International Journal of Multiphysics
Volume 18, No. 4, 2024
ISSN: 1750-9548

# Effect of High-Intensity Laser on Sacroiliac Joint Pain in Adult Women

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**Abstract**

Sacroiliac joint pain is the most common problem affecting females of adulthood age. The aim of this study was to determine the effect of high-intensity laser therapy (HILT), in the treatment of sacroiliac joint pain by assessing 30 female patients who participated in this study, with an average age of 18 to 30 years. Patients were randomly assigned into two groups, Group A (n=15) treated with HILT plus exercises and Group B (n=15) treated with placebo laser plus exercises for 4 weeks (12 sessions). All patients were evaluated before and after the treatment by the visual analog scale for pain, pressure algometry for pressure pain threshold and the Oswestry Disability Questionnaire (ODQ)-Arabic version for functional disability. The results showed a significant decrease in the severity of pain, pressure functional disability and, increase pain threshold in both groups. Comparison between both groups revealed that there was a statistically significant difference between both groups with favour to group (A). So it was concluded that pulsed high-intensity laser therapy is an effective method of pain alleviation and improving the functional ability in women with Sacroiliac joint pain.

**Keywords**: sacroiliac joint, high-intensity laser therapy, pain, functional ability.

## 1. Introduction

A nociceptive and painful mechanical stress within the sacroiliac joint (SIJ) or on the surrounding tissues linked to the innominate bones is known as sacroiliac joint pain (SIJP) [1]. Since it can travel down the posterior thigh to the S1 dermatome, it is frequently misinterpreted as radicular pain and is characterized as acute, dull, or shooting [2]. On the other hand, in certain instances, the malfunction cannot be accompanied by any symptoms, meaning the person unaware of any discomfort or suffering [3]. Sacroiliac joint dysfunction can be the result of inflammation, trauma, fault positioning, and lack of mobility, muscle imbalance, pelvic misalignment, and joint obstruction [4].

The prevalence ranges from 15 to 38%, with approximately 13% causing persistent low back pain [5]. Pain from the SIJ is commonly located in the buttocks (94%). Additionally, the groin (14%), upper lumbar spine (6%), lower lumbar spine (72%), and abdomen (2%), may also experience radiating discomfort. Of patients, 28% experience lower limb discomfort, with 12% reporting leg pain [6].

Sacroiliac joint pain is known to be more prevalent in young and middle-aged women [7]. As people age, their sacroiliac joints experience a variety of alterations. The joint surfaces in the early stages of maturity are smooth and permit multidirectional sliding motions. Age-related changes start at puberty and last the entirety of a person's life. The iliac surfaces grow rougher and covered in fibrous plaques during puberty. By adulthood, they have reached their maximum thickness of 1-2 mm [8]. During the

third decade, morphological changes accelerate and restrict motion [9]. To diagnose and confirm the presence of SIJP, MRIs and computed tomography (CT) are the most diagnostic imaging modalities that are advised. MRI is more effective in identifying bone marrow edema, which is a sign of inflammation in the sacroiliac joint [10, 11].

Given that SIJP is linked to a substantial health burden and an estimated 0.5 quality-adjusted life years (QALY) of disutility, it appears that the disease primarily affects individuals in the middle of their productive lives. Consequently, the financial burden of SIJP is high and increases with the duration of the condition. Comparing patients with SIJ discomfort to those with other common medical and surgical conditions, SIJP patients reported a noticeably worse state of health [12]. According to reports, individuals with SIJ discomfort have a worse quality of life than those who have mild heart failure or chronic obstructive pulmonary disease. This lower quality of life has also been compared to those who have hip and knee osteoarthritis [13].

Laser therapy (LT) is one of the non-invasive, painless techniques that can be used for a wide range of illnesses [14]. In addition to their mechanical and thermal effects, high-intensity laser therapy (HILT) can cause an electromagnetic field, photoelectric, electrochemical, and other changes in exposed tissues. The benefit of HILT is that its effects can reach deeper into structures because of its enhanced penetration depth when power is raised [15, 16]. It decreases pain and edema as it raises the blood circulation and also it enhances tissue regeneration. So HILT is a modality that has anti-inflammatory, analgesic, and bio stimulant properties that make it useful in a variety of painful situations. [17].

