Effect of Sacroiliac Joint Mobilization on the Level of Soft Tissue Pain Threshold in Asymptomatic Women

Tomasz Sipko, PhD, PT, Adam Paluszak, PhD, PT, and Agnieszka Siudy, MS, PT

Abstract

Objective: This study aimed to evaluate the effect of sacroiliac joint (SIJ) mobilization and/or self-mobilization on the level of soft tissue pain threshold in 21- to 23-year-old asymptomatic women (n = 20).

Methods: The FPIX Wagner Algometer was applied to compute the pressure pain threshold (PPT) over the right and left side of the iliolumbar ligament and lumbar erector spinae (L3). Measurements were taken of the right SIJ before and after a randomized protocol of oscillating mobilization, self-mobilization, and placebo treatment.

Results: A main effect of intervention (mobilization, self-mobilization, placebo) was confirmed by analysis of variance, with increases in PPT over the iliolumbar ligament ($F = 13.04$, $P < .05$) and erector spinae ($F = 12.28$, $P < .05$) on the mobilized side. The Wilcoxon test indicated that SIJ mobilization increased PPT over the iliolumbar ligament ($P < .05$) and erector spinae ($P < .05$) on both sides. Self-mobilization increased erector spinae PPT on the exercised side ($P < .05$), whereas the placebo did not cause any changes in PPT ($P > .05$).

Conclusion: The study provides evidence of local and global pain modulation resulting from oscillatory mobilization of the SIJ in women without pain symptoms. Self-mobilization of the SIJ has limited analgesic application. (J Manipulative Physiol Ther 2018;41:258-264)

Key Indexing Terms: *Pain; Pelvis; Spine; Therapeutics*

Introduction

The prevalence of low back pain in Europe and the United States is reportedly 49% to 70%.[1] Low back pain incidence increases throughout adolescence, occurring earlier in girls than in boys. Peak incidence occurs between the ages of 40 and 69 years and affects more females than males in all age groups.[2] In 13% of patients, it is caused by sacroiliac joint (SIJ) dysfunction.[3]

Mobilization of the spine is commonly prescribed by physiotherapists to treat neuromusculoskeletal disorders.[4] The oscillating amplitude of mobilization can be quantified as large (grades II and III) or small (grades I and IV) as is relative to the available range of movement.[5] Large-amplitude oscillations stimulate more mechanoreceptors and therefore are more effective at decreasing pain than small-amplitude oscillations.[6] Current evidence indicates that manual therapy has a moderate analgesic effect on pressure pain threshold (PPT) in patients with different forms of musculoskeletal pain.

Pressure pain threshold is often used as an outcome measure of various manual therapies on the modulation of pain.[7] For example, the effects of a 30-second spinal mobilization (1 set) versus a high-velocity, low-amplitude manipulation on lumbar spine PPT were investigated in asymptomatic participants.[8] There was no statistically significant change in PPT, although there was a trend for PPT to increase in the mobilization group compared with the high-velocity, low-amplitude manipulation and control groups. In another study, mobilization of the lumbar spine in asymptomatic persons did increase local and global PPT, although 4 sets of 30- to 60-second mobilization treatments were required,[9] irrespective of mobilization rate (2 Hz, 1 Hz, and quasi-static)[10] or amplitude (large- or small-amplitude oscillations and quasi-static).[11] Contrarily, SIJ manipulation did not significantly affect PPT over the posterior superior iliac spine (PSIS) in healthy women[12] but did significantly improve physical fitness (visual analog scale score), social function, mental health, and vitality in patients (n = 18) receiving manual therapy for SIJ-related leg pain.[13]

Considering the fact that mobilization of the lumbosacral spine region may lead to an increase in PPT,[9-11] it was hypothesized that grade III oscillatory mobilization and/or SIJ self-mobilization may cause an analgesic reaction in the lumbosacral region in participants without pain symptoms.

University School of Physical Education in Wroclaw, Faculty of Physiotherapy, Wrocław, Poland.

Corresponding author: Tomasz Sipko, PhD, PT, University School of Physical Education, Faculty of Physiotherapy, Al. Ignacego Jana Paderewskiego 35, 51-612 Wrocław, Poland. Tel.: +48 609050109. (e-mail: tsipko@wp.pl).

