurmond, W., Perez, R., 2016. Pain pressure threshold in the region of the sacroiliac joint in patients diagnosed with sacroiliac joint pain. Pain Physician 19, 147–154.
Wilson, E., Payton, O., Donegan-shoaf, L., Dec, K., 2003. Muscle energy technique in patients with acute low back pain. J. Orthop. Sports Phys. Ther. 33, 502–512.