ABSTRACT

**Background and Participant:** A professional dancer with low back pain seeks Massage Therapy for pain relief. Posture was analyzed to find and address hypertonic muscles and trigger point (TrP) pain. No previous studies have explored the effectiveness of this form of treatment on professional dancers.

**Objectives:** The purpose of this case report is to determine if correcting posture using Massage Therapy is an effective form of treatment in decreasing low back pain in a professional ballet dancer.

**Methods:** Nine treatments of Massage Therapy 1.5 – 2 hours in duration, 2 times per week for 5 weeks were given. The focus was to assess postural alignment, balance the structure and alleviate pain and TrPs. Treatments included a postural assessment at the beginning of each session, a daily Visual Analog Scale (VAS), and 3 additional tests pre- and post- study. Structural support for posture was employed and exercises were given for At-Home-Therapy.

**Results:** Subject’s pain decreased 60mm on the VAS. Some postural distortions decreased in magnitude and some completely corrected by the end of the study.

**Conclusion:** Massage Therapy offered one dancer with chronic low back pain relief and increased range of motion (ROM). More research is warranted to further investigate short- and long- term effects of Massage Therapy on this
population. This report also highlights the importance of proper postural alignment in repetitive movements as seen in athletic activity and in postural habits including sitting and sleeping.

**KEY WORDS:** Low Back Pain, Trigger Points, Scoliosis, Massage, Athletes,

**INTRODUCTION**

The professional ballet dancer can present all of the problems of any vigorous athlete. The majority of these problems are chronic in nature and occur in the lower extremities and low back. The rate of injury for female professional dancers is between 4.14 and 4.4 injuries per 1000 hours which leads to a significant loss in performance time. Dancing and performing with painful, nagging injuries is often the norm for many dancers and the second most injured area of the body in professional dancers is the spine.

The sheer physicality of their working lives is something dancers like all athletes become “addicted to”, and their athletic body becomes their identity. Critical injuries can threaten to terminate a dancer’s career and so endanger their embodied sense of self which can lead to depression. In a prospective study
carried out at the Mayo Clinic’s Sports Medicine Center in Rochester, MN, depression and anger significantly increased and vigor decreased after injury of competitive athletes.\(^{(7)}\) Further adding to the psychological effects of injury, there is growing evidence for the idea that pain-related fear (fear of pain/physical activity/ (re)injury) in back pain patients may be more disabling than pain itself.\(^{(8)}\) This is something athletes and non-athletes alike can relate to.

Scoliosis has been found in up to 80% of athletes with an asymmetric load on the trunk and shoulders.\(^{(9)}\) Most sports including tennis, baseball, golf, and further, gymnastics and dance are asymmetrical by nature. A retrospective analysis was conducted on the German national gymnastics team focusing on spinal changes due to stress at the end of their career found that of the 15 former gymnasts with back pain complaints, 6 cases of scoliosis were present.

In a study on dancers determining if experience, body structure, anatomical anomalies and injuries are associated with scoliosis, it was observed that scoliotic dancers presented a significantly higher prevalence of genu varum (bow legs), hallux valgus (bunions), and back injuries as opposed to non-scoliotic dancers.\(^{(10)}\) Examples of structural congenital anatomical anomalies include lower limb length inequality (LLLI) and short hemipelvis (when the pelvis is smaller on one side than the other). Anatomic anomalies such as these can tilt the sacral base producing a compensatory scoliosis.\(^{(11)}\) A level sacral base plane is necessary to
allow normalization of complex lumbosacral mechanics\textsuperscript{(12)} and if not level, can contribute to the biomechanics of back pain.\textsuperscript{(13)}

Subjects with low back pain have altered automatic postural coordination, both in terms of magnitude and timing of responses, indicating alterations in neuromuscular control.\textsuperscript{(14)} Injuries in dancers, even mild, can create compensatory patterns which could result in excessive stress and strain on bones, joints, ligaments, and muscles. Likewise it has been observed that pain can perpetuate through unconscious poor postural habits seen in standing, sitting, or sleeping which will place the affected muscle or muscles into a shortened position and keep it in an active state.\textsuperscript{(15)} Asymmetries within the structure can be observed, measured, and charted through postural analysis. The purpose of this case report is to utilize posture as a guide to balance the structure by using Massage Therapy with the aim to alleviate low back pain in a professional dancer.