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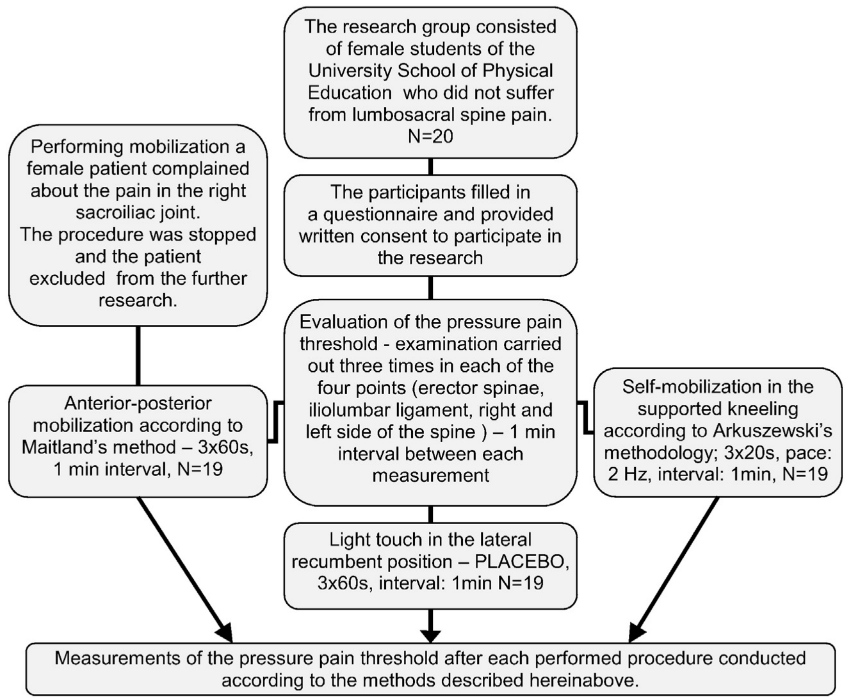

Fig 1. *Study procedure.*

The aim of the study was to determine the effect of mobilization and/or self-mobilization on PPT over the iliolumbar ligaments and erector spinae in their mobilized and immobilized parts. This study focused on the relationship between dosage and response as well as the cumulative effects of oscillatory mobilization, combined with active exercise via self-mobilization on soft tissue pain thresholds.

Methods

Participants

The research group consisted of 20 women aged 21 to 23 years studying physiotherapy at the University School of Physical Education in Wroclaw, Poland. The study was approved by the Ethics Committee of the University School of Physical Education (December 22, 2014). Before examination, all participants provided written consent to participate in the study and completed a questionnaire of 22 items on spine-related pain and previous and current medical status. Questions also addressed musculoskeletal workload and the amount of daily physical activity. The questionnaire was for informational purposes only so as to aid the recruitment process. Inclusion criteria were lack of present-day lumbosacral pain and lack of pain while mobilizing the SIJ. Orthopedic ailments, neurologic disorders, other injuries, and participation in extreme sports were set as the exclusion criteria.

Experimental Protocol

The study began with initial (baseline) PPT measurement followed by 3 stages, where each stage consisted of 1 type of manual therapy (oscillatory mobilization, self-mobilization, placebo) followed by PPT measurement (Fig 1). The intervention modalities were randomized to control for order effects or interaction between the 2 therapies. There was no additional break between the therapies besides the actual measurement because the primary goal was to study the cumulative effect of joint mobilization.

An FPIX Algometer (Wagner Instruments, Greenwich, Connecticut) was used to measure the PPT of the soft tissues over the lumbosacral region of the spine after each intervention. According to the International Association for the Study of Pain, PPT is the smallest stimulus causing the feeling of pain.[14] Pressure pain threshold has had high Pearson correlation coefficients ranging from 0.65 to 0.96 for intrarater reliability and from 0.47 to 0.89 for interrater reliability[15,16] as well as 0.90 to 0.99 for intra-observer reliability of 3 consecutive 10-second pressure measurements.[17] As such, PPT has been established as a reliable

Fig 2. *Dorsal mobilization of the sacroiliac joint.*

Fig 3. *Self-mobilization of the sacroiliac joint.*

Table 1. *Participant Demographics*

	Age $\bar{x}$/SD	Body Height (cm) $\bar{x}$/*SD*	Body Mass (kg) $\bar{x}$/*SD*	BMI $\bar{x}$/*SD*
***n* = 20**	21.58/0.69	165.31/4.4	56.68/6.91	20.75/2.06

BMI, body mass index; *SD*, standard deviation; $\bar{x}$, mean.

measure to evaluate the development and decline of experimentally induced muscle tenderness.

