Clinical Case Report Competition

Vancouver College of Massage Therapy (VCMT)

August 2014

Third Place Winner

Ryzanne Laroco

Effects of massage therapy on functional scoliosis, thoracic range of motion and shoulder pain: a case study
Effects of Massage Therapy on Functional Scoliosis, Thoracic Range of Motion, Chest Expansion and Left Shoulder Pain: A Case Study

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**Effects of Massage on Functional Scoliosis, Thoracic Range of motion, Chest Expansion and Shoulder Pain: A Case Study**

**Abstract**

**Objective:** The purpose of this case study is to determine if massage therapy will increase thoracic range of motion, chest expansion and decrease left shoulder pain in a female diagnosed with functional scoliosis.

**Background:** Studies have shown that massage therapy can decrease low back pain, increase quality of life and pulmonary function, restore range of motion in the thoracic spine and correct posture abnormalities due to scoliosis. The aim of this case study is to support current research and further investigate the effects of joint mobilization, Neuromuscular Techniques (NMT), Myofascial Release (MFR), Muscle Attachment Release (MATR) and Muscle Energy Technique used on a female subject diagnosed with functional scoliosis.

**Methods:** A 30-year-old female underwent a 10 treatments for 60 minutes consisting of 2 sessions each week over a period of 7 weeks. Muscle Energy Techniques (MET), joint mobilization, Myofascial Release (MFR), Neuromuscular Techniques (NMT), and Muscle Attachment Release (MATR) were used to encourage alignment of the thoracic spine, increase range of motion in the thoracic spine and improve diaphragmatic breathing. The subject engaged with a series of remedial exercise throughout the case study, focused on core and back strengthening, changes in activity daily living (ADL) and stretch exercises. Assessments performed included postural observation with photos and goniometric measurements encompassing trunk flexion, extension, and rotation. Skyline View and Adam’s test with palpation were taken on treatments 1, 5 and 10 to monitor the spinal curve. Costovertebral expansion measurements were taken on treatments 1, 5 and 10. Thoracic range of motion was measured before (pre-) and after (post-) each treatments. Subject embarked a pain journal using the Pain Quality Assessment Scale (PQRS). Journals consist of a scale from 0 to 10 and recorded medications consumed.

**Results:** Pain Journals conveyed a significant decrease in left shoulder pain. Subject reported pain levels were alleviated from 7/10 to 1/10 on Pain Quality Assessment Scale (PQRS). Thoracic range of motion increase with bilateral rotation and side flexion. Before and after photos display slight postural changes. Subject exhibited a gradual increase in chest expansion. Objective outcomes included a decreased in hypertoned muscles surrounding the left shoulder.

**Conclusions:** Further investigation is needed using massage as an effective technique on functional scoliosis. Future studies should focus on determining the effects of specific techniques focused on scoliosis. Greater priority should be placed on creating conservative methods on the progression of scoliosis.

**KEYWORDS**

A larger trial is desirable and additional scientific evidence is needed in this area of study.

**Introduction**

Nonstructural (functional) scoliosis involves a curve in the spine, without rotation and is usually reversible. Structural scoliosis involves a curve in the spine, with rotation, that is irreversible. Usually the cause for structural scoliosis is congenital and the cause of functional scoliosis is unknown (idiopathic) \(^3\,^4\).

Idiopathic scoliosis is classified according to both the age of onset and by the location of the curvature. When categorized by age there are three groups; infantile scoliosis, from birth to 3 years old, juvenile scoliosis from 3 to 9 years old and adolescent scoliosis from 10 to 18 years old. The most common type of scoliosis is found predominantly in adolescent females \(^5\,^6\). Other types of scoliosis include neuromuscular scoliosis and degenerative (adult) scoliosis. The patient must have at least a 10 degree lateral curve of the spine located in the lumbar, thoracic or thoracolumbar region \(^7\,^8\).

A variety of health-related issues may be affected by this condition. Depending on the severity of the scoliosis, impaired chest expansion may disrupt pulmonary function \(^9\). In severe cases, some deformities may compress visceral organs and cause impairment \(^9\). Other associated issues with this condition may include muscle pain due to muscle imbalances; as well as psychological and physiologic problems may arise as a result of poor posture \(^10\). Those who are at higher risk for complications are individuals who have been diagnosed with moderate to severe scoliosis before puberty, this is due to the curvature progression \(^11\,^12\,^13\).