**METHODS**

Nine treatments of Massage Therapy were used to treat the subject. Treatment times were 1.5-2 hours in duration which included a postural assessment and manual therapy, 2 times per week in a period of 5 weeks. Initial assessment also included a standard intake form, Visual Analog Scale(VAS)\textsuperscript{(16)},
the Henry Ford Hospital Headache Disability Inventory\(^{(17)}\), The McGill Pain Questionnaire\(^{(18)}\), and Schober’s Test\(^{(19)}\).

More specifically, the type of Massage Therapy employed was Neurosomatic Therapy – a blend of specific techniques used to address postural distortions with the aim to balance the structure.\(^{(20)(21)}\) Patient’s posture was measured and charted to use as a guide to determine which muscles are lengthened and which are shortened based on the positioning of boney landmarks.\(^{(22)}\) Persistent muscular contraction as a result of faulty alignment could activate TrPs – a nodule within a taught band in skeletal muscle fibers that can create local or radiating pain and may cause ischemia in referred zones; therefore TrPs were addressed with the manual methods outlined by Travell and Simons based on their extensive research.\(^{(11)}\) Further modalities employed include myofascial release, organ massage, and lymph drainage.\(^{(23)(21)(24)}\)

An extensive postural assessment was taken at the start of each session.\(^{(22)}\) The subject was measured and charted in standing, supine, and seated as the three positions offer different insights.\(^{(25)}\) The postural assessment determined the relative bilateral inferior/superior measurements of the temporal bones, occiput, acromion processes, clavicles, 3\(^{rd}\) ribs, greater trochanters, anterior superior iliac spines (ASIS), posterior superior iliac spines (PSIS), tibial tuberosities and heel pads. Measurements were also taken on the coronal plane to determine
anterior/posterior shear and/or rotation of some of the same mentioned anatomical landmarks as well as C1 and C2 positioning, obliquity (inflare/outflare) of pelvis, temporal bones, and pelvic flexion.

Tools:

- Charts and pens
- Step stool
- Plumb bob
- Goniometer with level
- Lift kit (various platforms in different heights in millimeters)
- Chopsticks (for measuring temporal obliquity)(22)
- Massage Star(26)
- Tape measure
- Grease Pencil(27)

Client Profile

Subject is a 33 year old female, 5’8” and 127 pounds, slender and physically conditioned. She is professional dancer, ballet teacher as well as a jewelry designer. Her pain presented itself in December of 2012 during a month of performing ballet 6 nights a week on what was described as a hard stage – a
floor that does not have much flex, or spring. Prior to the shows the travel to the venue was by car, drive time 9 hours in duration, which she believes was part of the initiation of pain. While not performing, subject spends an average of 15 hours a week rehearsing, 12 hours per week teaching ballet, 8 hours per week making jewelry in a slouched spinal flexion posture accompanied by heavy lifting 4 times per week (from participating in various trade shows to sell her jewelry). Prior to the presentation of pain, the subject’s normal weekly routine also included an hour and a half yoga class two times per week.

During the performances in December of 2012 the subject experienced moderate to severe pain, had a difficult time sleeping, and found it necessary to apply self-care in order to perform. Self-care included:

- The daily application of Traumeel ointment, a combination of diluted plant and mineral extracts widely used among professional dancers to treat acute musculoskeletal injuries, pain and inflammation.\(^{(28)(29)}\)

- Self-massage with foam rollers. Foam rollers are the most commonly used tools among professional dancers\(^{(30)}\) and have shown to reduce the feeling of fatigue post-performance which may in turn have the ability to enhance performance execution.\(^{(31)}\)
• Heat and ice applied to the low back pre- and post-performance respectively. Perhaps the most effective form of self-care in terms of regulating pain reported by the subject

• Subject was treated once by a Chiropractor during this time with no significant findings or improvements.

The subject sought Massage Therapy in January of 2013 after the pain found her immobile and unable to carry out her usual routine. She presented all three distortions/complaints common amongst dancers with scoliosis: slight genu varum (bow legs) along with medially rotated knees, bilateral hallux valgus (bunions), and back injury\(^{(10)}\) – which was the reason Massage Therapy was sought. Subject’s pain was at a 70mm on the 10cm initial intake VAS. She described it as a constant ache from her right sacral side radiating across the back to the left side, which after the first treatment then changed to a shooting pain radiating from her right sacrum down her right thigh stopping at the back of the knee.