The PPT examination was performed over the same sites on the left and right sides. Test sites under investigation were the erector spinae at the L3 level (1.5 cm away from the interspinous line) and the iliolumbar ligament attachment to the PSIS. These reference sites allowed for a perpendicular algometer position over a stable base of firm subcutaneous tissue. All measurements were taken with the participant lying in the prone position on a therapeutic table. Pressure was expressed in newtons per square centimeter (N/cm^2).

Manual Therapy

The interventions were based on anteroposterior oscillatory mobilization, self-mobilization, and a placebo (light touching). Dorsal oscillatory mobilization using Maitland's method[18] was performed by a therapist with 12 years' experience in musculoskeletal physiotherapy. The participant initially lay in the supine position with the right PSIS moved off the therapeutic table and right leg bent at the knee and hip joints. The therapist grasped the ASIS and performed an anteroposterior grade III mobilization characterized by a large-amplitude motion[5] (Fig 2). The mobilization was held for 60 seconds and then repeated 3 times, with each set separated by a 1-minute interval.

Self-mobilization was based on Arkuszewski's methodology.[19] It began in a supported kneeling position on the edge of the therapeutic table, hands and knees placed at the same height. With the right knee supported on the bed (foot suspended), the left foot was placed over the right lower leg and the participant began performing a rhythmical movement of the left ilium ventrally and dorsally at a pace of 2 Hz for 20 seconds (Fig 3). The procedure was repeated 3 times. Each trial ended with a 1-minute break in the prone position.

The placebo simulated mobilization in the left lateral position using light touch treatment, where hand placement and duration were similar to the osteopathic manipulative treatment protocol but with minimal force so as to optimize the placebo effect.[20]

Statistical Analysis

Statistical analysis was conducted with the Statistica 12.0 software package (StatSoft, Krakow, Poland). The Shapiro-Wilk test for normality was applied to check the

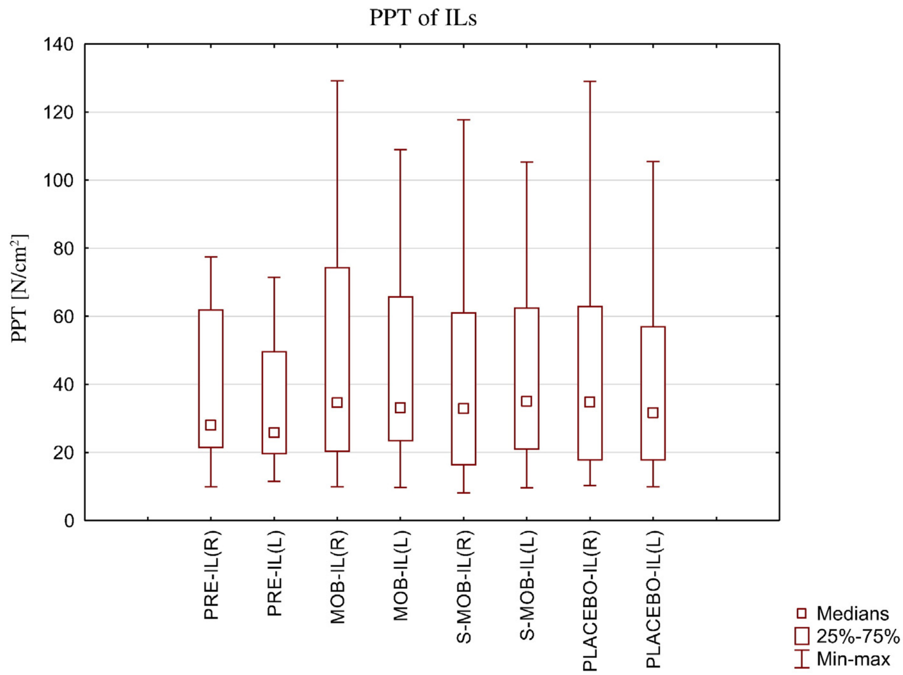

Fig 4. *Medians and lower and upper quartiles (25%-75%) and minimum (Min)-maximum (max) values of pressure pain threshold (PPT) over iliolumbar ligaments (ILs) on the right (R) and left (L) side before intervention (PRE) and after mobilization (MOB), self-mobilization (S-MOB), and placebo.*

data set. Pressure pain threshold data were not normally distributed; thus, further analysis was conducted with the use of nonparametric tests. The main effect of the intervention was assessed with Friedman analysis of variance (ANOVA), and the Wilcoxon test for paired samples was used to compare the effect of intervention on PPT. Because of the non-normal distributions, the results were presented throughout as medians with lower and upper quartiles (25%-75%). The level of significance was $P \leq .05$ for all statistical procedures.