Scoliosis treatments are based primarily on two factors, the degree of the spinal curvature and the skeletal maturity of the patient \(^14\). There are three main options individuals may seek to treat scoliosis which include bracing, surgery or observation. Braces are intended to help correct spinal development and prevent progression of lateral curve \(^14\). Surgery is used in severe cases while observation uses the “sit and wait” tactic.

There is a lack of evidence with conservative treatment such as physical therapy and exercise as a form of method to prevent the progress of scoliosis and surgical delays \(^15\). However, physical therapy and exercise is highly recommended for those with any type of scoliosis. A combination of manual therapy and exercise are aimed to maintain strong and flexible back.
muscles to prevent further progression of scoliosis\textsuperscript{15}. Untreated scoliosis will result in complications. This led to an interest in the effects of massage therapy on functional scoliosis.

With the use of joint mobilizations and stretching the thorax, this method has been proven to increase expiration rates and chest expansion \textsuperscript{15,16}. Recoil techniques such as rib springing are considered osteopathic methods used to reduce connective tissue adhesions, mobilize joints and stretch fascia\textsuperscript{4,17}. Sustained translatory joint mobilization techniques is used primarily for regaining movement and functional range of motion in a desired area, as well as Muscle Energy Technique (MET)\textsuperscript{17}. Myofascial Release (MFR) is a slow subtle method that can be used to release fascial or muscle imbalances creating asymmetry in the body \textsuperscript{7,17}. Historically, scoliosis emanates bony and soft tissue imbalances. In conjunction with physical activity and the use of these techniques, this gives an opportunity for a conservative method. With this consensus, manual therapy can be used to reduce signs and symptoms associated with scoliosis.

This case study will focus on massage therapy as form of conservative treatment on a female diagnosed with functional scoliosis. With the use of joint mobilizations, Neuromuscular Techniques (NMT), Myofascial Release (MFR), Muscle Attachment Release (MATR) and Muscle Energy Technique (MET), this case study is looking to improve thoracic range or motion, improve chest expansion and decrease pain in an individual with functional scoliosis.

**Subject Case Description**

A 30 year old female complains of chronic left shoulder pain due to her scoliosis. Her daily activities consist of biking, long walks, video games with extended sitting, playing music and knitting. Her occupation as a mental health worker consist of 10-12 hour days at 4 days a week. General health status was reported as slightly sedentary. Subject wants to engage in more physical activities and improve exercise habits with remedial exercises given through this case study.

The subject was diagnosed with functional scoliosis and a sway back posture in her mid-twenties. Her primary complaint is pain on left shoulder that has been reoccurring for 4 years. As stress levels increase subjects’ pain increases. Other contributing factors are long hours spent sitting, long hours at work and poor posture was reported as aggravating factors. Relieving factors included massage and heat packs placed on areas of soreness. Prior to the case study, subject consumed ibuprofen 3 times a day to help decrease pain and cyclobenzaprine (muscle
relaxant) up to 4 times a week before bed or throughout the day to help relieve pain. At its worse, subject rated the left shoulder pain 7/10 on the PQRS and 5/10 on average.

The subject had been previously treated for 2 years by a physiotherapist. Appointments were scheduled for 20 minutes a sessions every 2-6 weeks. After each visitation, subject experienced soreness and tenderness for 24-48 hours. Subjects’ pain was alleviated for only a few days. The subject was looking for alternative physical therapy to help relief pain. Subjects’ goal was to reduce the number of visit to physiotherapy and longer lasting results.

Prior to this case, the subject underwent weekly massage treatments in conjunction with physiotherapy. Appointments focused on of body aches, relaxation and neck pain. None specifically intended to increase chest expansion, thoracic range of motion or alleviate left shoulder pain. At the time of the case study the subject was able to withdraw all visitations to physiotherapy. Subject reported massage reduced body aches, improved flexibility and alleviated left shoulder pain for a longer period than physiotherapy treatments. Subject used a Brace\(^3\) prescribed by the physiotherapist to help correct posture before and throughout the case study.

