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# The Therapeutic Effects of Muscle Energy Technique on Sacroiliac Dysfunction in Young Women

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## Abstract

**Objectives:** Muscle energy technique (MET) is one of the alternatives for the treatment of joint dysfunctions. Previous studies investigated this technique without considering the kind of dysfunctions. Therefore, the aim of this study was to evaluate the therapeutic effects of MET by considering the type of dysfunction and the direction of the corrective maneuver in women with iliosacral joint dysfunctions.

**Materials and Methods:** This randomized controlled clinical trial included 60 women with anterior innominate or posterior innominate dysfunctions and were randomly divided into the treatment group (n = 30) receiving a session of MET and the control group (n = 30). The range of flexion and extension of the lumbar, visual analogue scale (VAS), active straight leg raising (ASLR), and pressure pain threshold (PPT) at five points were measured before, after, and 24 hours after MET.

**Results:** Before, after, and 24 hours after the intervention, the mean change of the range of lumbar flexion and extension showed an increase. However, the mean change of the level of VAS and ASLR decreased significantly ($P < 0.05$) in the treatment group with corresponding 95% confidence intervals.

**Conclusions:** According to the results of this study, using MET by considering the kind of dysfunction may more efficiently improve a patient's symptoms.

**Keywords:** Muscle energy technique, Sacroiliac dysfunctions, ant innominate, Posterior innominate

## Introduction

Low back pain is a common and costly health problem, the prevalence level of which is up to 30-40% per year so that 60-80% of women are afflicted with this problem at least once in their lifetime (1). It is also indicated that women suffering from sacroiliac joint (SIJ) dysfunctions comprise a large group (up 30%) of patients with low back pain (2).

The high prevalence of the functional disorders of this joint indicates that it is worthwhile to consider it as a subject of investigation.

Vleeming et al confirmed Donatelli's studies representing that understanding and learning the structure and functional disorders of the SIJ are necessary for learning the function of the spine. He stated that the biomechanical role of SIJ in the transferring of the weight to the lower extremity is highly important, and any disruptions in the alignment of the SIJ cause pain and disorders in the joint. Therefore, the treatment based on joint biomechanical corrections can be considered as an appropriate solution for sacroiliac disorders (3).

On the other hand, van Wingerden et al indicated that muscle isometric contraction was necessary for the effective transfer of load from the spine through the pelvis to the legs and their contractions can increase stability on SIJs (4). SIJ dysfunction can be due to sudden or repetitive trauma or imbalance between the muscles around the joint (5).

Muscle Energy Technique (MET) is one of the current therapies to treat joint dysfunctions. In this technique, isometric muscle contraction is applied against an external counter-force to indirectly treat the joint dysfunction via the force exertion of muscles (6).

## Objectives

Previous studies have investigated the positive effects of MET on nonspecific low back pain. Unfortunately, a few studies have assessed the effectiveness of MET on specific SIJ dysfunctions in women and have used a common technique for all patients with different SIJ dysfunctions regardless of the type of dysfunction while the therapists of dysfunctions in the SIJ section should identify the type of dysfunction and its correction (7,8).

Therefore, the aim of this study was the short-term evaluation of the therapeutic effects of MET by considering the type of dysfunction and the direction of the corrective maneuver in women with SIJ dysfunction.

## Materials and Methods

This randomized controlled clinical trial was confirmed by the Ethics Committee of Tehran University of Medical

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**Key Messages**

The results of this study could support evidence of the benefits of MET which includes the following:

- Increase the range of lumbar flexion and extension up to 24 hours.
- Increase the range of internal and external rotations of the hip up to 24 hours.
- Decrease the level of pain (VAS), which these analgesic effects can continue up 24 hours.
- Increase the ability of ASLR up 24 hours.

Sciences (IR.TUMS.VCR.REC.1395.211) and the Iranian Registry Clinical Trial (https://www.irct.ir/trial/27842; identifier: IRCT20171126037633N1).

The women suffering from unilateral SIJ pain for more than one year with a primary diagnosis of lumbosacral disorders by an orthopedic specialist were referred to the researchers. They agreed to participate in this study after completing and signing a consent form and a questionnaire to exclude lumbar pathology. Then, they underwent physical examinations for the diagnosis of functional disorders of SIJ. Sixty 18-40 year-old women (with a mean age of 28.7 years) suffering from anterior innominate or posterior innominate dysfunctions entered the study.

