

# Managing Musculoskeletal Pain Through Targeted Therapeutic Massage During Pregnancy: A Case Report

Kirana Peters, BS, BFA, CNS, LMT<sup>1</sup>\*

<sup>1</sup>Center for Neurosomatic Studies, Largo, FL, USA

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**Background:** Musculoskeletal shifts during pregnancy can cause structural stress, leading to pain symptoms. There is evidence that manual therapies such as massage therapy, physical therapy, and chiropractic may be of benefit. Neurosomatic therapy is a treatment that combines structural analysis with a variety of massage techniques to help restore proper postural alignment and alleviate the root cause of musculoskeletal pain.

**Objective:** To examine the effects of neurosomatic therapy on pain reduction in a pregnant patient during her third trimester.

**Methods:** A 36-year-old female in her third trimester of pregnancy received 10 massage therapy treatments performed by a student at the Center for Neurosomatic Studies. The sessions were conducted twice per week over a 5-week period, and began with an initial interview to gather information about the client's symptoms. Each session also incorporated the use of a posturology chart to assess structural asymmetries, followed by targeted massage therapy techniques. Outcome measures used to track progress included posturology charts, the McGill Pain Questionnaire (MPQ), Quebec Back Pain Disability Scale (QBPDS), Visual Analog Scale (VAS), as well as ongoing verbal feedback from the client.

**Results:** While the MPQ and QBPDS questionnaires showed no significant improvement, verbal feedback indicated a decrease in or elimination of pain symptoms in some areas and an overall reduction in pain compared to the patient's first pregnancy.

**Conclusion:** These findings suggest that there may be a need for the development of pregnancy-specific pain outcome measures that incorporate normative data that

reflects the typical progression of symptoms. Without establishing such baselines, it is challenging to evaluate treatment-related changes in pain and functioning during pregnancy. Neurosomatic therapy may be a helpful intervention for decreasing pain throughout pregnancy; however, research with multiple participants is needed to provide stronger evidence supporting the benefits of this approach.

**KEYWORDS:** Massage therapy; prenatal massage; pregnancy massage; pain management; third trimester; case report; musculoskeletal pain; musculoskeletal manipulations

## INTRODUCTION

Musculoskeletal pain is common among the pregnant population,<sup>(1-5)</sup> ~50–85% experiencing low back pain, and ~20% experiencing pelvic girdle pain, partially due to the anterior shift in the center of mass in the body.<sup>(1)</sup> Anterior shift may lead to excessive lumbar lordosis, which in turn can cause mid-thoracic pain.<sup>(1)</sup> Structural stress from pregnancy, leading to low back pain, can cause referred leg pain.<sup>(5)</sup> For most women, this pain resolves post-birth; however, some experience pain for a year or longer.<sup>(2)</sup> Low back and pelvic pain may occur separately or together, typically increasing as the pregnancy progresses, and can interfere with sleep and daily activities.<sup>(3)</sup> Low back pain is characterized between the 12th rib and gluteal fold, and pelvic girdle pain (PGP) is typically in the vicinity of the sacroiliac (SI) joints.<sup>(4)</sup> The musculoskeletal shifts during pregnancy include increased lumbar lordosis, overactivity of pelvic and low back muscles, thoracic joint hypermobility,

and an expanding pelvis.<sup>(1)</sup> This increases activity in the paraspinal muscles, rectus femoris, external obliques, psoas major, and adductor longus.<sup>(1)</sup> As pregnant women gain weight and have reduced ability to activate their core muscles, they may develop cervical pain due to using their head and neck as a lever to turn during sleep.<sup>(1)</sup> Musculoskeletal shifts during pregnancy give evidence to suggest that the root cause of pelvic pain during pregnancy might be mechanical as opposed to just hormonal.<sup>(1)</sup> Pregnant women may benefit from manual therapies such as massage,<sup>(1,4,5)</sup> acupuncture,<sup>(1,3,6)</sup> yoga,<sup>(6)</sup> and chiropractic.<sup>(1,4,6)</sup> Physical therapy has been shown to decrease low back and pelvic pain during pregnancy by strengthening muscles around the spine and pelvic floor.<sup>(2)</sup> Exercise therapy in land or water may also help strengthen the pelvic floor and decrease low back pain and PGP.<sup>(3)</sup> Osteopathic manipulative therapy has been shown to reduce low back pain, and craniosacral therapy to improve pelvic pain.<sup>(3)</sup> Other therapies include homeopathy, meditation, herbal medicine, and other manual therapies.<sup>(4)</sup> Many women seek non-medication-based treatments since the options for medications during pregnancy and the postpartum period are limited and potentially harmful to the fetus.<sup>(7)</sup> Women also seek non-pharmaceutical pain control methods to cope during labor.<sup>(8)</sup> One study examined the effects of a 30-min sacral massage on labor pain and anxiety. The experimental group had statistically lower levels of pain, lower anxiety, more positive perceptions of labor, and no negative side effects for the fetus compared to the control group.<sup>(8)</sup> Another study showed that those who received a massage had less pain, labor was ~3 h shorter, and they had less need for medications.<sup>(6)</sup>

Many health-care professionals and individuals are concerned that massages during pregnancy could cause complications such as premature labor. A review was conducted to discuss the contraindications of relaxation massage in this population.<sup>(9)</sup> Side effects were mild, such as tiredness and soreness, and postnatal complications were unrelated to the treatments.<sup>(9)</sup> The experimental group had a decline in leg and back pain, decreased anxiety, lowered noradrenaline and dopamine levels, and improvements in mood and sleep.<sup>(9)</sup> Some believe that acupressure points or reflexol-

ogy may induce early labor; however, there are no current scientific indications to support this claim.<sup>(9)</sup> Deep venous thrombosis, which can lead to pulmonary embolism, is five times more likely during pregnancy.<sup>(9)</sup> Since symptoms resemble typical pregnancy complaints and diagnosis can be challenging, it is best to avoid deep tissue massages in the legs to avoid loosening blood clots.<sup>(9)</sup> The abdominal region should also be avoided as it can lead to placenta or uterine rupture.<sup>(9)</sup> Women who have complicated pregnancies should consult with their OBGYN before getting a massage.<sup>(9)</sup>