**Method**

**Physical Examination**

Baseline measurements were used to determine and biomechanics asymmetry from head to toe. This included before and after photos taken approximately 5 feet away in an anterior view and posterior view with a grid scale. Spinous processes from cervical spine 6 (C6) to spinous process of the thoracic spine 12 (T12) were landmarked for the posterior photos. Postural observation and palpation was taken and denoted on clinical charts. Fascial Restrictions and hypertonicity were noted that could be contributing to restricted movement of the thoracic spine. Particular attention was places on spinous process deviations and misalignment of the spine. During physical examination, special tests were used to confirm functional scoliosis from structural scoliosis with a Skyline view and Adam’s Test\(^14\).

Prior to each treatment the subject was asked to give a brief description of pain and show the location of pain on a photo from PQAS\(^2,4\). Clinical records show aggravating and relieving factors that contribute to the subjects’ pain. In
addition, the subject was asked to keep a pain journal throughout the case study. This journal contained a pain scale from 1–10 and included a description of mild, moderate and severe for each number from PQAS\textsuperscript{2,4}. This journal contained sleeping position, the number and type of medications consumed.

In order to accurately record the progress in thoracic range of motion, a total of 20 measurements were taken before (pre–) and after (post–) treatment. A tape measure was used to record flexion, extension and bilateral side flexion\textsuperscript{13}. With the use of goniometer, measurements were taken encompassing rotation to the right and to the left \textsuperscript{15,16}.

At the initial treatment, 5\textsuperscript{th} treatment and 10\textsuperscript{th} treatment Skyline View and Adams Test were assessed, as well as costovertebral joint movement was recorded\textsuperscript{1}. Chest expansion was determined by using costovertebral expansion test at four different levels \textsuperscript{1}.

The subject used the Pain Quality Assessment Scale (PQAS) to record pain levels throughout the case study (See Appendix 2). PQAS helped determine different aspects of pain such as intensity, tenderness, superficial or deep pain felt by the subject.

Reassessment of posture and current pain measurements were denoted on clinical records. Results of the study were shared with the subject and an exit interview was conducted. Feedback was obtained from the subject at the end of the 10\textsuperscript{th} treatment.

**Summary of Treatments**

This case study included a 10 treatment protocol. Each treatment lasted 60 minutes with the subject treated in a prone and supine position. Treatments occurred twice a week over a period of 7 weeks. Before conducting the last 3 treatments, subject decided to have 1 week with no massage. The purpose for this is to monitor the subjects’ progress and the duration it would take for the left shoulder pain to return.
For the 1st, 2nd and 3rd treatments the following protocol was applied. Treatments started in a prone position with a hydroculator heat pack across the upper back and mid back. MET was used for postural corrections on bilateral shoulders, with more focus on lowering the left. MFR was used to reduced and address fascial restrictions on thoracolumbar fascia, latissimus dorsi and teres major. NMT such as bowing and stripping was used to decrease hypertonicity on the erector muscles. Muscle approximation and MFR was on upper trapezus. NMT stripping was applied to intercostals between the ribs, especially on the left side. MATR was applied on levator scapula and bilateral gluteal muscles. Furthermore, oscillations was used on T4, T7 and T11 to encourage alignment. In the supine position the same techniques were applied with addition to one other technique. Pin and stretch combined with NMT was applied on pectoral muscles and anterior neck muscles to encourage muscle length. Cervical translations were also applied on C3, C4. Swedish Techniques were applied to all the areas above.

By the 4th treatment, other techniques were found to be more beneficial. In addition to the methods above the following techniques were incorporated for the remainder of the case study. Diaphragmatic breathing with resistant strengthening, rib springing was applied on the left side of the thoracic cage and rib separation specifically to left ribs 9 and 10 were used to encourage motility of ribs. Pin and stretch to the pectoral group was added along with pin and stretch of the rotator cuff muscles. Specific joint mobilization to T4, T7 and T11 were used to encourage alignment of spine.

As part of the treatment protocol, the subject was asked to engage in remedial exercises and changes in daily activities. Remedial exercises focused on core strength, back strengthening, stretching of the pectoralis muscles and anterior neck muscles (See Appendix 3). Subject was given instructions on sleeping position (See Appendix 4). Subject was educated on postural changes for extended periods of standing or sitting (See Appendix 5).

**Results**
Table 1 to 6 covers range of motion in the thoracic spine measured in centimeters for side flexion and degrees for rotation. Table 7 to 10 illustrate chest expansion, measured in centimeters and Table 11 shows weekly pain levels based of PQAS$^{3,4}$.