## 2. Objectives

To determine if high intensity laser treatment can alleviate sacroiliac joint discomfort, a controlled trial study with data collected over a period of 4 weeks (12 sessions) was carried out at the Outpatients' Clinics, Faculty of Physical Therapy, Kafr Al-Sheikh University, from January 2023 to December 2023.

## 3. Methods

In this study, 30 participants (females only) were assigned to two equal groups of 15 participants for the study. Group-A (n = 15) received high intensity laser with exercises and Group-B (n = 15) with an average age of 22.67 ± 3.13 received placebo laser with exercises. Every subject volunteered for her inclusion in the study with criteria of age between18–30 years, body mass index did not exceed 30 kg/m2, the presence of pain over the sacroiliac joint with no surgical history, unmarried, tender SIJ on palpation and employed women and no lumber disc prolapse or spinal deformity [18]. The exclusion criteria was infections, fracture in and around the SIJ Complex, arthritis of joint, smoking girls, patient not willing to participate in the study, any history of surgery, lumbar spine disc herniation or back injury and tumor around the joint.

This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Kafr Al-sheikh University (code: P.T/ WH/2/2023/24.

To keep the rights of every subject, every subject had signed an informed consent. The principal investigator (the same therapist) carried out all interventions, evaluations, and measurement recording at the start and end of the trial in order to deliver safe and effective treatment. All the patients were given explanation of the treatment protocol in their understandable language.

Samples collection

In order to prevent selection bias, one of the two wrapped cards that represented the two treatment groups was picked randomly by the participants.

Data collection

Data obtained from all women in the both groups included demographic data; age, weight, height, BMI, and affected side were recorded. Pre-treatment assessment of the measured outcomes was carried

out at the start of the trial, and post-treatment assessment was carried out after four weeks using Visual Analogue Scale (VAS), Oswestry Disability index (ODI) and Pressure Algometer.