Results

Participant Demographics

All participants were characterized by normal body mass (Table 1).

PPT of Iliolumbar Ligaments

Friedman ANOVA indicated a significant main effect for intervention (oscillatory mobilization, self-mobilization, placebo) on PPT over the iliolumbar ligament on the mobilized right side ($F = 13.04$, $P = .004$) but no effect on the opposing left side ($F = 4.77$, $P = .188$). The results of the Wilcoxon test revealed that PPT in this region increased on both the mobilized ($P = .01$) and opposite ($P = .029$) sides as a result of mobilization. Self-mobilization and placebo did not have any significant influence on iliolumbar ligament PPT of either side ($P > .05$) (Fig 4).

PPT of Erector Spinae

Friedman ANOVA also indicated a significant main effect for intervention on erector spinae PPT on the mobilized side ($F = 12.28$, $P = .006$) but no effect on the opposite side ($F = 4.77$, $P = .06$). Wilcoxon analysis revealed that mobilization increased erector spinae PPT on both the mobilized (right) ($P = .004$) and opposite ($P = .02$) sides. Self-mobilization applied on the right side ($P = .01$) significantly increased PPT but did not have any effect on the opposing left side ($P > .05$). Placebo did not influence PPT on either side ($P > .05$) (Fig 5).

Discussion

As hypothesized, a main effect of the intervention was found in which oscillatory mobilization and self-mobilization of the SIJ increased the PPT over lumbosacral soft tissues on the mobilized side. Additional statistical analysis revealed the intervention to have other effects albeit dependent on the therapeutic measure. Only oscillatory mobilization of the right SIJ caused a significant increase in PPT over the iliolumbar ligament and erector spinae on both sides. This study provides evidence that SIJ mobilization, performed at a rate of 1 Hz on asymptomatic volunteers, produces an immediate and significant improvement in PPT measures. This was irrespective of the reference site, indicating both local and global hypoalgesia. Such observations indicate the activity of a neurophysiological mechanism that modifies PPT in the area of mobilization as well as peripheral regions associated with

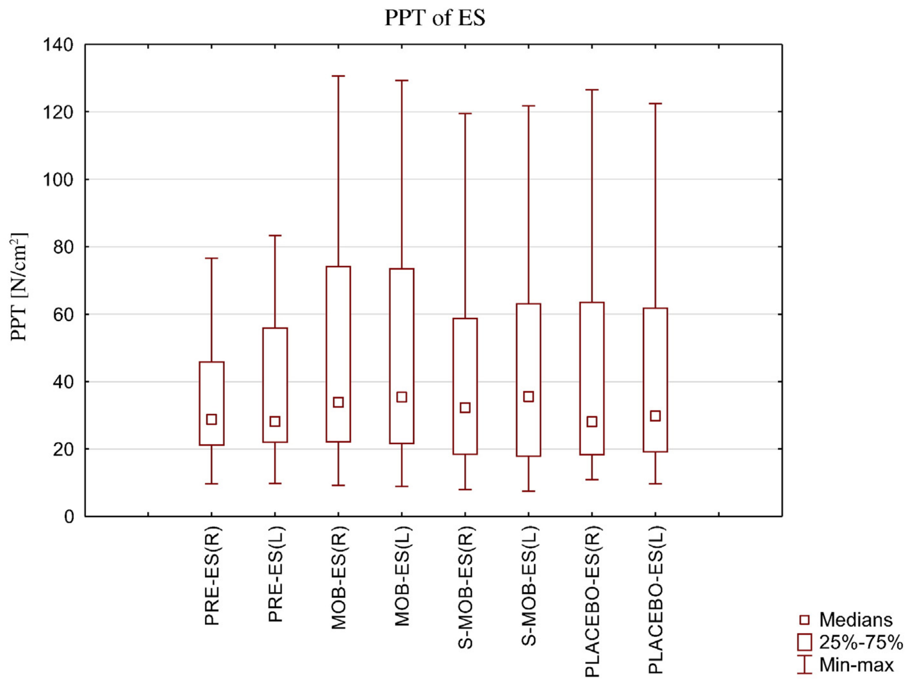

Fig 5. *Medians and lower and upper quartiles (25%-75%) and minimum-maximum values (min-max) of pressure pain threshold (PPT) over erector spinae (ES) on the right (R) and left (L) side before intervention (PRE) and after mobilization (MOB), self-mobilization (S-MOB), and placebo.*

the activation of descending inhibitory pathways.[21] It appears that the mechanical force generated during manual therapy is necessary to initiate this chain of neurophysiological responses involving both the peripheral and central nervous systems that comprise the pain experience.[22]