Patients were randomly divided into the treatment group (n=30) receiving MET and the control group (n=30).

### Inclusion and Exclusion Criteria

The women were included in this study if they had anterior or posterior innominate dysfunctions and their levels of current pain were at least three by visual analogue scale (VAS). On the other hand, patients were excluded from the study if any pathology was observed in the lower extremities, the spinal column, and central and peripheral nervous systems.

Several tests were conducted on patients before starting the study, including measuring the distance between umbilicus to anterior superior iliac spine (ASIS), iliac crest height, levelness of posterior superior iliac spines (PSISs), levelness of ASISs, standing flex test, Gillet test, long-sitting test, and provocation test. Likewise, measuring the distance between the umbilicus to ASIS was used for exiting the patients with the in- and out-flare of ilium dysfunctions.

Due to the high reliability and validity of long-sitting and provocation tests for the recognition of anterior innominate or posterior innominate dysfunction, they should be positive (9,10), and three out of five tests of iliac crest height, levelness of PSISs, levelness of ASISs, standing flex test, and Gillet test for the diagnosis of anterior innominate or posterior innominate dysfunction should be positive as well (10,11).

### Protocol

All outcome measures were collected by the same examiner (Examiner 1), who was blinded to treatment group division.

Outcome measurements consisted of the range of flexion and the extension of the lumbar spine, VAS, active straight leg raising (ASLR), and pressure pain threshold (PPT) in five points (i.e., right PSIS, right SIJ, left PSIS, left SIJ, and the right Deltoid).

### Flexion and Extension of Lumbar Spine

The lumbar range of motion was measured using the modified Schober test, which has high validity and inter- and intra-rater reliability (12). These measurements were carried out three times and their mean was used for analysis.

### Visual Analogue Scale

The VAS was used to measure the level of existent pain. It was a 10-cm (100 mm) line and its left end defined no pain (0) and the right end showed the worst pain or extremely severe pain (10). The patients were asked to draw a vertical mark on each line indicating the level of their current pain (13).

### Active Straight Leg Raising

To perform this test, supine patients were requested to lift their extended leg 20 cm off of the table while not moving, laterally bending, or rotating the lower extremity. Based on the patient's ability to perform the motion, the test was scored as follows.

A score of 0 was assigned if patients did the test without any pain or heavy and tremor. A score of 1 was considered if the patient reported that her ability to move was low, but the examiner observed no symptoms of movement disorders such as vibration or rotation of the limb. Further, a score of 2 was given if the patient mentioned that her ability to do the test was low and the examiner also observed the signs of movement disorders such as vibration or rotation of the limb. Finally, a score of 3 was assigned if the patient was unable to do the test (14).

### Pressure Pain Threshold

The PPT was measured by a digital algometer, which is a valid and reliable device for measuring PPT (15). The algometer was vertically placed on 5-points including right SIJ, right PSIS, left SIJ, left PSIS, and the bulk of the right deltoid. The PSISs are touched at 4 cm outside the center line at the level of S2 in the inferior and the depth of skin dimples and SIJs are touched at 2 cm in the lateral and inferior of PSISs (16).

Then, the pressure was applied at a constant speed until the patient started feeling pain at that point, and the number displayed in the algometer at that moment was recorded as well.

Using a random number, the subjects were randomly allocated to the treatment (MET) or control (sham) group by a third person who was unknown to Examiners 1 and 2.

Examiner 2 performed the intervention to the treatment or control group. The control group was placed in the sham position by lying supine on a treatment table. The subjects were also unaware of their allocated group.

### Muscle Energy Technique

In this study, the participating patients received one session of MET. It should be noted that the technique was performed by a physiotherapist with a history of 10 years of manual therapy, and approved and supervised by the study's supervisor.

To correct the anterior innominate rotation, one should use the posterior pelvic muscles to twist the innominate to the posterior. Accordingly, the gluteus maximus muscle was used in this study.

The patient was asked to lay on her back while gangling the healthy lower extremity over the edge of the bed and flexing the hip and the knee of the dysfunctional side. We placed ourselves in front of the patient and fixed her flexed knee with our shoulders and moved the limb to the end of the range. For more stability, we held the edge of the bed on both sides and told the patient to push her knee against our shoulders with sub-maximal isometric contraction so that the force to be 70% of the maximum force and hold it for 7-10 seconds. After the contraction, the patient relaxed, and we immediately flexed the hip again to get a new barrier. This technique was repeated 3-4 times until we felt no barrier. In the end, we returned the limb to the baseline position passively (17).