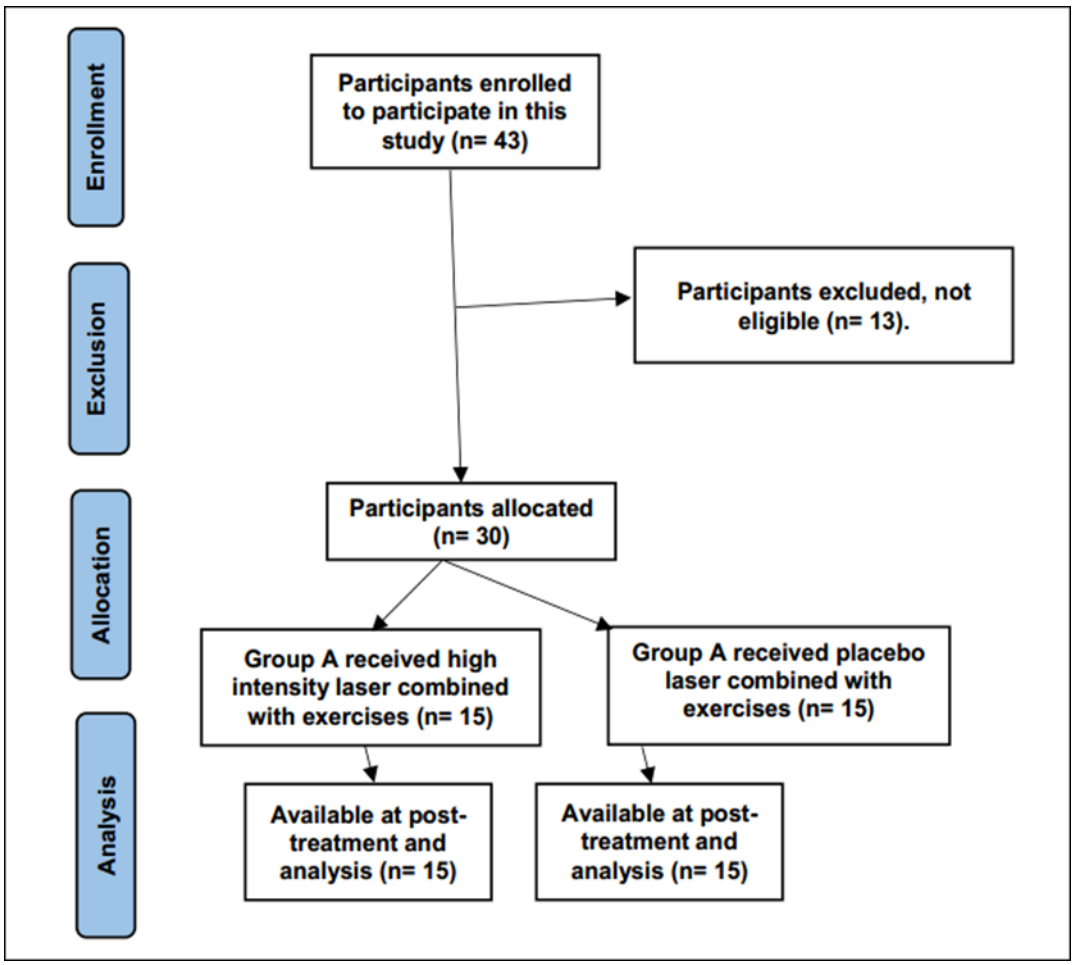


**Figure (1): flow chart of the study.**

Visual Analogue Scale: A 10-cm horizontal line was employed to measure the pain intensity. It has been demonstrated that the VAS is valid and reliable measurement [19, 20].

Oswestry Disability Index, the Arabic version [21] is used to find out the amount of functional impairments in 10 everyday activities of daily living about the pain intensity, personal care, lifting, walking, sitting, standing, sleeping , sex , social and travel. Each item consist of 6 statements which are scored from 0 to 5, with 0 indicating the least disability and 5 the greatest then the total score is calculated as a percentage with 0% indicating no functional impairments and 100% indicating the highest level of functional impairments.

Pressure Algometry is used to measure pain thresholds (PPT). With an accuracy of 0.1 kg/cm2, the algometry could measure 10 kg/cm2. The participant was lying in prone position with the arms by her sides. The therapist used an anthropological pencil to mark the selected areas under examination. Five points were examined; the first point was 1 cm inferior and medial to the posterior superior iliac spine (PSIS), and the other four points were lateral, superior, medial, and inferior by 2 centimetres to the first point. The second point (2 cm laterally) was near the PSIS where the gluteus maximus muscle attached to the iliac crest. The third (superior) point was overlying the erector spinae muscle, while the fourth (medial) point was overlying the deep posterior sacroiliac ligament. The fifth (inferior) point was where

the gluteus maximus muscle was attached to the posterior sacral faces and posterior sacroiliac ligament [22].

After that, measure the PPT with a 1 cm2 probe area by applying a steady pressure axially on each marked site until the subject reported discomfort. Calculated the mean of each point after measuring three times with an interval between them of 10 seconds.

Patients only in group (A) (study group) received high intensity laser and traditional exercises. The high intensity laser device (Fisioline Y200219 LPLUS1601), Italy. The laser has a spot applicator with a lens diameter of 20mm. Applicator of 60mm diameter with a circular area treated diameter of 55 mm above the affected sacroiliac joint, wavelength 1064 nm, energy of 3.19 kJ/[cm.sup.2], frequency 60 KHZ, duty cycle 50%. Patient position: prone lying position bare skin with a pillow under pelvis. Application: The spot applicator of the laser was directed 5cm above the patient and perpendicular to the skin for 20 minutes, three times per week for 4 weeks (12 sessions) and stopped the sessions during the menstruation period. The patient was instructed not to move after the device is turned on. The therapist should put on the safety goggles.

Exercise program was designed to be easily done with no need for special equipment. The exercises included piriformis stretching, hamstring stretching, and core stability exercises [23].

A piriformis muscle stretch was performed while the participant was lying in a supine position. The therapist crossed the foot of one limb over the knee of the other limb (abduction, external rotation, and 90° flexion of the hip and knee). The flexed limb was passively pushed toward the chest to the participant's pain-free degree. For at least 30 seconds × 3 repetitions, with progression in time of stretch.

A hamstring muscle stretch was performed while the participant was lying in a supine position. One limb was rested on the plinth, and the therapist held the ankle of the other limb and passively stretched the hamstring to the participant's pain-free limit. With maintenance of the hip flexion, knee extension, and the ankle joint in a neutral position. For at least 30 seconds × 3 repetitions, with progression in time of stretch.