Research conducted by Willet et al[10] on asymptomatic participants indicated that lumbar spine activation caused an analgesic effect, where the measured points corresponded to the dermatomes of selected spine segments. However, the highest increase in PPT values (19.6%) was identified in the paraspinal muscles (ie, those situated closest to the mobilization). Moss et al[21] suggest a change of 15% in PPT values is needed to represent a clinically significant effect. The mean percentage change above baseline measures in this study were 21.12% to 21.69% over the iliolumbar ligaments and 18.9% to 28.4% over the paraspinal muscles after mobilization but only 11.3% to 15.3% over the iliolumbar ligaments and 13.4% to 22.4% over the paraspinal muscles after self-exercise. The results suggest that mobilization has greater capacity to produce hypoalgesia in the absence of pain or articular dysfunction. Similar results were reported by Willet et al.[10]

In this study, self-mobilization involved active exercise with movement of the left ilium ventrally and dorsally. The results of these exercises were reflected only by an increase in erector spinae PPT on the same side, with no change in PPT over the iliolumbar ligament. This finding suggests the limited application of SIJ self-mobilization in asymptomatic participants.

The sagittal mobility of the SIJ is restricted by the iliolumbar ligaments.[23] Hence, in addition to the stress induced by L5 movement, the iliolumbar can also be stressed by SIJ movement in the sagittal plane. This indicates that a combination of movements (L5 and the SIJ) can lead to extra stress and pain, such as that experienced by pregnant women.[24] This can be of special interest to clinicians treating patients with low back pain. There is a record of the global pelvic manipulation technique being bilaterally applied to women with primary dysmenorrhea, significantly increasing PPT over the SIJ as well as reducing self-reported acute low back–pelvic pain.[25]

Our results add knowledge to the findings of Hegedus et al,[26] who determined that a single spine mobilization treatment does not produce a long-term effect at any significant level. However, the significance of Hegedus et al[26] should be interpreted as subordinate from a clinical point of view because articular mobilizations and/or manipulations are seldom used in isolation in clinical practice. In most instances, they are embedded in treatment plans that contain myofascial techniques, therapeutic exercises, and/or various forms of communication. Therefore, we suggest considering a combination of mobilization and self-mobilization to gain better therapeutic effects. This issue would require further analysis evaluating the durability of SIJ mobilization combined with self-mobilization in asymptomatic and symptomatic groups.

Limitation

The present findings should be considered against several limitations. First, the results cannot be generalized to the whole population because we recruited only young, healthy women. The applied treatment methods may not have any effect on PPT in the patient population. Second, a washout period between the 2 types of modalities was not used, so it is possible that there may be other explanations for increased PPT. Third, the cumulative effects of the 3 measurements cannot be excluded,[27] but in this case, it can be inferred that the analgesic reaction should be similar at each test site. Nonetheless, our findings must be interpreted cautiously because the study only assessed immediate effects.

Conclusion

Evidence is provided of local and global short-term pain modulation in response to oscillatory mobilization of the SIJ in women without pain symptoms. Self-mobilization of the SIJ has limited analgesic application. The long-term analgesic effects of mobilization should be further evaluated particularly in asymptomatic populations.

Funding Sources and Conflicts of Interest

No funding sources or conflicts of interest were reported for this study.

Contributorship Information

Concept development (provided idea for the research): T.S., A.P., A.S.

Design (planned the methods to generate the results): T.S., A.P., A.S.

Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): T.S., A.P., A.S.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): T.S., A.P., A.S.

Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): T.S., A.P., A.S.

Literature search (performed the literature search): T.S., A.P., A.S.

Writing (responsible for writing a substantive part of the manuscript): T.S., A.P., A.S.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): T.S., A.P., A.S.

Practical Applications

- This study provides evidence that SIJ mobilization performed at rates of 1 Hz on asymptomatic volunteers produces an immediate and significant improvement in PPT measures. This was irrespective of the reference site, indicating both local and global hypoalgesia.
- The results of self-mobilization were reflected only by an increase in erector spinae PPT on the same side, with no change in PPT over the iliolumbar ligament.
- This finding suggests the limited application of SIJ self-mobilization in asymptomatic participants.

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