One should use the anterior pelvic muscles to twist the innominate to the anterior in order to correct the posterior innominate rotation. Therefore, the rectus femoris muscle was applied in this study.

The patient lay supine and the lower extremity of the dysfunctional side dangled over the edge of the bed in such a way that the hip was extended and the knee was flexed while the healthy hip and the knee were flexed and the patient held them with her hands. We stood in front of the patient and put one of our hands on the anterior of the healthy knee and the other hand on the anterior supracondylar region of the dysfunctional side. We pushed the supracondylar region down until we felt a barrier and then asked the patient to push the knee upward opposing the force of our hand with the sub-maximal isometric contraction so that the force to be 70% of the maximum force and hold it for 7-10 seconds. After the contraction, the patient relaxed, and we immediately extended the hip more upward to get a new barrier. This technique was repeated for 3-4 times until no barrier was felt. Finally, we returned the limb to the baseline position passively (17).

It should be noted that the patient's breathing should be relaxed while performing the technique (17).

The functional sacroiliac tests were re-checked immediately after the technique, and the technique was performed on the patient again if the test results were positive. The patient was excluded from the study if the tests were positive again after the re-check. The outcome measurements were determined before, immediately, and 24 hours after MET.

The physical conditions such as room temperature, room lighting, time, and place were the same in all cases. Each patient was also asked the time of her monthly periods, and the techniques were not performed on her in those days.

The scheme and the purpose of the study were fully explained to all participants, and the tests were started only after they signed the informed consent form. At every step, the tests were to be stopped if there was a lack of co-participants. All participants were reassured of the confidentiality of their data and became aware of the possible side effects of the techniques. We assured them to take responsibility in case of any problem and compensate it as much as possible. The informed consent form was obtained from all participants.

SPSS software (version 21) was used to analyze the data, and the one-sample Kolmogorov-Smirnov test was applied to evaluate the normal distribution of the data. Based on the obtained data, the distribution of all variables was normal ($P > 0.05$). Repeated-measured tests demonstrated a statistically significant difference in the variables before, immediately, and 24 hours after the intervention in the study group. The significance level was set at $P < 0.05$.

## Results

Table 1 presents the data of the anthropometric characteristic of 60 participants and demonstrates that there were no statistically significant differences in anthropometric data between the two groups.

The results of the repeated-measure test in both groups are provided in Table 2. As shown, some variables had a significant difference ($P < 0.05$) before, immediately, and 24 hours after the intervention with corresponding 95% confidence intervals.

### Lumbar Flexion and Extension

The average distance between the two skin points during forward bending by the modified Schober test increased significantly at pretest, immediately, and 24 hours after

**Table 1.** Anthropometric Characteristic for MET and Control Groups (Each group n = 30)

| Variables | Group | Mean | SD | Range |
|---|---|---|---|---|
| Age (y) | MET | 28.70 | 6.52 | 18-39 |
| | Control | 29.10 | 5.22 | 18-39 |
| Weight (kg) | MET | 60.50 | 8.36 | 46.0-75.0 |
| | Control | 58.80 | 8.12 | 50.5-68.0 |
| Height (m) | MET | 1.64 | 0.04 | 1.52-1.71 |
| | Control | 1.61 | 0.03 | 1.53-1.69 |
| BMI (kg/m²) | MET | 22.44 | 2.74 | 17.5-27.54 |
| | Control | 23.10 | 2.98 | 7.68-28.11 |

*Note*. MET: Muscle energy technique; SD: Standard deviation; BMI: Body max index.

**Table 2.** The Variation of All Variables Before, Immediately, and 24 Hours After MET in the Treatment and Control Groups