Nearly five months after the performances in December of 2012, it was noted by the subject that lifting any object even light, requires guarding in anticipation of pain. Sitting has become very painful and is most severe upon driving. Making jewelry has become heavily interrupted by the necessary intermittent standing breaks to avoid sitting for extended periods of time. Some
of the yoga stretches that were previously beneficial to the subject’s physical conditioning, which required flexion of the spine and nutation of the sacrum, are now avoided all together. Most disturbing to the subject is her inability to execute ballet positions to her fullest potential. There were even times the pain led her to a depressed state.

Initially a Lower Limb Length Inequality (LLL1) was suspected so a radiograph was taken by her chiropractor as described by Travell and Simons.\textsuperscript{(11)} The findings reported 1.5mm LLLI, a structurally short right hemipelvis of 4mm and a left pelvic obliquity. Beyond that, no acute abnormalities of the pelvis and lumbar spine were present as reported by a radiologist. The subject’s medical history is clear of previous diagnosis aside from migraines at least once a month triggered hormonally and by stress, taking NSAIDs upon the initial signs.

The subject’s fear of seeking conventional physician’s opinion is that she will be asked to abstain from dance for an extended period of time in order to alleviate pain and/or address it with medication. The subject’s goals are to be able to sit and dance without pain and prevent future occurrences. This is the subject’s first injury in her dance career that has posed as such an obstacle and threat to her livelihood.
Treatment Plan

A VAS was given at the start and end of each session as well as a daily log which was further broken down into: Active Pain Scale, Sitting Pain Scale, and Overall Pain Scale. Every treatment began with a posture assessment taking approximately 30 minutes in duration. In the first and last session, the postural assessment was repeated a second time by the Clinical Supervisor. Using posture as a guide to look at bone and joint positioning indicates which muscles appear to be elongated and which appear to be shortened. The information can then be utilized as a guide for structural balancing of the musculoskeletal system via manual therapy using various techniques and modalities. The treatments including the posture assessment were 1.5 - 2 hours.

Almost all treatments included an anterior abdominal massage to address the flattened lumbar spine. The abdominal treatment usually began with 5 minutes of skin rolling of the abdominal area, short gliding strokes on the rectus abdominis, unidirectional frictioning of the pubis attachments, and static compression of the psoas. In treatment 6, 7, 8 and 9 diaphragm massage was given with directed breathing and cross fiber strokes under the anterior ribcage. Liebenson has noted that when an individual sits, the lumbar spine commonly becomes kyphotic and the sternum and pubic symphysis become approximated,
compressing the diaphragm. Keeping these fibers in a shortened state can create hypertonicity of the muscle.

It has been observed that softening the organs through massage can facilitate change in stubborn postural distortions. Liver and spleen massage followed by lymph drainage of the anterior torso were employed in the 5th and 7th treatment. The organ massage was performed by scraping under the right anterior ribcage in the area of the liver medially then laterally towards the common bile duct, then to the gallbladder, followed by compression of the ribcage over the liver in three 1 second pumps with directed breathing, during exhale in a caudad direction in supine and sidelying, and a cephalad direction in prone. The spleen had a similar protocol but on the left side, draining medially.

The iliacus was addressed to influence the pull of the pelvic inflare with deep scraping of the muscle with directed breathing. The iliopsoas treatment concluded with 1-2 minutes of unidirectional frictioning the attachment at the lesser trocanter. Pelvic outflare was addressed with 2-5 minutes of gluteus maximus skin rolling and deep pressure glides at the attachment on the gluteal tuberosity as well as static compression and long unidirectional strokes on the piriformis. Pelvic obliquity was further treated with inch long strokes on the sacrotuberous ligament, unidirectional frictioning the sacral ligaments along the
sacral foramen with the Massage Star and finally, assisting the pelvis through multi-dimensional ROM.\(^{(20)}\)

Some of the treatments addressed the subject’s soft tissues surrounding distortions of the atlas and axis including shear, tilt and rotation. 1-2 minutes of dural tube compression/traction always preceded neck treatment. This was performed by pulling the cranium cephalad for 3 seconds to create a distractive pressure on the dural tube, followed by 3 seconds of caudal pressure on the crown and rhythmically repeating. Cervical treatments included compression, gliding and unidirectional frictioning of the sternocleidomastoid (SCM), scalenes, rectus capitis anterior, longus coli and longus capitis. These muscles either have a direct attachment to the cervical spine, or are involved with holding a cervical distortion in place as in the case with the SCM.\(^{(20)}\)