![Graph](image)

Table 1. Side flexion to the right in thoracic spine, measured in centimeters.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side Flexion to Right</td>
<td>44</td>
<td>43</td>
<td>40</td>
<td>38</td>
<td>38</td>
<td>36</td>
<td>37</td>
<td>35</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Side Flexion to Right</td>
<td>42</td>
<td>40</td>
<td>39</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>35</td>
<td>32</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

![Graph](image)

Table 2. Side flexion to the left in thoracic spine, measured in centimeters.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side Flexion to Left</td>
<td>49</td>
<td>49</td>
<td>45</td>
<td>40</td>
<td>37</td>
<td>39</td>
<td>38</td>
<td>37</td>
<td>36</td>
<td>33</td>
</tr>
<tr>
<td>Side Flexion to Left</td>
<td>44</td>
<td>45</td>
<td>40</td>
<td>37</td>
<td>38</td>
<td>38</td>
<td>37</td>
<td>36</td>
<td>33</td>
<td>33</td>
</tr>
</tbody>
</table>

As can be seen in Table 1 and Table 2 there has been a significant increase in bilateral side flexion.
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Table 3. Right rotation of thoracic spine, measured in degrees.

Table 4. Left rotation of the thoracic spine, measured in degrees.

As shown in Table 3 and Table 4, there has been an increase in bilateral rotation of the thoracic spine.
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Table 5. Extension of the thoracic spine, measured in centimeters.

As seen on Table 5 there has been minimal changes in extension with thoracic range of motion.

Table 6. Forward flexion in thoracic spine, measured in centimeters.

Table 6 shows an increase in forward flexion of the thoracic spine.
Table 7. Chest expansion, measured at the 4th intercostal space in centimeters.

Table 7 shows a slight change in chest expansion measured at the 4th intercostal space.

Table 8. Chest expansion, measured at the axilla in centimeters.

Table 8 reveals gradual improvements in chest expansion measured at the axilla.
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Table 9. Chest expansion measured at the nipple line in centimeters.

In Table 9 there has been a gradual increase in chest expansion measured at the nipple line.

Table 10. Chest expansion measured at the 10th rib in centimeters.

Table 10 reveals an increase in chest expansion measured at the 10th rib.
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Table 11

PQRS: Pain Quality Assessment Scale

Subject discloses significant decrease in pain levels shown in Table 11. Results are based on a weekly average.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Special Test</th>
<th>Initial Yield</th>
<th>Description</th>
<th>Final Yield</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Skyline View</td>
<td>+</td>
<td>C7 Moderate deviation to the right</td>
<td>+</td>
<td>C7 Moderate deviation to the right</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>T11 Moderate deviation to the left</td>
<td></td>
<td>T11 Moderate deviation to the left</td>
</tr>
<tr>
<td>2</td>
<td>Adams Test</td>
<td>+</td>
<td>C7 Moderate deviation to the right</td>
<td>+</td>
<td>C7 Moderate deviation to the right</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>T11 Moderate deviation to the left</td>
<td></td>
<td>T11 Moderate deviation to the left</td>
</tr>
<tr>
<td>2</td>
<td>Skyline View</td>
<td>+</td>
<td>C7 Slight deviation to the right</td>
<td>+</td>
<td>C7 Slight deviation to the right</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>T11 Slight deviation to the left</td>
<td></td>
<td>T11 Slight deviation to the left</td>
</tr>
<tr>
<td>2</td>
<td>Adams Test</td>
<td>+</td>
<td>C7 Slight deviation to the right</td>
<td>+</td>
<td>C7 Slight deviation to the right</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>T11 Moderate deviation to the left</td>
<td></td>
<td>T11 Moderate deviation to the left</td>
</tr>
</tbody>
</table>
Table 12 discloses a positive for Skyline View and Adam’s Test. Special test reveals a slight change in deviations of the spinal column.

Before and after photos show minor postural improvement (See Appendix). On palpation, clinical findings showed a decrease in hypertonicity on muscles surrounding the left shoulder.

**Discussion**

Initially, during physical examination C3 and C4 translations were moderately decreased to the right. Bilateraly pectoral muscles were hypertoned. Left levator scapula and trapizus was more hypertoned in comparison to the right. Diaphragmatic breathing was asymmetrical, left side displayed lack of movement. There was a decrease in thoracic range of motion, especially in rotation and side flexion. As seen in Table 11, curvature of the spine remained deviated in a forward flex position. This signifies a slight positive for structural scoliosis in an individual diagnosed with functional scoliosis.