Massage therapy is a broad term that encompasses a wide variety of specialties, and each technique has its own benefits, depending on the patient's needs and goals. Certain massage techniques, such as Swedish massage, incorporate relaxation and full-body treatments. Neurosomatic therapy (NST) is a more specific and targeted pain treatment approach. A form of structural therapy, the core belief is that an imbalance in posture can lead to musculoskeletal pain and dysfunction. The approach focuses on identifying and addressing the root cause of pain by correcting structural imbalances through detailed postural assessment and targeted neuromuscular techniques. NST aligns with the concept of the regional interdependence (RI) model in treating musculoskeletal disorders, emphasizing the interconnected relationships between different regions of the body.<sup>(10)</sup> Under the RI model, dysfunction in one part of the musculoskeletal system can create stress that contributes to pain or dysfunction in other areas, regardless of their anatomical proximity.<sup>(10)</sup> Postural assessments using a posturology chart<sup>(11)</sup> and analysis of daily movement patterns, along with patient symptoms, help identify possible imbalances that contribute to pain. While the specific area of pain may be treated if indicated, other surrounding muscles and organs that may be causing the pain or are influenced by the pain are also treated. This includes possible trigger points causing referred pain, dysfunction due to compensations for the pain, poor postural habits, or dysfunction from injury, trauma, or surgery. NST is rarely a full-body treatment; instead, a treatment plan is created targeting specific soft tissues. The approach incorporates trigger point, myofascial, and other neuromuscular techniques, along with compression, static pressure, friction strokes, and firm slow glides as some of the main mas-

sage techniques used. Corrective exercises, stretches, or other homework may be suggested to help support their progress. NST practitioners receive additional training beyond basic massage, including visceral manipulation. Dysfunction in the muscular system can impair the function of certain organ systems, and vice versa. Additional training covers muscles of the anterior neck, treatment of facial/eye muscles, cranial and C1/C2 soft-tissue mobilizations, as well as intra-oral techniques for managing temporomandibular joint dysfunction and other issues of the jaw, tongue, throat, and sinuses. There may be benefits with NST in the pregnant population, since musculoskeletal shifts during pregnancy can cause pain. This case report investigates the effects of NST on a pregnant patient in her third trimester, intending to ease symptoms and prevent the pain she experienced throughout her first pregnancy.

## METHODS

### Participant

The patient was a 36-year-old, 5'1", and 71.67 kg female. She had begun her third trimester of her second pregnancy at the beginning of this case report. During her first pregnancy, she was working as a nurse and experienced daily rib pain during her third trimester that began at a pain scale of 2–3/10 and grew to 8–9/10 as the day progressed. She felt pain around the middle of the right rib cage, and described it as searing, stabbing, consistent, nagging, and distracting regardless of how she breathed. The pain pattern during pregnancy started at the right sacral area, radiated up her back to the lower ribs, and spread superiorly around her right side. She had experienced pain around her right SI area prior to pregnancy. She treated this condition in her first pregnancy with myofascial release, Reiki, therapeutic massage, and stretching. She worked with a massage therapist 1–2 times a week, for 30- to 60-min sessions, which provided relief. Resting and sleeping also provided relief. She spent long hours working at a desk, driving, and caring for her 5-year-old child. She worked out 1–2× a week by walking, weightlifting, and cardio exercises. Her doctor had suggested sleeping on her left side for better circulation. Since she typically slept on her right side, this change

made it difficult for her to get comfortable, leading to difficulty falling and staying asleep. She was diagnosed with asthma and has a family history of heart-related issues, high blood pressure, and high cholesterol. The upper trapezius and posterior cervical region had been problematic prior to pregnancy, and she had received massage, physical therapy, and chiropractic care. A therapist noted tight muscles on her left side, which may have contributed to her lateral pelvic tilt. She was not on any prescription medications, but took multivitamins, essential fatty acids, prenatal DHA (docosahexaenoic acid), magnesium, and Benadryl. Based on initial intake and assessment measures, her pain was 2–3/10 around the right SI/gluteal region, left side of the neck, and low right posterior rib area. The patient's goal was to mitigate or prevent the rib pain that she experienced during her first pregnancy, as well as ease any musculoskeletal pain she was currently experiencing. There were no contraindications mentioned for massage; however, care was taken to perform most of the session in the side-lying position to avoid pressure on the belly region, and deep work on the lower legs was avoided.

### Intervention

This case report was conducted by a student enrolled at the Center for Neurosomatic Studies, a comprehensive 1,278-h educational program focused on advanced studies in anatomy, clinical massage, and neuromuscular techniques. This program is designed to prepare students for state licensure in massage therapy and to earn certification as a neurosomatic specialist. All treatments provided during the case study were performed under the supervision of a certified neurosomatic specialist, who also served as an instructor within the program. Treatments were conducted in accordance with the student therapist's scope of practice and closely monitored to ensure safety and adherence to professional standards.

Each session included an interview to assess the patient's symptoms, as well as a posturology chart assessment. The NST posturology approach measures approximately 86 bony landmarks of the body, including the bones of the cranium.<sup>(11)</sup> Measurements in both standing and supine positions include superior/inferior and anterior/posterior alignments of these

structures. The main postural findings throughout the study are documented in Figure 1. A superior right shoulder and sternum were present, indicating a left torso tilt in both standing and supine positions. The right shoulder and sternum were anterior when standing, indicating a left thoracic rotation; however, this was reversed in the supine position, with the left shoulder and sternum appearing anterior in most assessments. The left anterior superior iliac spine and greater trochanter were elevated in both standing and supine measurements. The same asymmetry across both positions is termed a "fixation," which may indicate significant muscular restrictions maintaining the tilt.<sup>(11)</sup> The patient presented with asymmetry in the coronal plane, with shoulders positioned posterior to the midline and the head anterior to the midline, representing a forward head posture. Her anterior pelvic tilt ranged between 9 and 12 degrees throughout the study. This

range is close to the normal range of a non-pregnant woman, which is between 5 and 10 degrees.<sup>(11)</sup> This was an unexpected finding, as anterior pelvic tilt typically increases during pregnancy. Supine measurements of the lower body show evidence of a structural limb length discrepancy (LLD), possibly due to a shorter femur on the right. Further investigation with an x-ray would be helpful to support this finding. The patient stood with feet in an externally rotated position, which was more pronounced on the right side. A spinal assessment during session 4 indicated the presence of a possible S-curve scoliosis. When the thoracic rotation was counteracted in session 6 by positioning the patient, pain radiated from the right hip upward along the same side. The left side of her cranium consistently appeared more anterior in the supine position. This included the temporal bone, mastoid process, maxillary arch, and posterior ramus of the mandible (Figure 2).