Lateral thoracic myofascial release and manual stretching were employed to address the torso tilt in treatments 7 and 8.\(^{(23)}\) Serratus posterior inferior received 3 minutes of frictioning the lower four rib attachments in treatments 4, 6, and 7. The hypertonicity of quadratus lumborum was explored with frictioning of the attachments along the 12\(^{th}\) rib, lumbar spine and iliac crest as well as gliding strokes. Hypertonicity of the gluteus minimus, gluteus medius, tensor fascia latae and iliotibial band were explored to address the pelvic tilt and the adductors were treated with long glide strokes and attachment frictioning at the pubis.\(^{(33)}\)
Treatments 5, 8 and 9 focused on the shoulder for 15 minutes. Depression of the shoulder and anterior projection of the glenohumeral joint were treated by compression and manual stretching of the pectoralis major, unidirectioning frictioning of pectoralis minor, and pincer compression of the anterior and middle deltoid. Upper trapezius was softened with compression prior to supraspinatus glides with the thumb and Massage Star. Teres major and minor were addressed with glides on the muscles and unidirectional frictioning at the axillary boarder of the scapula as well as subscapularis scraping in side lying. Attention to the lower limbs was incorporated in treatments 7, 8 and 9. At least 10 minutes were spent gliding gastrocnemius, soleus, and flexor hallicus longus as well as the entire calf through indirect kneading.\(^{(21)}\)

At-Home-Therapy was given on several instances:

1) Subject began using a 4 millimeter sit lift one week prior to treatments by placing under the right ischeal tuberosity every time she sits in order to address the short hemipelvis.\(^{(11)}\)

2) After the 2\(^{nd}\) treatment the subject was asked to support and maintain lumbar lordotic curvature while driving and sleeping by placing a rolled towel behind or under the lumbar spine respectively.\(^{(35)}\)

3) An important homework assignment was discussed after the 3\(^{rd}\) treatment which deserves particular attention. The subject was asked to consciously
maintain the neutral curves in the spine while practicing ballet. The common posture for ballet may consequently flatten the lumbar and cervical lordotic curves which can lead to poor biomechanics.\(^{(36)}\)

4) Research has indicated decreased core stability as a risk factor for low back injuries.\(^{(37)}\) In a study done on 14 participants connected to an EMG to test trunk muscle recruitment in response to various speeds of limb movement, those with low back pain failed to recruit transversus abdominis in advance to fast limb movement.\(^{(37)}\) Therefore transversus abdominis and pelvic floor strengthening exercises\(^{(38)}\) were given after the 7\(^{th}\) treatment.

**RESULTS**

**Final Intake**

Schober’s Test determines reduced flexion of the lumbar spine. Of a possible 15cm (normal ROM in flexion of the lumbar spine) the subject was 14cm pre-treatments and increased to 14 ¼ cm five days post-study displaying a ¼ cm increase in flexion of the lumbar spine. The Headache Disability Index remained exactly the same before and after the treatments. The most obvious change of the three tests given was seen in the McGill Pain Questionnaire. The subject started
at a 46 of a possible 78 on the McGill Pain Questionnaire before treatments began with the higher scores indicating greater pain, and 0 representing someone who is not experiencing true pain. Five days following the final treatment the subject reported only 3 out of 78.

**Postural Assessment**

Postural assessments showed a general decrease in magnitude in pelvic rotation, pelvic tilt, and torso rotation from the beginning of the 9 sessions compared to the last few sessions. Some postural distortions re-facilitated after a few days between treatments, even after showing improvement post-treatment as in the case with pelvic rotation, shoulder depression and atlas/axis placement. Some postural distortions completely corrected by the end of the 9th treatment as in the case with sacral tilt, pelvic flexion disorder (when one half of the pelvis is in greater flexion than the other half), and eventually, pelvic rotation. (*figures 3 and 4*)

**Visual Analog Scale**

The mean of daily VAS in Active, Sitting and Overall pain dropped from 4 at the beginning of the case report to 1’s and 0’s towards the end of the report. (*figure 1*) A pre-and post-treatment VAS shows a drop of pain level post-treatment to 0 in treatments 4 – 9. (*figure 2*) In comparing the subject’s general
pain from before the initial treatment to five days after the final treatment there was a decrease of 70mm on the subject’s VAS. A study observing interpretation of VAS ratings found that a 33% decrease in pain represents a reasonable standard for determining that change in pain is meaningful from the patient’s perspective. (39) Using this study’s findings as a guideline, anything more than a drop of 23.1mm on the subject’s VAS is significant.
**Figure 1** Mean of Daily VAS in Active, Sitting & Overall Pain

**Figure 2** Visual Analog Scale Pre- and Post- Treatment
**figure 3** Postural Chart - Treatment #1

**figure 4** Postural Chart - one week post-treatment #9
DISCUSSION

This case report found that using posture as a guide to balance the structure with Massage Therapy alleviated low back pain in a professional dancer. This was done by addressing both structural and functional asymmetries.