As hypothesized, massage therapy was able to impact thoracic range of motion, chest expansion and shoulder pain. Throughout the study, subject was able to improve thoracic range of motion and chest expansion. By the 7th treatment results became consistent. The most significant finding was the increased mobility bilateral rotational and side flexion of the trunk. By the end of the study these motions became relatively equal.

PQAS^3 reveals a decrease in the level of pain experienced by the subject. Perhaps using a different questionnaire more pertinent to case can be suggested, such as a pulmonary function questionnaire.

Postural observation shows a decrease in sway back posture, a decrease in forward head posture and reduced glenohumeral rotation. On palpation clinical charts show a decrease in hypertoned muscles associated with left shoulder pain. These results are subjective to the invigilator.
Subject reported a significant reduction in medication consumption. The subject no longer consumes ibuprofen or cyclobenzaprine (muscle relaxant) 3 times a day to help decrease pain. Ibuprofen consumption has been reduced to once a week. Cyclobenzaprine consumption has declined to once or twice a week.

During the exit interview the subject reported significant improvements. For 2 years of physiotherapy the subject was unable to experience long lasting improvements that did not cause her discomfort for 24 hours or more after treatments. Subject commented on the reduction of medication consumption “I use to take ibuprofen and cyclobenzaprine to help me function throughout the day… or to help me sleep… since these treatments it has taken much longer for the pain to come back… I can go on for days without thinking about that persistent dull ache I’ve been experiencing for so long.” Subject request to continue treatments beyond this experiment.

An interesting finding was the muscle imbalances throughout the whole body. Left leg was held in a slightly flex position, while the right was slightly extended. Right pelvis presented with a slight posterior tilt and subject presented with moderate pes cavus on the right versus the left. Although this study focused on the thoracic and chest areas it is important to intergrade other parts of the body to help correct the imbalances in the thoracic spine.

There were a number of variables that may have impacted the results validity and reliability. This included changes with the administered treatments. Perhaps studies can develop a treatment protocol. Goniometric measurements may have been skewed due to examiner inexperience. For future research, it is important to use the proper equipment in order to measure movement. Possibly, a laser grid and other equipment can be used to record rotational movements.

Future studies on massage therapy and functional scoliosis may require a larger sample size for comparative reasons as well as X-ray imagery to monitor any skeletal adaptations. Further investigation is needed to establish massage as an effective treatment for functional scoliosis.

Hopefully through this case study apprises massage practitioners and other health care providers to see the benefit of conservative methods when treating individuals with scoliosis. For those seeking an alternative treatment,
massage may be a beneficial influence for structural and nonstructural deformities. Massage can increase awareness of exiting deformities and direct correctional exercises. By addressing muscular and fasical restrictions surrounding the spine individuals are able to adapt and correct their posture gradually. Massage techniques can enhance local circulation, bring relief to musculoskeletal pain, reduce adhesions and encourage joint mobility restricted by spinal deformities. Essentially massage can intergrade body and mind awareness. Through this, individuals become more vigilant about strengthening elongated and overstretched areas that may be contributing to deformities. Conversely, massage can reduce the stress due to a scoliosis curve by relieving shortened muscles and individuals can then engage in stretching remedies to those areas. A scoliosis posture contains a configuration of muscle imbalances. Respectively, massage can intervene and encourage balance in the body preventing the progression of scoliosis.

Hopefully future research will embark more on the use of joint mobilization, Neuromuscular Techniques (NMT), Muscle Attachment Release (MATR), Muscle Energy Techniques (MET) and Myofascial Release (MFR) on scoliosis. May this case study encourage further research, interest and knowledge on massage as a form of treatment to prevent or decrease symptoms associated with functional scoliosis.