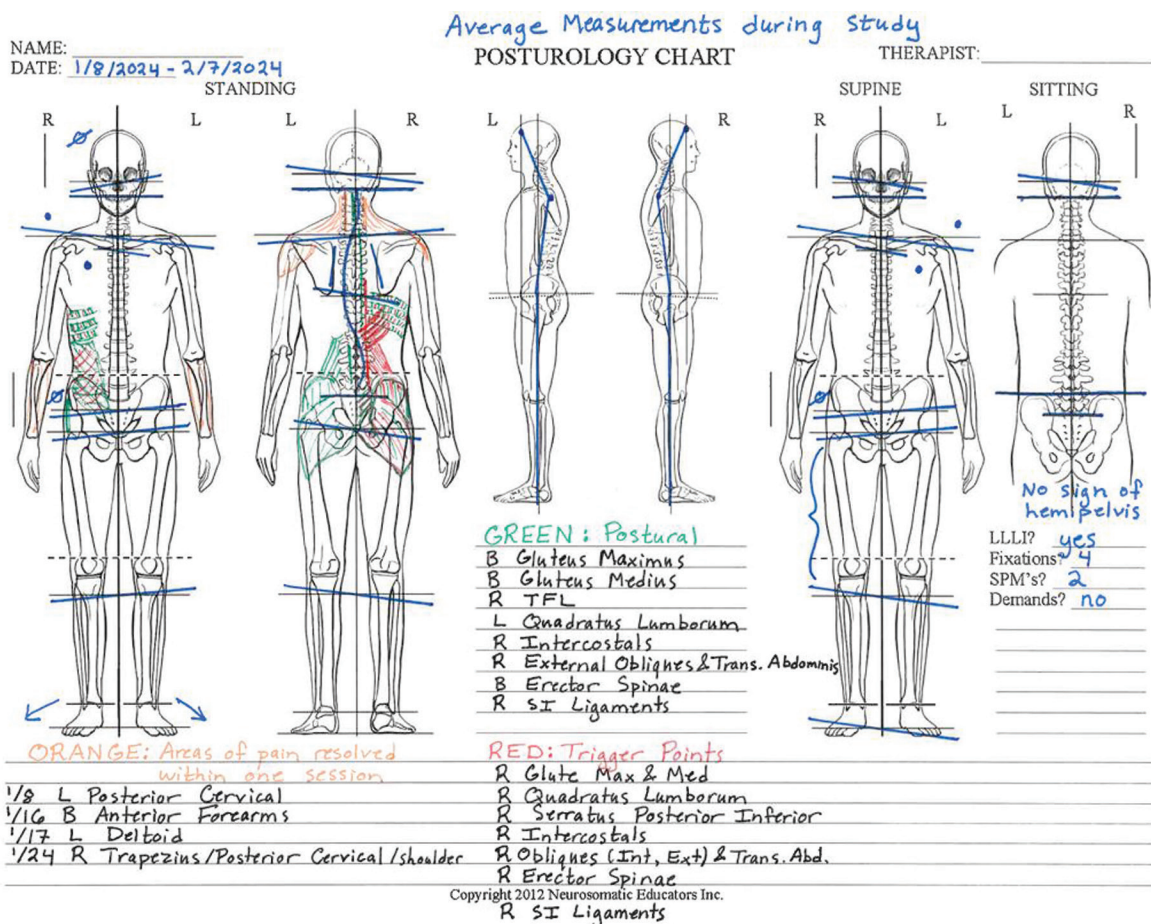


FIGURE 1. Average posturology measurements/postural and trigger point muscles treated.