| Variable | Group | Before Mean ± SD | Immediately Mean ± SD | 24 h After Mean ± SD | *P* Value Within-Groups | *P* Value Between-Groups |
|---|---|---|---|---|---|---|
| Lumbar flex (cm) | MET | 20.02 ± 1.06 | 20.77 ± 1.01 | 21.00 ± 1.01 | <0.001 | 0.03 |
| | Control | 19.89 ± 0.93 | 19.98 ± 0.96 | 20.00 ± 1.01 | 0.56 | |
| Lumbar Ext (cm) | MET | 13.6 ± 0.52 | 12.95 ± 0.62 | 12.65 ± 0.58 | 0.005 | <0.001 |
| | Control | 13.40 ± 0.48 | 13.29 ± 0.83 | 13.37 ± 0.48 | 0.63 | |
| ASLR | MET | 2 ± 0.64 | 0.95 ± 0.60 | 0.60 ± 0.598 | <0.001 | 0.000 |
| | Control | 2.89 ± 1.02 | 2.98 ± 0.93 | 3.00 ± 1.03 | 0.93 | |
| VAS | MET | 7.33 ± 1.41 | 5.05 ± 1.70 | 3.85 ± 1.38 | 0.00 | 0.000 |
| | Control | 6.85 ± 1.68 | 7.05 ± 1.59 | 6.89 ± 1.42 | 0.91 | |
| PPT right PSIS (kg/cm²) | MET | 3.71 ± 0.97 | 4.45 ± 1.01 | 4.83 ± 0.95 | 0.64 | 0.28 |
| | Control | 4.29 ± 0.87 | 4.39 ± 0.87 | 4.17 ± 0.96 | 0.58 | |
| PPT right SIJ (kg/cm²) | MET | 4.08 ± 1.18 | 4.84 ± 1.12 | 5.17 ± 1.06 | 0.57 | 0.67 |
| | Control | 3.95 ± 1.12 | 4.35 ± 1.18 | 4.09 ± 1.24 | 0.64 | |
| PPT left PSIS (kg/cm²) | MET | 4.17 ± 0.85 | 4.79 ± 0.75 | 5.11 ± 0.86 | 0.45 | 0.43 |
| | Control | 4.19 ± 0.97 | 4.39 ± 0.99 | 4.26 ± 0.89 | 0.81 | |
| PPT left SIJ (kg/cm²) | MET | 4.30 ± 0.94 | 4.90 ± 0.90 | 5.23 ± 1.01 | 0.34 | 0.68 |
| | Control | 4.79 ± 1.07 | 5.18 ± 0.97 | 4.93 ± 0.89 | 0.57 | |
| PPT right deltoid (kg/cm²) | MET | 4.55 ± 0.85 | 4.99 ± 0.87 | 5.13 ± 0.93 | 0.29 | 0.34 |
| | Control | 4.72 ± 1.02 | 4.93 ± 1.09 | 4.83 ± 0.87 | 0.42 | |

Note. Ext: Extension; MET: Muscle energy technique; ASLR: Active straight leg raising; VAS: Visual analog scale; PPT: Pressure pain threshold; PSIS: Post superior iliac spine; SIJ: Sacroiliac joint.

the test in the MET group, and no significant difference was observed in the control group at pretest, immediately, and 24 hours after the test (Table 2).

However, the average distance between the two skin points during backward bending during the modified Schober test decreased significantly at pretest, immediately, and 24 hours after the intervention and there was no significant difference in the control group at pretest, immediately, and 24 hours after the test (Table 2), implying that the mean change of the range of lumbar flexion and extension significantly increased ($P<0.05$) immediately and 24 hours after the MET compared to the sham position and this growth continued up to 24 hours after the intervention ($P<0.05$), the related data are illustrated in Figures 1A and 1B.

It is notable that decreasing distance between the two skin points during extension indicates the increasing range of extension.

## VAS and ASLR

As per Figure 2A, the mean change of the level of VAS decreased significantly before, immediately after, and 24 hours after the intervention ($P<0.05$) and this decline continued up to 24 hours after the intervention ($P<0.05$) although there was no significant difference in the control group at pretest, immediately, and 24 hours after the test (Table 2).

Based on the data in Figure 2B, the mean score of the ASLR before, immediately after, and 24 hours after the intervention showed a significant decrease immediately after the intervention ($P<0.05$), and this reduction continued up to 24 hours ($P<0.05$) although no significant difference was found in the control group at pretest, immediately, and 24 hours after the test (Table 2).