The alternative arm and leg raising exercise which performed from quadruped position. The participant contracted the abdominal muscles to stabilize the spine, then lifted one arm and the contralateral leg. After holding this position, the participant slowly lowered the raised limbs and repeated the exercise for the alternating sides. For at least 15 seconds × 3 repetitions for each side, with progression in time.

Prone Bridge (plank). The participant adopted a prone elbow position while raising the body onto the forearms and maintained the hips and back in a straight-line posture. For at least 15 seconds × 3 repetitions, with progression in time.

Group (B): received placebo laser as the spot applicator of the laser was directed beside the participant on the plinth without direct radiation on the participant, without the participant's knowledge, because the device produces audible pulses, giving the participant the same instructions and practicing the same exercises as Group (A).

## 4. Results

Comparing the mean values of age, weight, height, BMI, and number of births for all participants in both groups using unpaired t-test revealed that there were no significant differences between them in age (p= 0.42), weight (p= 0.25), height, (p= 0.53), BMI (p= 0.64), and affected side (p= 0.69) as shown in Table 1.

Table 1: Descriptive statistics and comparison of mean values of age, weight, height, and body mass index for all women in both groups using unpaired t-test.

| **Demographics** | Mean ± SD | | T-value | P-value | Sig. |
|---|---|---|---|---|---|
| | Group A | Group B | | | |
| **Age (years)** | 23.53 ± 2.59 | 22.67 ± 3.13 | 0.83 | 0.42 | **NS** |
| **Weight (kg)** | 77.33 ± 6.14 | 79.73 ± 4.85 | -1.19 | 0.25 | **NS** |
| **Height (cm)** | 169.21 ± 5.58 | 170.53 ± 5.77 | -0.64 | 0.53 | **NS** |
| **Body Mass Index ($kg/m^2$)** | 27.07 ± 2.22 | 27.47 ± 2.45 | -0.47 | 0.64 | **NS** |

SD = Standard deviation, T-value = T-statistic, P-value = Probability, Sig. = Significance, NS = Non-significant.

Table 2 showed the comparison of the pre and post-treatment mean values for pain intensity within Group (A) and Group (B), there were found significant differences (p= 0.0001*), between group comparison revealed no significant difference pre-treatment and, there was a significant difference post treatment with favour to group A (p=0.005*).

Table 2: Within and between group comparisons of mean values of pain intensity.

| Items | Mean ± SD | | P-Value |
|---|---|---|---|
| | Group A | Group B | |
| **Pain Intensity** | | | |
| Pre-treatment | 7.53 ± 0.99 | 7.61 ± 0.83 | 0.84 |
| Post-treatment | 3.21 ± 2.01 | 4.93 ± 0.96 | 0.005* |
| P-Value | 0.0001* | 0.0001* | |
| SD = Standard deviation, P-value = Probability. | | | |

Table 3 showed within and between both groups for pain pressure threshold at five points. PPT at the first point (p= 0.0001*), PPT at the second point (p= 0.0001*), PPT at the third point (p= 0.0001*), PPT at the fourth point (p= 0.0001*), PPT at the fifth point (p= 0.0001*. Comparing the pre-treatment mean values between both groups found no significant differences while post-treatment mean values between both groups found significant differences between them in favour of Group (A).

Table 3: Within and between group comparisons of mean values of pain pressure threshold.

| Items | Mean ± SD | | P-Value |
|---|---|---|---|
| | Group A | Group B | |
| **Pain Pressure Threshold at the First Point** | | | |
| Pre-treatment | 3.59 ± 1.38 | 3.33 ± 1.19 | 0.59 |
| Post-treatment | 6.43 ± 0.65 | 5.61 ± 1.15 | 0.02* |
| P-Value | 0.0001* | 0.0001* | |
| **Pain Pressure Threshold at the Second Point** | | | |
| Pre-treatment | 3.16 ± 1.48 | 2.89 ± 1.15 | 0.58 |
| Post-treatment | 6.56 ± 0.68 | 5.23 ± 0.71 | 0.0001* |
| P-Value | 0.0001* | 0.0001* | |
| **Pain Pressure Threshold at the Third Point** | | | |
| Pre-treatment | 2.76 ± 0.85 | 2.63 ± 0.81 | 0.68 |
| Post-treatment | 6.33 ± 0.92 | 5.24 ± 0.87 | 0.002* |
| P-Value | 0.0001* | 0.0001* | |
| **Pain Pressure Threshold at the Fourth Point** | | | |
| Pre-treatment | 2.95 ± 0.52 | 3.1 ± 0.43 | 0.41 |
| Post-treatment | 6.97 ± 1.36 | 5.86 ± 0.97 | 0.01* |