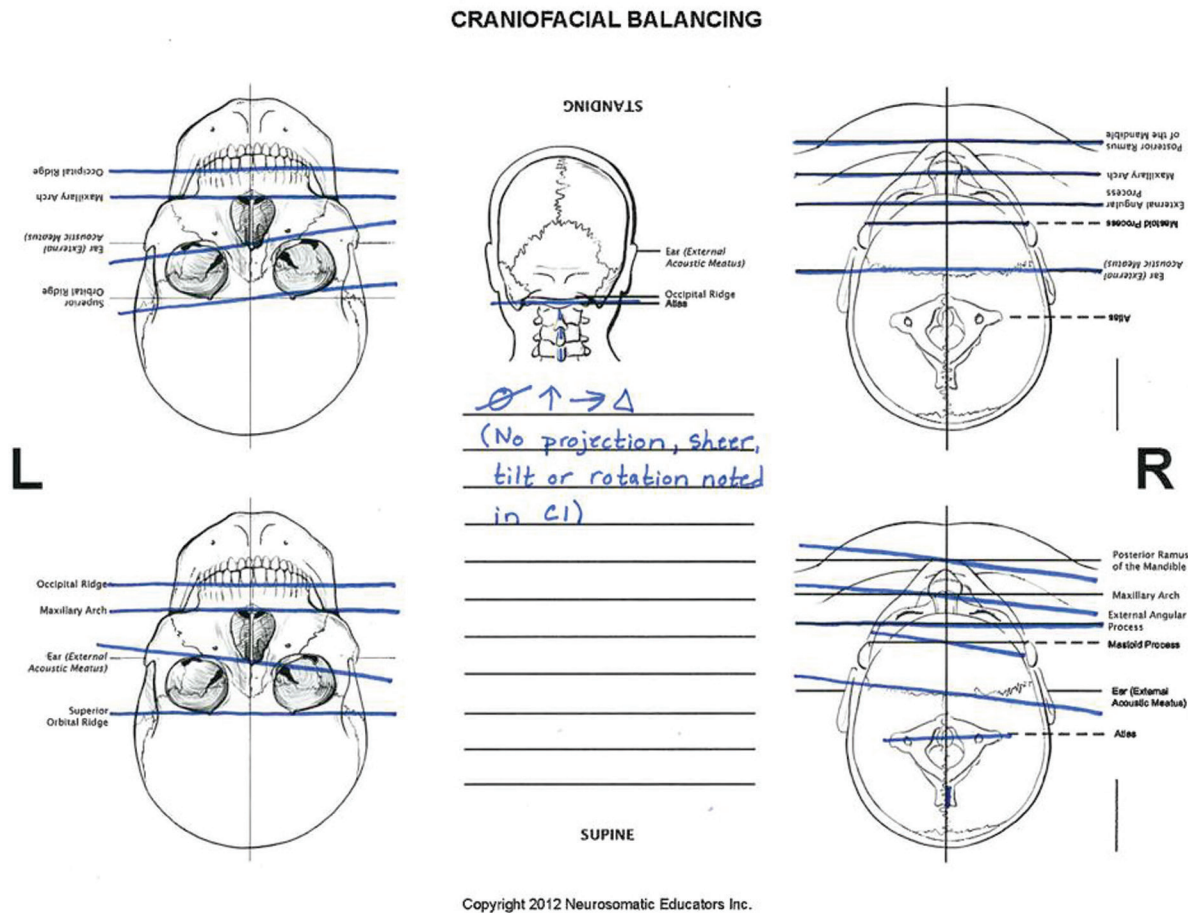


FIGURE 2. Average craniofacial measurements.

Following the patient's daily interview of symptoms and postural assessment, a targeted treatment plan was developed to address specific structures. General massage therapy techniques included glides, friction strokes, and compression applied using hands, fingers, elbows, and forearms. While multiple upper body muscles were treated to address pain symptoms, much of this report's focus is on the treatment of the SI/gluteal region and rib/thoracic area. Treatment strategies for these regions were categorized into two groups: (i) muscles restricted due to structural imbalances and (ii) muscles potentially harboring trigger points, referring to the patient's areas of discomfort. A detailed list of muscles treated, the rationale for their inclusion, and the techniques used are provided in Table 1. A visual representation of these muscles is documented in Figure 1. Table 1 and Figure 1 illustrate the author's hypothesis regarding muscles that may

cause structural imbalance and pain. They do not represent all the structures treated during the study. For a complete daily treatment protocol, refer to Table 2. Further explanation of the clinical reasoning can be found in the discussion section of this report. Home care suggested to the patient included gentle side stretches to relieve pain in the rib cage area, as well as rolling the glutes and SI region with a tennis ball. A total of 10 60-min therapy sessions were conducted twice weekly over 5 weeks. Sessions took place in a shared space with soft instrumental music and massage tables separated by curtains.

### Outcome Measures

Outcome measures included the McGill Pain Questionnaire (MPQ), Quebec Back Pain Disability Scale (QBPDS), Visual Analog Scale (VAS), as well as patient-reported verbal results and posturology charts. MPQ,

TABLE 1 (Part 1 of 2). Muscles Treated, Explanation, and Findings

| Postural                             |                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                               |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Muscle                               | Explanation                                                                                                                                                                                                                                                               | Technique/Findings                                                                                                                                                                                                                                                            |
| B gluteus maximus                    | <ul style="list-style-type: none"> <li>- Patient presented external rotation of the lower limbs (more severe on the R side)</li> </ul>                                                                                                                                    | <ul style="list-style-type: none"> <li>- Sensitivity around areas, especially glute attachment. More restriction on R side versus L</li> <li>- Friction, glides, and elbow/forearm static pressure/compression</li> </ul>                                                     |
| B gluteus medius                     | <ul style="list-style-type: none"> <li>- R side could contribute to inferior lateral pelvic tilt due to muscle shortening</li> <li>- Patient presented lower than normal anterior pelvic tilt measurement. Glutes can contribute to retroversion of the pelvis</li> </ul> |                                                                                                                                                                                                                                                                               |
| R tensor fascia latae                | <ul style="list-style-type: none"> <li>- Muscle may be restricted due to inferior side of pelvic tilt</li> </ul>                                                                                                                                                          | <ul style="list-style-type: none"> <li>- More restricted and sensitive on R</li> <li>- Side-lying forearm static pressure and friction strokes with fingers</li> </ul>                                                                                                        |
| L quadratus lumborum                 | <ul style="list-style-type: none"> <li>- Possible restrictions due to high side of pelvic tilt and scoliotic curve</li> </ul>                                                                                                                                             | <ul style="list-style-type: none"> <li>- Firm, slow glides with fingers, static pressure to release restricted areas</li> </ul>                                                                                                                                               |
| R intercostals                       | <ul style="list-style-type: none"> <li>- Possible R side restriction due to concavity in the thoracic region (scoliosis)</li> </ul>                                                                                                                                       | <ul style="list-style-type: none"> <li>- Extremely sensitive in certain areas</li> <li>- Slow firm glides with fingers, and static pressure to release restricted areas</li> </ul>                                                                                            |
| R obliques and transversus abdominis | <ul style="list-style-type: none"> <li>- External obliques could be a source of patient's left thoracic rotation</li> </ul>                                                                                                                                               | <ul style="list-style-type: none"> <li>- Lots of restriction and sensitivity including lateral and anterior iliac crest and tight fascia near ilium</li> <li>- Firm glides with palm and fingers, static pressure to release constricted areas, myofascial release</li> </ul> |
| R SI ligaments                       | <ul style="list-style-type: none"> <li>- Possible restrictions on R side due to pelvic tilt and scoliotic pattern</li> </ul>                                                                                                                                              | <ul style="list-style-type: none"> <li>- Friction strokes with fingers</li> </ul>                                                                                                                                                                                             |
| B erector spinae                     | <ul style="list-style-type: none"> <li>- Possible restrictions due to pelvic tilt and scoliotic pattern</li> </ul>                                                                                                                                                        | <ul style="list-style-type: none"> <li>- Firm glides with palm and fingers</li> </ul>                                                                                                                                                                                         |
| Trigger Point                        |                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                               |
| Muscle                               | Explanation                                                                                                                                                                                                                                                               | Techniques/Findings                                                                                                                                                                                                                                                           |
| R gluteus maximus                    | <ul style="list-style-type: none"> <li>- Trigger points can refer around the buttock and SI area</li> </ul>                                                                                                                                                               | <ul style="list-style-type: none"> <li>- Sensitivity around areas, especially glute attachment. More restriction on R</li> <li>- Friction, glides, and elbow/forearm static pressure/compression</li> </ul>                                                                   |
| R gluteus medius                     | <ul style="list-style-type: none"> <li>- Trigger points can refer to the low back, buttock, and SI area</li> </ul>                                                                                                                                                        |                                                                                                                                                                                                                                                                               |
| R quadratus lumborum                 | <ul style="list-style-type: none"> <li>- Possible elongation due to pelvic tilt/scoliotic pattern, leading to potential pain due to attachment on ribs</li> <li>- Can create referral into the low buttock/SI area</li> </ul>                                             | <ul style="list-style-type: none"> <li>- Firm, slow glides with fingers, static pressure to release constricted areas</li> </ul>                                                                                                                                              |