Acknowledgement
I wishes to thank Christine Baseden, a Senior Instructor at Vancouver College of Massage Therapy (VCMT) and Registered Massage Therapist (RMT) for her consultation in developing this case study. I would like to express my appreciation to Christine Baseden for being my case study advisor. Thank you for all guidance and advice throughout this whole project. Also, I want to acknowledge Rob Dos Santos (RMT, Clinic Instructor) for his amazing insight and diverse modalities with his approach towards Functional Scoliosis. A great thanks to all the instructors, especially Rosanna Durante (RMT, Associate Dean) at Vancouver College of Massage Therapy (VCMT) for the education they have provided in managing spinal pathologies. Thank you, staff and administration at VCMT for the use of their facilitation. Finally, I would like mention my gratitude and appreciation towards my case subject. Great thanks to my subject for her patience, commitment and enthusiasm throughout this project, for this study would have not been achievable and enjoyable without her.
Appendix 1. Photographs of Before and After Photos

Figure 1 Before

Figure 2 After
Appendix 2. Pain Quality Assessment Scale (PQRS) (Pain Journal)
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<table>
<thead>
<tr>
<th>Comparative Pain Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0</strong></td>
</tr>
<tr>
<td><strong>1 Very Mild</strong></td>
</tr>
<tr>
<td><strong>2 Discomforting</strong></td>
</tr>
<tr>
<td><strong>3 Tolerable</strong></td>
</tr>
<tr>
<td><strong>4 Distressing</strong></td>
</tr>
<tr>
<td><strong>5 Very Distressing</strong></td>
</tr>
<tr>
<td><strong>6 Intense</strong></td>
</tr>
<tr>
<td><strong>7 Very Intense</strong></td>
</tr>
<tr>
<td><strong>8 Utterly Horrible</strong></td>
</tr>
<tr>
<td><strong>9 Excruciating Unbearable</strong></td>
</tr>
<tr>
<td><strong>10 Unimaginable Unspeakable</strong></td>
</tr>
</tbody>
</table>

0-10 Pain Scale
Lucile Packard Children’s Hospital
Heart Center/CVICU
http://www.pudendal.info/documents/ComparativePainScale.htm - Author
Alice Rich, RN – Recommender and Maintainer
12/08 Last Update
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Pain Assessment Scales

The National Initiative on Pain Control™ (NiPC™) has provided these diagnostic tools to assist you in assessing the severity and quality of pain experienced by your patients. We suggest that you produce multiple photocopies so that you may obtain written feedback to place in the patient’s history file.

Date:

0–10 Numeric Pain Rating Scale

Medication:
Consumed when:
Reason:
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Where is Your Pain?

Please mark, on the drawings below, the areas where you feel pain. Write “E” if external or “I” if internal near the areas which you mark. Write “EI” if both external and internal.

![Human body drawings showing areas to mark for pain]

PAIN QUALITY ASSESSMENT SCALE® (PQAS®)

**Instructions:** There are different aspects and types of pain that patients experience and that we are interested in measuring. Pain can feel sharp, hot, cold, dull, and achy. Some pains may feel like they are very superficial (at skin level), or they may feel like they are from deep inside your body. Pain can be described as unpleasant and also can have different time qualities.

The Pain Quality Assessment Scale helps us measure these and other different aspects of your pain. For one patient, a pain might feel extremely hot and burning, but not at all dull, while another patient may not experience any burning pain, but feel like their pain is very dull and achy. Therefore, we expect you to rate very high on some of the scales below and very low on others.

Please use the 20 rating scales below to rate how much of each different pain quality and type you may or may not have felt **OVER THE PAST WEEK, ON AVERAGE**.

<table>
<thead>
<tr>
<th>1. Please use the scale below to tell us how <strong>intense</strong> your pain has been over the past week on average.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No pain</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Please use the scale below to tell us how <strong>sharp</strong> your pain has felt over the past week. Words used to describe sharp feelings include <strong>&quot;like a knife&quot;</strong>, <strong>&quot;like a spike&quot;</strong>, or <strong>&quot;piercing&quot;</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Not sharp</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Please use the scale below to tell us how <strong>hot</strong> your pain has felt over the past week. Words used to describe very hot pain include <strong>&quot;burning&quot;</strong> and <strong>&quot;on fire&quot;</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Not hot</strong></td>
</tr>
</tbody>
</table>
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4. Please use the scale below to tell us how dull your pain has felt over the past week.

<table>
<thead>
<tr>
<th>Not dull</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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</thead>
<tbody>
<tr>
<td>The most dull sensation imaginable</td>
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</tbody>
</table>

5. Please use the scale below to tell us how cold your pain has felt over the past week. Words used to describe very cold pain include “like ice” and “freezing.”