| | | | |
|---|---|---|---|
| P-Value | 0.0001* | 0.0001* | |
| **Pain Pressure Threshold at the Fifth Point** | | | |
| Pre-treatment | 3.05 ± 1.02 | 2.69 ± 0.76 | 0.28 |
| Post-treatment | 6.43 ± 1.17 | 5.37 ± 0.96 | 0.01* |
| P-Value | 0.0001* | 0.0001* | |
| SD = Standard deviation, P-value = Probability. | | | |

Table 4 showed the results of comparison for functional disability in the pre and post-treatment mean values, there were found significant differences for functional disability (p=0.0001*). Comparing the pre-treatment mean values between both groups, there were found no significant differences between them for functional disability (p=0.79). While the post-treatment mean values between both groups found significant differences between them in favour of Group (A) for functional disability (p=0.005*).

Table 4: Within and between group comparisons of mean values of functional disability.

| Items | Mean ± SD | | P-Value |
|---|---|---|---|
| | Group A | Group B | |
| **Functional disability** | | | |
| Pre-treatment | 27.8 ± 11.82 | 28.67 ± 5.02 | 0.79 |
| Post-treatment | 13.13 ± 5.95 | 19.33 ± 5.16 | 0.005* |
| P-Value | 0.0001* | 0.0001* | |
| SD = Standard deviation, P-value = Probability. | | | |

## 5. Discussion

It's known that there are many ways and methods to treat sacroiliac joint pain, regardless of the leading causes, even if many of these ways may require a long time for recovery or the possibility of practicing the traditional social life This study was carried out to clarify the effectiveness of HILT with therapeutic exercises in the treatment of patients with SIJP. The results of this study demonstrated that high-intensity lasers with exercises are more effective than placebo laser with exercises in all parameters, including pain scores, functionality, and quality of life scores. They helped the participants to get satisfactory improvement and return to normal musculoskeletal performance. In addition to what we noticed during the practical work was that many participants observed that there was a rapid progression even though we didn't finish all sessions, and if for any reason that may worsen the symptoms, they got better after being exposed to HILT, and we hoped that to be new in the management of sacroiliac joint pain through the efficacy and rapidity.

The theory behind how HILT reduces pain was predicated on how high intensity laser beams cause small and slow light absorption chromophores. Light diffusion in all directions (the scattering phenomenon) is a characteristic of tissue absorption. This phenomenon increases the mitochondrial oxidative reaction, which in turn promotes the generation of ATP, RNA, and DNA. HILT can reduce the pain impulse conduction as it may raise the latency and lower the conduction velocity of sensory nerves; it also increases the pace at which substances that resemble the morphine effect are produced in human tissue, which are two possible reasons for its sedative effects. It could also enhance blood flow, vascular permeability, cell metabolism, and block pain from being transmitted across Aδ and C-fibers [24, 25], so HILT reduces the inflammation and pain.

The results of this study agreed with a study done by Dundar et al. (2015) who evaluated the effectiveness of pulsed Nd:YAG HILT plus exercises in treating myofascial pain syndrome of the trapezius. The results showed that this treatment approach was successful in improving patients' quality of life, pain scores, neck disability, physical functioning, and overall health perceptions [26]. According to Kheshie et al. (2014), patients with osteoarthritis (OA) in the knee who combined HILT and low level laser therapy (LLLT) with exercise experienced pain reduction and improved knee function scores. Both therapy approaches were better than exercise alone for people with knee OA, with HILT + exercise showing greater benefits than LLLT + exercise [27]. Be aware that the laser's duration, wavelength, and coherence are among its own unique characteristics that affect how effective it is.