TABLE 1 (Part 2 of 2). Muscles Treated, Explanation, and Findings

| Postural                                                     |                                                                                                                                                                  |                                                                                                                                                                                                      |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Muscle                                                       | Explanation                                                                                                                                                      | Technique/Findings                                                                                                                                                                                   |
| R serratus posterior inferior                                | - Can refer locally and cause TPs into the rib cage area                                                                                                         | - Slow, firm glides with fingers, static pressure to release constricted areas                                                                                                                       |
| R intercostals                                               | - Can harbor TPs locally, and also refer anteriorly (patient did have anterior rib area pain)                                                                    | - Extremely sensitive in certain areas<br>- Slow firm glides with fingers, and static pressure to release restricted areas                                                                           |
| R obliques (internal and external) and transversus abdominis | - Possible elongation due to pelvic tilt/scoliotic pattern, leading to potential pain due to attachment on ribs<br>- Possible localized TPs into R rib cage area | - Lots of restriction and sensitivity including lateral and anterior iliac crest and tight fascia near the ilium<br>- Firm glides with palm and fingers, static pressure to release restricted areas |
| R SI ligaments                                               | - Can cause trigger points locally and refer to low buttock                                                                                                      | - Friction strokes with fingers                                                                                                                                                                      |
| R erector spinae                                             | - TPs can refer to the low buttock/SI                                                                                                                            | - Slow, firm glides with fingers                                                                                                                                                                     |

B = bilateral; L = left; R = right; SI = sacroiliac; TP = trigger point.

QBPDS, and VAS were administered prior to the first treatment, then once a week for the duration of the study (Figure 3). Patient-reported verbal results from sessions 1–9 were collected 1 week after each treatment session, prior to the next session, while the final session was recorded immediately post-treatment (Table 2). A posturology chart was completed each week prior to treatment. The MPQ has been widely used in both experimental and clinical pain studies, and it includes descriptors for pain along with a point value system assigned to each descriptor.<sup>(12)</sup> The QBPDS is a 20-item questionnaire designed to measure physical disability caused by low back pain and has been used by researchers to monitor patient progress and evaluate the effectiveness of given interventions.<sup>(13)</sup> This questionnaire was developed based on the World Health Organization’s definition of a disability, which encompasses any restriction or lack of ability to perform an activity that would be considered a normal range for a human.<sup>(13)</sup> The VAS measured the patient’s subjective pain levels on a scale of 0–10.

Analysis

Results are derived using all assessment measures, including questionnaires and verbal feedback.

Ethical Review

The practitioner obtained informed consent for the research and writing of this case report, and personal client information was omitted. Confidentiality always remained. To ensure quality care, the patient was involved in treatment planning. Goals were considered throughout, and the patient consented to each day’s treatment. Care was given to monitor the patient’s pain tolerance during treatments, to prevent overly exciting the sympathetic nervous system, which could result in discomfort and decrease the effectiveness of treatment.

RESULTS

Results from both the QBPDS and the MPQ showed an increase in reported pain levels over the course of the treatments (Figure 3). In contrast, the VAS remained relatively low except for session 5 (Figure 3), where the patient attributed her pain to