<table>
<thead>
<tr>
<th>Not cold</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td>The most cold sensation imaginable (“freezing”)</td>
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</tbody>
</table>

6. Please use the scale below to tell us how sensitive your skin has been to light touch or clothing rubbing against it over the past week. Words used to describe sensitive skin include “like sunburned skin” and “raw skin.”

<table>
<thead>
<tr>
<th>Not sensitive</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most sensitive sensation imaginable (“raw skin”)</td>
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</tbody>
</table>

7. Please use the scale below to tell us how tender your pain is when something has pressed against it over the past week. Another word used to describe tender pain is “like a bruise.”

<table>
<thead>
<tr>
<th>Not tender</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most tender sensation imaginable (“like a bruise”)</td>
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</tbody>
</table>

8. Please use the scale below to tell us how itchy your pain has felt over the past week. Words used to describe itchy pain include “like poison ivy” and “like a mosquito bite.”

<table>
<thead>
<tr>
<th>Not itchy</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most itchy sensation imaginable (“like poison ivy”)</td>
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</tbody>
</table>

9. Please use the scale below to tell us how much your pain has felt like it has been shooting over the past week. Another word used to describe shooting pain is “zapping.”

<table>
<thead>
<tr>
<th>Not shooting</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most shooting sensation imaginable (“zapping”)</td>
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</tbody>
</table>

10. Please use the scale below to tell us how numb your pain has felt over the past week. A phrase that can be used to describe numb pain is “like it is asleep.”

<table>
<thead>
<tr>
<th>Not numb</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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</tr>
</thead>
<tbody>
<tr>
<td>The most numb sensation imaginable (“asleep”)</td>
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</tbody>
</table>

11. Please use the scale below to tell us how much your pain sensations have felt electrical over the past week. Words used to describe electrical pain include “shocks,” “lightning,” and “sparkling.”

<table>
<thead>
<tr>
<th>Not electrical</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most electrical sensation imaginable (“shocks”)</td>
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<td></td>
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</tbody>
</table>

12. Please use the scale below to tell us how tingling your pain has felt over the past week. Words used to describe tingling pain include “like pins and needles” and “pricking.”

<table>
<thead>
<tr>
<th>Not tingling</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most tingling sensation imaginable (“pins and needles”)</td>
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<td></td>
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</tbody>
</table>

13. Please use the scale below to tell us how cramping your pain has felt over the past week. Words used to describe cramping pain include “squeezing” and “tight.”

<table>
<thead>
<tr>
<th>Not cramping</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<th>10</th>
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</thead>
<tbody>
<tr>
<td>The most cramping sensation imaginable (“squeezing”)</td>
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<td></td>
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</tbody>
</table>

14. Please use the scale below to tell us how radiating your pain has felt over the past week. Another word used to describe radiating pain is “spreading.”

<table>
<thead>
<tr>
<th>Not radiating</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most radiating sensation imaginable (“spreading”)</td>
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</tbody>
</table>

15. Please use the scale below to tell us how throbbing your pain has felt over the past week. Another word used to describe throbbing pain is “pounding.”

<table>
<thead>
<tr>
<th>Not throbbing</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most throbbing sensation imaginable (“pounding”)</td>
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</tr>
</tbody>
</table>
Effects of Massage Therapy on Functional Scoliosis, Thoracic Range of Motion, Chest Expansion and Left Shoulder Pain: A Case Study

16. Please use the scale below to tell us how aching your pain has felt over the past week. Another word used to describe aching pain is "like a toothache."

<table>
<thead>
<tr>
<th>Not aching</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most aching sensation imaginable</td>
<td>&quot;like a toothache&quot;</td>
<td></td>
<td></td>
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</tbody>
</table>

17. Please use the scale below to tell us how heavy your pain has felt over the past week. Other words used to describe heavy pain are "pressure" and "weighted down."

<table>
<thead>
<tr>
<th>Not heavy</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most heavy sensation imaginable</td>
<td>&quot;weighted down&quot;</td>
<td></td>
<td></td>
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</table>

18. Now that you have told us the different types of pain sensations you have felt, we want you to tell us overall how unpleasant your pain has been to you over the past week. Words used to describe very unpleasant pain include "awful", "horrible", "unendurable", and "unbearable." Remember, pain can have a low intensity but still feel extremely unpleasant, and some kinds of pain can have a high intensity but be very tolerable. With this scale, please tell us how unpleasant your pain feels.