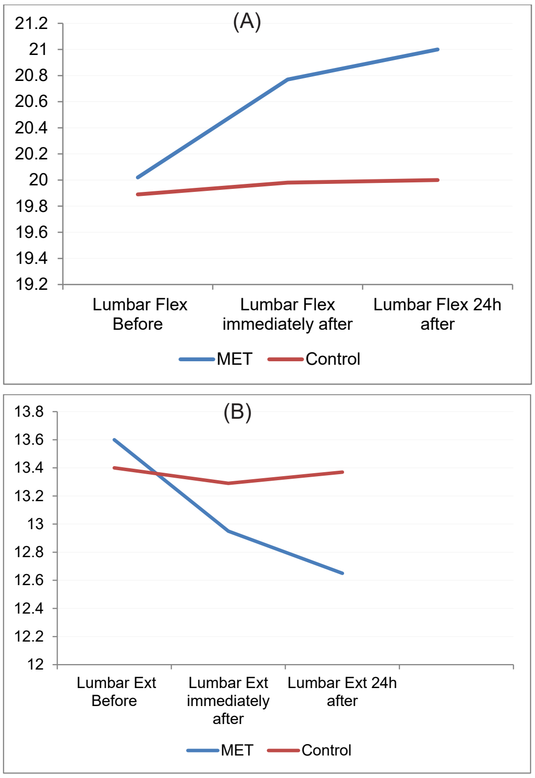


**Figure 1.** Variations in the Range of Lumbar (A) Flexion and (B) Extension Before, Immediately After, and 24 Hours After MET and the Sham position. Note. MET: Muscle energy technique.

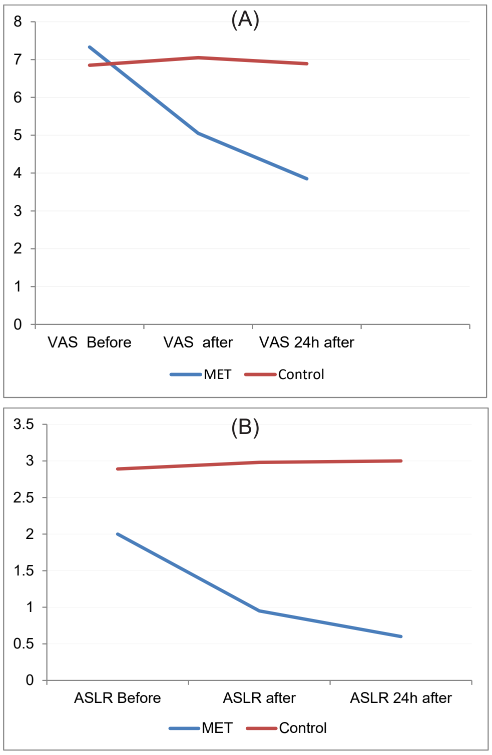


**Figure 2.** Variations of the (A) VAS and (ASLR) Before, Immediately After, and 24 Hours After MET and the Sham Position. Note. VAS: Visual analogue scale; MET: Muscle energy technique.

### Pressure Pain Threshold

The mean change of the outcomes from PPT for the five points, including right PSIS, right SIJ, left PSIS, left SIJ, and right Deltoid revealed that there were no significant differences in both groups immediately after and 24 hours after the intervention ($P > 0.05$).

## Discussion

This study was the first one to determine the range of the flexion and extension of the lumbar spine, VAS, and ASLR, and PPT at the five points before, immediately after, and 24 hours after MET in patients with anterior innominate or posterior innominate dysfunctions.

Based on the results of this study, MET helped relieve the level of pain. This technique also increased the flexion and extension of the lumbar spine while decreasing the mean score of ASLR. The effects of this technique remained up to 24 hours as well. Therefore, the findings showed that this technique can assist people with iliosacral dysfunctions to cope with the symptoms and improve their conditions.

From the biomechanical point of view, an active tension of muscles around the SIJ maybe causes the movement between the coxal bone and the sacrum (e.g., transversus abdominis, piriformis, gluteus maximus, obliquus externus abdominis, M. obliquus internus abdominis, hamstring, and rectus femoris). From these muscles, the gluteus maximus and rectus femoris have more biomechanical effects because of their lines of action and create an effective force (counterforce) on SIJ (18).

Fossum et al claimed that MET may cause neurological and biomechanical effects such as hyperalgesia, altered proprioception, and motor programming, changes in the circulation of blood and lymph fluid, and increased range of motion of the joint in patients who had cervicogenic headache (19).

Researchers such as Chaitow and Crenshaw (20), Franke (21), Greenman (22) have long been using MET to treat osteoarticular disease by focusing on tightened muscles and reduced muscle extensibility in joint dysfunctions. These researchers have applied many MET techniques for the realignment of lumbar and pelvic dysfunctions. In this study, this technique was used for iliosacral dysfunction with evaluated physiological measures such as a range of movement of lumbar joints and pain.