TABLE 2 (Part 1 of 3). Daily Treatment Procedures and Verbal Results

| Date             | Patient Complaints/<br>Postural Distortions                                                                                                                                 | Muscles Treated                                                                                                                                                                                                                 | General Treatment Aim                                                                                                                                                                                                     | Patient's Verbal Results                                                                  |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| January 8, 2024  | - R low back/SI area pain, up toward her first few ribs (posterior and anterior)<br>- L posterior neck pain                                                                 | - B upper trapezius<br>- B anterior scalenus<br>- B upper cervical<br>- B erector spinae<br>- R obliques/ribs<br>- R QL and low back<br>- R iliac crest                                                                         | - Treat along the line of pain symptoms for possible restrictions and trigger points (TPs)<br>- Resolve posterior neck pain                                                                                               | - No back pain<br>- No rib pain<br>- No neck pain<br>- R glute/SI area some pain remained |
| January 10, 2024 | - R glute pain near SI joint                                                                                                                                                | - B glutes, SI ligaments, IT, TFL (all tighter on R side)<br>- R serratus posterior inferior<br>- B ribs/intercostals<br>- R QL/low back<br>- B erector spinae                                                                  | - Relieve possible constriction on R side glute and TFL<br>- Treat along the line of pain pattern for TPs to help prevent recurrence of pain                                                                              | - No rib pain (recurred one night but released with a light stretch)                      |
| January 16, 2024 | - B forearm pain (throbbing at night)<br>- R rib pain but resolved with side stretches<br>- R SI area pain                                                                  | - B forearms<br>- B intercostals<br>- R QL and low back<br>- B Glutes<br>- R Glute attachment and TFL                                                                                                                           | - Relieve forearm pain<br>- Relieve R SI pain<br>- Prevent rib pain<br>- Relieve tightness in glutes to help correct external rotation                                                                                    | - No glute/SI pain<br>- No forearm pain                                                   |
| January 17, 2024 | - L deltoid area pain (patient said possibly from sleeping)<br>- R rib pain toward the front of the body                                                                    | - B trapezius<br>- B latissimus (tight)<br>- B intercostals<br>- B iliac crest<br>- B QL and low back<br>- B deltoid<br>- L rhomboids<br>- R supraspinatus and infraspinatus<br>- B teres major and min (attachments sensitive) | - Relieve deltoid pain<br>- Relieve anterior rib area pain<br>- Relieve tight muscles in the upper body, treat general rotator cuff muscles (B teres Maj/min, B lat, B deltoid all sensitive. Restrictions in L rhomboid) | - No deltoid pain<br>- No rib pain                                                        |
| January 22, 2024 | - R pinching in posterior neck<br>- R shoulder pain<br>- R low back<br>- R SI area<br>(Patient reports a pulling sensation in the neck which hurts when turning the head R) | - R upper, middle, low trapezius<br>- R posterior cervical<br>- R splenii<br>- R intercostals<br>- R SI area<br>- R glutes and attachments<br>- R TFL                                                                           | - Relieve neck and shoulder pain (trapezius could be constricted causing pain in the neck/shoulder and upward rotation of R scapula)<br>- Relieve R low back pain and SI pain                                             | - No trapezius pain/pinching<br>- Thoracic/rib pain gone                                  |

TABLE 2 (Part 2 of 3). Daily Treatment Procedures and Verbal Results

| Date             | Patient Complaints/<br>Postural Distortions                                                                                                      | Muscles Treated                                                                                                                                                                                                                                                                         | General Treatment Aim                                                                                                                                                                                                                          | Patient's Verbal Results                                                                                                                                            |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| January 24, 2024 | - R SI area pain (when rotating her torso to the R to the proper postural position, pain worsened in the SI area and up the R side of her spine) | - B erector spinae<br>- L latissimus (very sensitive)<br>- B iliac crest<br>- R trapezius (upper, middle, low)<br>- B QL<br>- B intercostals<br>- B SI ligaments<br>- B glutes and TFL<br>- L glute attachments, IT band                                                                | - Relieve R SI pain<br>- Focus on L side hip area and QL to balance the pelvic measurements<br>- Revisit trapezius on R side to prevent recurrence of pain<br>- Prevent rib pain                                                               | - No pain when rotating patient into proper thoracic alignment (previous session sent pain up through the R side of her body from SI and up the R side of the back) |
| January 29, 2024 | - R SI area/low back                                                                                                                             | - R latissimus<br>- R longissimus<br>- R iliocostalis<br>- R erectors<br>- R trapezius and cranial attachments<br>- R posterior serratus<br>- R rhomboids<br>- R iliac crest<br>- R external obliques                                                                                   | - Relieve R SI pain<br>- Relieve R low back pain<br>- Focus on releasing R muscles that may be causing pain as well as restriction while rotating the torso into proper alignment                                                              | - No pain<br>- Less restriction in external obliques/fascia                                                                                                         |
| January 31, 2024 | No pain                                                                                                                                          | - B upper trap (more sensitive on R side)<br>- B erector spinae<br>- B QL<br>- B intercostals<br>- B iliac crest<br>- B glutes and SI area<br>- B TFL<br>- B external obliques                                                                                                          | - Revisit areas to prevent recurrence of pain<br>- Bilateral work to help both structural ilium/external obliques and TP causes of pain                                                                                                        | - Less sensitivity in the iliac crest and fascia near ilium/external obliques                                                                                       |
| February 5, 2024 | - B low back/SI pain<br>- B rib/thoracic area pain                                                                                               | - B anterior scalene<br>- B intercostals<br>- B external, internal, obliques, and transversus abdominis<br>- B iliac crest (L side less sensitive than prior treatment)<br>- B trapezius (upper, middle, low)<br>- B erector spinae<br>- B QL<br>- B SI ligaments<br>- B glutes and TFL | - Relieve B low back and SI pain<br>- Relieve B rib/thoracic pain<br>- Release restrictions around abdominal muscles (very sensitive transversus abdominis and obliques)<br>- Prevent rib pain<br>- Prevent recurrence of upper trap/neck pain | - Less pain in the low back<br>- Less pain in the thoracic/rib region                                                                                               |

TABLE 2 (Part 3 of 3). Daily Treatment Procedures and Verbal Results

| Date             | Patient Complaints/<br>Postural Distortions                                            | Muscles Treated                                                                                                                                                                                                     | General Treatment Aim                                                                                                  | Patient's Verbal Results |
|------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------|
| February 7, 2024 | - B low back pain near<br>the SI area (very slight)<br>- B slight anterior rib<br>pain | - B erector spinae<br>- B low and middle trapezius<br>- B iliac crest<br>- B external and internal obliques<br>- B intercostals<br>- B QL<br>- B glutes and SI area<br>- B TFL and IT band<br>- B anterior scalenus | - Relieve B low back pain<br>- Relieve B rib pain<br>- Revisit general areas for structural<br>and TP dysfunction/pain | Overall feels good       |

B = bilateral; IT = iliotibial; L = left; QL = quadratus lumborum; R = right; SI = sacroiliac; TFL = tensor fasciae latae

an improper sleeping position. According to verbal results (Table 2) collected from sessions 1–9, the patient reported either no pain or a decrease in pain in 100% of sessions. In the final session, the patient reported feeling generally well overall. Pain in the posterior cervical, trapezius, forearm, and deltoid/shoulder areas was eliminated after a single treatment session (Table 2 and Figure 1). Recurring pain areas included the SI/gluteal region, low back, and rib/thoracic area. Posturology chart measurements remained largely consistent throughout the 10 sessions. Notably, session 5 showed the greatest lateral pelvic tilt angle, which correlated with the highest VAS score recorded during the study. The discrepancy between the patient's verbal reports and the outcomes measured by standardized questionnaires is explored in the discussion section of this report.