In a study related to Kim et al. (2015), which determined that in the management of frozen shoulders, HILT significantly reduced pain after three and eight weeks [28]. In line with another study by Stiglić-Rogoznica et al. (2011) demonstrated that patients with knee OA showed a remarkable and statistically significant reduction in pain due to an immediate analgesic effect. Furthermore, there were no adverse events between patients during or after the treatment [29]. When HILT and ultrasound therapy were compared for treating low back pain (LPB), Fiore et al. (2011) discovered that HILT was more successful in lowering pain and impairment. [30]. Song HJ et al. (2018) performed a systematic review of HILT results in the treatment of back and neck pain that significantly improved pain and disability scores [31]. Based on a prior study by Akkurt et al. (2018), they discovered that silicone insoles and HILT are useful physical therapy techniques for individuals with plantar fasciitis in terms of improving function and quality of life while lowering discomfort [32]. Also a study done by Alayat et al. (2014) found that in the patients with chronic low back pain (CLPB), HILT combined with exercise was effective in in decreasing the pain intensity using VAS, increasing lumbar range of motion (ROM), the Roland Disability Questionnaire (RDQ), and Modified Oswestry Disability Questionnaire (MODQ) after 4 weeks of treatment [33]. In addition to a study of Santamato et al. (2009) on people with Sub-acromial Impingement Syndrome whom results demonstrated an increase in the afflicted shoulder's muscle strength, functionality, articular mobility, and discomfort reduction [34].

Therefore, in general conclusions of studies around HILT, a reduction in pain perception has a major impact on the patient's improved quality of life and increased range of motion in individuals with musculoskeletal illnesses. Functional ability could therefore be enhanced as well. And for further benefit, HILT and exercises together have been demonstrated to have a clinically apparent impact on alleviating pain and functional improvement quickly and effectively. A proven conclusion is based on a study by Karaca that used HILT for three weeks to treat individuals with subacromial impingement syndrome (SAIS) demonstrated that HILT was effective in the short term at lowering pain and disability [35].

Improving the mechanics of the lumbar spine, pelvis, and hip are from the goals of treatment. So the present study indicates that exercise therapy is clinically able to decrease pain and improve function and is important in rehabilitation as it has been shown to be low-cost, effective, and secure. Core muscles have been dubbed the "powerhouse," serving as the driving force behind all limb movement. So a thorough strengthening or stimulation of these core muscles has been promoted as a method to prevent and rehabilitate many lumbar spine and musculoskeletal problems [36]. As the pelvic core muscles are connected to the SIJ fascia and muscles, strengthening them is important.

And for more explanation, people who have SIJP are frequently found to have weaker gluteus medius and maximus, lower abdominal, and hamstring muscles. In any case, retraining several muscle groups to activate simultaneously is thought to be essential for a full recovery, so specifically, the reason for taking the hamstring into consideration since it gives the SIJ stability due to its direct attachment and fascial connections to the sacrotuberous ligament, an extrinsic SIJ ligament that stabilizes the joint [37]. The piriformis muscle is commonly found to be shortened. It runs from the sacrum to the greater trochanter, so it has been thought that the tension in this muscle would affect the stability of the SIJ [38]. So stretching exercises would be helpful, as they improve range of motion in the joint, reduce stiffness, and pain in muscles, reduce the risk of muscle strains and other injuries, and improve postural awareness and body posture, and increase circulation, which in turn decreases the recovery period after exercise.

Group (B) received the same exercises as Group (A) so, the improvement and reduction of symptoms in Group (B) resulted from these specific exercises as stretching and core stability exercise (CSE) that have been done to maintain individual muscles' flexibility and strength. It has been agreed with Beomryong Kim and Jongeun Yim, who looked at how individuals with nonspecific LBP responded physically following an intervention that included hip muscle stretching exercises combined with CSE [23]. As well mentioned by Kavcic et al. (2004), CSE can assist stabilize the spine and develop muscular activity patterns without overloading the tissue [39].

## 6. Conclusion:

In fact, the results showed that HILT combined with exercise was beneficial in decreasing SIJP symptoms in terms of reducing pain and increasing functional performance and was more effective and rapid than placebo laser with exercise. Also, it can be used as a conservative therapy substitute for the many side effects of the drugs already in use.

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