A radiograph was viewed to confirm the suspected LLLI. The LLLI was only 1.5 mm so no further intervention took place with that, but what was more significant was the structurally short right hemipelvis of 4mm. The effect of a small hemipelvis on lumbar scoliosis is greater than that of an equal difference in leg length. This is because the distance between the ischial tuberosities is approximately half the distance between the femoral heads, so the effect of an asymmetrical pelvis during sitting would be greater than that of a LLLI of the same magnitude.\(^{(11)}\)

Persistent muscular contraction as a result of faulty alignment seen in scoliosis, could activate TrPs.\(^{(11)}\) It has also been observed that pain from a TrP can perpetuate through unconscious poor postural habits such as sleeping or sitting which will place the affected muscle or muscles into a shortened position and will keep it in an active state.\(^{(15)}\) This can perhaps contribute to the subject’s pain in sitting, which the sit lift can address.

Human movement is achieved through a complex and highly coordinated mechanical interaction between bones, muscles, ligament and joints within the
musculoskeletal system and anything that interferes with the basic element of normal motor control can result in dysfunction and pain. Lumbar lordosis plays an important role in alignment and balance. The subject’s lumbar and cervical lordotic curves had been compromised from years of practicing ballet in a “pulled up”, “tucked under” postural pattern creating a flattened lumbar and cervical spine. The act of “pulling up” is defined by lifting the ribcage and sternum, keeping shoulders relaxed and over hips, using abdominal muscles to “tuck the hips under” to keep the back straight. Pulling up is also essential to a dancer on pointe to avoid putting more weight than necessary onto their toes. The subject’s pain in dancing was addressed through exploring proper biomechanics, which requires the weight of the body to be translated into the center of the joints.

Perhaps introducing proper biomechanics and focusing on restoring the lumbar curve can influence the entire spine. It has been observed that surgical restoring of lumbar lordosis results in spontaneous correction of the thoracic curve and sacral slope in patients with degenerative flat back syndrome. More research is needed to discern whether there can be a restoration of spinal curves and its relationship to functional biomechanics in subjects with flat back syndrome using methodically adapted postural changes as opposed to surgical intervention. This change in biomechanics for the subject may require a great
deal of time and focus to re-pattern new, more functional biomechanics. With
patience, change in habitual postural patterning can be possible.\(^{43}\)

In a study done at the UK Dance Conservatory aiming to assess the link
between postural stability and previous lower limb injuries, the findings reported
the necessity of a greater understanding of both dancers and the environments in
which they dance to fully ascertain injury susceptibility.\(^{44}\) This points out an
important factor that is unfortunately often overlooked (especially with dancers
who aren’t protected by union rules) – the importance of proper spring in the
stage floor. One of the problems with the stage the subject performed on in
December of 2012 was the particularly hard floor. If the floor doesn’t absorb any
of the force upon impact from jumps, performing on a hard stage can further
compress joints and possibly damage tissue. There are many factors that can
contribute to injury and being aware of how to prevent them is something dancers,
athletes, managers and event planners can benefit from knowing.

Some of the challenges presented in this study came from a lack of
experience on the part of the therapist. Time was wasted on repeat protocols to
correct a distortion when moving on to explore other muscles as culprits would
have been more beneficial. Another limitation in the study was the inability to
quantify the postural changes. Relying on the therapist’s keen eye and angle of
lines drawn on the chart (figures 3 and 4) are not the most precise methods of
measuring the degree of distortion. A sound method for defining and quantifying the degree of postural distortion is warranted for use in treatments and future research.

Considering the final results in the VAS, The McGill Pain Questionnaire, the final intake and the reported overall sense of well-being in the subject, the treatments were effective in meeting the subject’s goals – to alleviate back pain. A follow-up report would be necessary to further investigate the efficacy of Massage Therapy for long-term pain relief as well as correlating the connection of back pain and headaches, both initially present in the subject.

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REFERENCES


26. Acuforce Massage Star. Acuforce;