Patient Impressions

“While I was seeing you, the pain I’d normally feel day to day would be uncomfortable, but I could live with it, never surpassing a 4/10, which I feel is a huge improvement from my last pregnancy. I do feel that it’s all the work you did to help mitigate current issues while also preventing future issues from happening/getting worse. I haven’t quite experienced the same intensity of pain I did in my previous pregnancy, and I’m approximately 6 weeks away from birth. A win in my book. While the sessions were intense and sometimes left me sore, the next day I felt refreshed, renewed, and well rested. Though I haven’t felt 100%, the progress and differences I have experienced is enough to motivate me to continue sessions as part of self-care.”

DISCUSSION

Part of this patient's pregnancy-related pain may be influenced by structural dysfunction present prior to pregnancy. Correcting for these imbalances, such as evening the hips, may help prevent similar pain patterns in subsequent pregnancies. In session 5, the patient reported higher pain levels and demonstrated a greater angle of lateral pelvic tilt compared to other sessions. This provides some evidence of a connection between the degree of postural distortions and higher levels of pain. The patient expe-

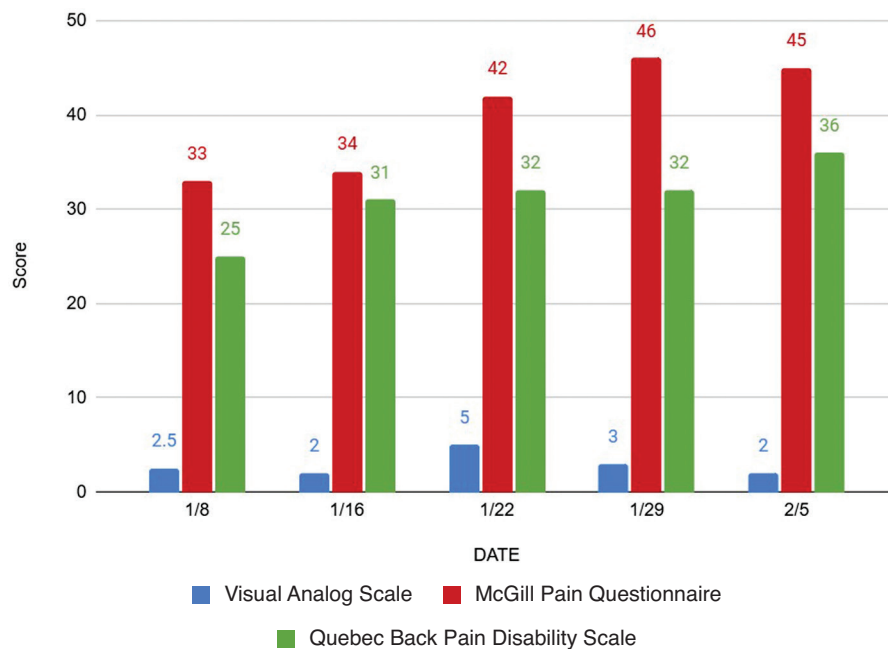


FIGURE 3. Assessment measures. Blue: Visual Analog Scale; red: McGill Pain Questionnaire; green: Quebec Back Pain Disability Scale.

rienced right SI joint pain prior to pregnancy. Identifying the underlying cause of this dysfunction, along with her pelvic tilt, could be key to understanding her broader pain patterns. During pregnancy, the natural shifts in the musculoskeletal system may have worsened existing muscular imbalances—such as muscles that are overly lengthened or overly shortened. These changes could have contributed to the spread of pain to other areas of her body. Muscles that connect the hip and rib cage may be especially prone to strain, inflammation, or discomfort under these conditions. Lateral pelvic tilt can result from a variety of factors, including structural LLD, functional or idiopathic scoliosis, or intrinsic pelvic dysfunction. In this case, the patient described a “pulling up” and “tight sensation” on the left side of her hip and back, suggesting that muscular imbalances likely contributed to both pelvic tilt and functional scoliosis. Certain postural habits or repetitive activities, such as prolonged sitting at a desk, driving posture, or the way she carried her older child, may also play a role. For example, regularly holding her child on her left hip could lead to elevation of that side, creating muscular imbalances and functional scoliosis. This compensatory pattern could strain surrounding muscles, such as short-

ening the gluteus medius and potentially triggering pain or tension in the SI joint and gluteal region. Her postural distortions and associated pain patterns, as observed in the posturology chart, support this hypothesis. Future assessments would benefit from a more detailed analysis of her habitual movement patterns, which may be contributing to these imbalances. Additionally, exploring the relationship between pre-pregnancy postural distortions/pain and those observed during pregnancy could offer valuable insights. Other structural factors may be at play. Her relatively low anterior pelvic tilt measurements during pregnancy suggest that she may have a more posteriorly tilted pelvis when not pregnant, pointing to a possible underlying pelvic distortion. In such cases, interventions like pelvic mobilizations or referral to a pelvic floor specialist may be appropriate. The patient may also benefit from a multidisciplinary approach, including physical therapy and exercise, to help maintain the improvements achieved through NST by strengthening weak areas that may be contributing to imbalance. Finally, fetal positioning should be considered in future case reports, as pressure from the fetus on the ribs or thoracic spine may contribute to pain or postural distortion.