<table>
<thead>
<tr>
<th>Not unpleasant</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most unpleasant sensation imaginable</td>
<td>&quot;unbearable&quot;</td>
<td></td>
<td></td>
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19. We want you to give us an estimate of the severity of your deep versus surface pain over the past week. We want you to rate each location of pain separately. We realize that it can be difficult to make these estimates, and most likely it will be a "best guess," but please give us your best estimate.

**HOW INTENSE IS YOUR DEEP PAIN?**

<table>
<thead>
<tr>
<th>No deep pain</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most intense deep pain sensation imaginable</td>
<td></td>
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</tr>
</tbody>
</table>

**HOW INTENSE IS YOUR SURFACE PAIN?**

<table>
<thead>
<tr>
<th>No surface pain</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most intense surface pain sensation imaginable</td>
<td></td>
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</table>

20. Pain can also have different time qualities. For some people, the pain comes and goes and so they have some sensations that are completely without pain; in other words the pain "comes and goes." This is called intermittent pain. Others are never pain free, but their pain types and pain severity can vary from one moment to the next. This is called variable pain. For these people, the increases can be severe, so that they feel they have moments of very intense pain ("breakthrough" pain), but at other times they can feel lower levels of pain ("background" pain). Still, they are never pain free. Other people have pain that really does not change that much from one moment to another. This is called stable pain. Which of these best describes the time pattern of your pain (please select only one):

( ) I have intermittent pain (I feel pain sometimes but I am pain-free at other times)
( ) I have variable pain ("background" pain all the time, but also moments of more pain, or even severe "breakthrough" pain or varying types of pain)
( ) I have stable pain (constant pain that does not change very much from one moment to another, and no pain-free periods)
Appendix 3. Remedial Exercise

### Back and Core Strengthening
**Hold plank on all fours**
One arm reached above
Opposite leg stretched out

**Frequency:** Do exercise once a day (or every other day)
**Intensity:** Hold for 30 seconds – gradually increase hold to 45 seconds or 60 seconds (repeat 3x)
(Add weights to increase intensity)
**Duration:** Do exercise for 7 weeks

### Core Strengthening
**Plank**
Hold plank on a half ball or flat surface

**Frequency:** Once a day (or every other day)
**Intensity:** Hold for 30 seconds – gradually increase hold to 45 seconds, or 60 seconds (repeat 3x)
(Add weights to increase intensity)
**Duration:** Do exercise for 7 weeks

### Rhomboids Strengthening
**Back flies with weights**

**Frequency:** Once a day (or every other day)
**Intensity:** 3 sets, 10 reps
(Increase weights to increase intensity)
**Duration:** Do exercise for 7 weeks

### Erectors Stretch
**Figure Four**

**Frequency:** Once a day (or every other day)
**Intensity:** Hold right side for 30–60 seconds, Hold left side for 10–20 seconds
**Duration:** Do stretch for 7 weeks

### Pectoralis Stretch
**Frequency:** Once a day (or every other day)
**Intensity:** Hold ea. side for 20–30 seconds
**Duration:** Do stretch for 7 weeks

### Anterior Neck Stretch
**Frequency:** Once a day (or every other day)
**Intensity:** Hold ea. side for 20–30 seconds
**Duration:** Do stretch for 7 weeks

### Hydro
Do pectoralis stretch in the shower.

**Heat pack**
**Frequency:** When sore (1xday)
**Intensity:** Warm
**Duration:** 10 minutes

**Hot shower**
**Frequency:** Once a day, before treatment
**Intensity:** Hot
**Duration:** 10–15 minutes
Appendix 4. Sleeping Position

Ideal position
Subject was suggested to sleep supine on their back.

Side lying position
Pillow accordingly, aimed to keep a neutral position of the whole spine.

Pillow supporting head

Pillow between legs - decrease any rotational components in the hip

Pillow in front of chest – refrain from forward rotation of the shoulders

Appendix 5. Postural Education

Sitting
Sit on sit bones (ischial tuberosity), not tail bone

Do not cross legs

Head forward – place computer monitor of TV directly infront

Back slightly arch, add small pillow behind back

When using the computer, ensure shoulders are lowered and retracted

Ensure elbow are at 90 degrees to keyboard

Standing
Engage core

Stance, shoulder length apart

Chin up

Ears leveled to shoulders

Correct posture each time you see your reflection throughout the day
References