Chaitow and Crenshaw found that relaxation occurred in the affected muscles following MET with an emphasis on segmental muscle contraction and limited joint motion. They proposed that the mechanism of relaxation was related to the inhibition of motor activity through Golgi tendon organs. Following the isometric contraction of the agonist muscle (the muscle that causes movements in the joint), Golgi tendon organs strain and stimulate Ib afferents, and these afferents inhibit the motor neurons of the homonymous muscle and reduce muscle spasms through a feedback circuit (20). On the other hand, antagonist muscles (The muscle that is on the opposite side of the movement axis and acts on the contrary to the agonist muscle) are inhibited after the technique due to reciprocal inhibition, allowing an increase in the range of motion (20). Rowlands and Sheard indicated that MET simultaneously stimulates agonist and antagonist muscles, and this seems to reduce the perception of pain. This technique is better to be carried out before other rehabilitation techniques (e.g., strengthening) for reducing pain (23,24).

In a pilot clinical trial study, Wilson et al assessed the effect of MET on acute low back pain by conducting a common maneuver of the technique for all patients regardless of the kind of the functional disorder. On the other hand, they argued that performing a MET even with a session would reduce the severity of self-reported disability and pain (25). Additionally, Dickenson and Moayedi & Davis reported that MET has analgesic effects due to the Gate-control theory. According to this theory, the excitation of large-diameter axons by mechanoreceptor afferents can cause inhibition in nociceptive afferents at the dorsal horn of the spinal cord (26, 27).

Degenhard et al showed that the concentrations of endogenous pain inhibitors such as encephalin and endorphin increase during MET (28).

The results of our research are in line with those of Dhinkaran et al, indicating that along with corrective exercises, MET is moderately significant over conventional physiotherapy for improving functional ability and decreasing pain by considering the kind of dysfunction (29). The present study also evaluated the ASLR score, and the results revealed that MET can decrease the mean score of ASLR, which may show the realignment of iliosacral dysfunction.

The SIJs are the intermediate ring between the spines. The lower limbs and the pelvis and the presence of any functional dysfunction in SIJs lead to impaired pelvic and lower limbs. Patients with sacroiliac disorder usually have a feeling of slow and heavy movements in activities such as walking and running (14).

Mens et al evaluated the relationship between the ability of ASLR and the mobility of pelvic joints in patients having pelvic girdle pain and dysfunctions. They found that the impairment of ASLR was mainly located on the painful side. Therefore, ASLR could be an appropriate test for the detection of dysfunctions at related pelvic joints (30).

Our findings showed non-significant differences in PPT after MET and the sham position. It seems that studies reporting significant differences in PPT after manual therapy have done these techniques in the upper regions of the spine (31-33). Mechanoreceptor and nociceptor density in the lower region of the spine (lumbar and SIJs) are lower compared to the upper region of the spine (33,34).

What differentiates this study from other studies using MET is the consideration of the kind of dysfunction (anterior innominate or posterior innominate), and the results of this study represented that this kind of treatment may be more efficient in improving patients' symptoms.

## Conclusions

In general, the results of this study could support the evidence on the benefits of MET. It was observed that MET could significantly increase the range of lumbar flexion and extension. In addition, this increase in the range of motion continued for up to 24 hours.

As mentioned earlier, MET could cause hypoalgesia and pain reduction. In this study, it was concluded that the use of MET causes a decrease in the level of pain (VAS). It was further found that the analgesic effect of MET can continue for up 24 hours in the other points of the body. Based on the results of this study, the ability of ASLR increased after MET, and therefore, MET was a non-traumatic intervention that could be an impressive treatment against sacroiliac dysfunctions. Finally, the MET can be used to reduce pain and correct SIJ disorders thus this intervention can be effective for the treatment of patients with SIJ dysfunction.

## Limitations of the study

The low number of patients and the use of only one gender can be termed as the limitations of this study. Therefore, we recommend that future studies repeat this research with a larger number of patients of both genders.

## Suggestion

Future studies should also assess the effects of MET on patients with other joint dysfunctions as well as other techniques.

### Authors' Contribution

AV wrote the manuscript and designed the study. AS developed the original idea and did critical revision of the manuscript for important intellectual content. BAM studied concept and design. Go and MRH contributed to the development of the protocol. ZK did statistical analysis.

### Conflict of Interests

The authors have no personal or financial relationships with other peoples or organizations that could present the potential conflict of interests in their works.

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