This case study addressed multiple potential causes of the patient's SI/glute/back/rib pain, combining structural and trigger point elements, along with treatment for other presenting complaints. This approach, even if potentially helpful for the patient, creates multiple variables and makes it more challenging to analyze results. To assess fewer variables, it would be beneficial to conduct a study that focuses on one aspect, such as helping to correct her potential functional scoliosis. More consistency in treating the same structures during each session would make an easier analysis of results. Manual treatments were limited by pregnancy-related contraindication, which prevented access to the diaphragm, portions of the abdominal muscles, and the psoas. It is possible that correcting structural imbalances may naturally lead to a reduction in trigger points. Further exploration of the patient's rotational pattern could be insightful. In session 6, when the patient was rotated into a more anatomically balanced position, pain radiated from the right SI area up to the cervical spine. By session 7, despite the presence of postural distortion, the patient experienced no pain when rotating her torso into the correct alignment.

Since each pregnancy is unique, it is possible that this patient would not have had the same levels of pain as her first pregnancy. Therefore, it is difficult to directly correlate these sessions with the cause of her decreased pain in her subsequent pregnancy. However, the patient believed that the therapeutic sessions contributed to her reduced pain levels during this pregnancy, as reflected in her verbal feedback (Table 2). It is a common belief that subsequent pregnancies may be less painful than the first pregnancy. While this may be the case, it is not necessarily true for many women. According to one study, 68% of participants had recurring PGP in subsequent pregnancies, 70% of whom reported worse pain than in the first pregnancy.<sup>(14)</sup> Another study measuring severe low back pain in first versus subsequent pregnancies showed 84% of women experienced the same symptoms as compared to the first pregnancy.<sup>(15)</sup> Among the control group, women without back pain in the first pregnancy reported a 40% incidence of back pain in a subsequent pregnancy.<sup>(15)</sup> It would be interesting to compare the postural distortions between the two groups, as it could demonstrate if there is a corre-

lation between greater structural imbalances prior to pregnancy and higher pain during pregnancy. The cause of higher pain in the experimental group would be helpful to know, as perhaps there is a potential to prevent this pain with structural work before pregnancy.

The rapidly changing musculoskeletal structure during the third trimester of pregnancy, along with potential increase in pain due to postural and biomechanical adaptations, creates challenges in accurately assessing treatment outcomes. For instance, the QBPDS focuses on daily activities such as bending over, or rolling over in bed, which may be naturally limiting due to the rapid growth of the baby rather than pain or dysfunction alone. As a result, these scores may reflect expected physiological limitations rather than true clinical deterioration, leading to misinterpretations of treatment effectiveness. The Pregnancy Mobility Index (PMI)<sup>(16)</sup> may have been a better scale than the QBPDS, since it is a mobility scale specifically designed for the pregnant population; however, the limitation still presents when it comes to assessing treatment outcomes. Similar to QBPDS, it measures difficulties doing certain everyday tasks such as turning in bed and putting on shoes. There is an assumption that the PMI scores generally increase during pregnancy and decrease after delivery.<sup>(16)</sup> This natural fluctuation of scores due to the complex and dynamic nature of pregnancy-related changes, causing potential pain and mobility restrictions, creates an added variable when assessing treatment results. Therefore, a greater PMI or QBPDS score may not necessarily indicate ineffectiveness of treatment. Similarly, the overall VAS score, which remained fairly consistent throughout the study, may not necessarily indicate a lack of improvement. In the context of progressing physical stressors in late pregnancy, maintaining a consistent pain level could be interpreted as a positive treatment outcome. However, such interpretations require caution, as VAS scores are inherently subjective and influenced by multiple variables. To obtain more accurate results, future research may benefit from the development of assessment tools that account for these changes that occur throughout pregnancy, possibly by establishing normative symptom baselines for each week of pregnancy. A significant limitation of the QBPDS is the

lack of an established minimal important difference.<sup>(13)</sup> Without clear thresholds to determine whether a score change is clinically meaningful, it becomes difficult to distinguish between statistically non-significant changes and those that are important from a patient perspective.<sup>(13)</sup> The MPQ measures overall pain descriptors, but lacks specificity in the areas of pain unless paired with a pain diagram. A variety of factors can influence results, including the general subjectivity of pain. Pain perception is influenced by multiple elements such as physical, environmental, psychological, and social factors.<sup>(17)</sup> In one study, moderate to intense physical activity increased pain tolerance in pregnant women.<sup>(17)</sup> Additionally, the psychological aspects of a therapist–patient relationship should be considered as well, since there is evidence to suggest that the therapist, despite the modality used, influences the perceived effectiveness of treatment.<sup>(4)</sup>

## CONCLUSIONS

Musculoskeletal pain is common during pregnancy and can be caused by a variety of factors. The body undergoes a series of physical and structural changes during the gestational period, which can create shifts within the muscular system, potentially leading to pain symptoms. NST, which combines structural analysis and targeted massage techniques, may be beneficial in the pregnant population to help balance the structure and decrease pain. Pre-existing structural imbalances may contribute to worsening pain symptoms during pregnancy, as the additional biomechanical and hormonal stresses of gestation can exacerbate underlying musculoskeletal dysfunction. Addressing underlying structural imbalances in the body through NST in pre-pregnant women may potentially lead to better outcomes regarding pain reduction during pregnancy. Future research may benefit from the development of pregnancy-specific pain outcome measures that include normative data that reflect the typical progression of symptoms on a weekly basis. Without accounting for this added variable, it is difficult to evaluate the results of treatment. Establishing such baselines could provide more accurate reference points for evaluating treatment-related changes in pain and function during pregnancy. Since

this is a one-person case report, which has its limitations, research involving multiple participants is needed to provide stronger evidence of the benefits of NST for the pregnant population.

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## CONFLICT OF INTEREST NOTIFICATION

The author declares there are no conflicts of interest.

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**Corresponding author:** Kirana Peters, Center for Neurosomatic Studies, 13923 Icot Blvd, Suite 814, Clearwater, FL 33760, USA  
**E-mail:** sunbeammyogawellness@gmail.com