AZUSA PACIFIC UNIVERSITY

THE EFFECTS OF MANUAL SUBOCCIPITAL RELEASE ON PATIENTS WITH LOW BACK PAIN

by

Samantha Whiteside

A capstone project submitted to the

School of Behavioral and Applied Sciences

in partial fulfillment of the requirements

for the degree Doctor of Physical Therapy

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ABSTRACT

THE EFFECTS OF SUB OCCIPITAL RELEASE ON PATIENTS WITH LOW BACK PAIN

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Background. Low back pain is one of the most common injuries seen in outpatient physical therapy practice. Research has suggested multiple treatment methods for the course of the injury; however, research on the effectiveness of manual suboccipital releases on this population has been limited. *Purpose*. The purpose of this study was to examine the effectiveness of a manual suboccipital release on patients with nonspecific low back pain. *Literature review*. Current literature has supported the use of manual muscle release technique on patients with low back pain. Research has suggested that targeting muscles in the low back and lower extremities has been most effective. However, it is uncertain if treating muscles at the start of the superficial back line will have an effect on low back pain. *Case description*. The patient was a 41-year-old female schoolteacher with chronic nonspecific low back pain and muscle stiffness. She complained of pain while sitting and standing for extended periods as well as with sneezing. *Discussion*. While there are multiple ways to treat low back pain, manual

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therapy has provided good outcomes. In this case study, applying manual therapy to the suboccipital muscles, which is the start of the superficial back line, provided immediate changes to the patient's low back pain. This is important as it gives clinicians more tools for working with low back pain patients, as well as provides a more instant form of relief in the clinic for patients who have not seen immediate changes.

Keywords: low back pain, suboccipital, manual muscle release, trigger point release, case report, superficial back line

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CHAPTER 1

INTRODUCTION

Low back pain is a significant health problem in all parts of the world and is most often treated in primary care and physical therapy settings. It is typically described as pain or muscle stiffness localized in the low back area, but can sometimes extend down the lower extremities, deemed leg pain (sciatica). The most prominent symptoms of non-specific low back pain are pain and disability (Koes, Van Tulder, & Thomas, 2006). The typical course of treatment for nonspecific low back pain has included, but is not limited to, (a) therapeutic exercises, (b) manual therapy, (c) stretching, and (d) therapeutic modalities. Manual muscle release techniques that target the specific areas of pain often have been used on low back pain patients. While research has shown this option has provided relief, a large number of patients still have not seen improvements in their symptoms after treatment. The purpose of this study was to examine the effects on pain and lumbar range of motion with manual muscle release techniques on the suboccipital muscles in patients with low back pain.

Chapter 2 reviews and details the current literature available on the treatments of low back pain, as well as on headaches, which suboccipital releases most commonly has been used. The current research has supported the use of therapeutic exercises, modalities, and manual therapy as key treatment options for patients with low back pain. While modalities like ultrasound have proven to be effective on patients with low back

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pain, (Ebadi et al., 2012), the effects of manual therapy on patients with low back pain has been more prominent. Manual therapy with active soft tissue release has proven to be a very effective option in treating patients with low back pain as well as leg pain (Kameda & Tanimae, 2019). Therefore, the research has demonstrated the effectiveness of manual muscle releases on patients with low back pain. Based on the anatomical structure of the body, the muscles involved in low back begin at the base of the skull and extend downward as an entire unit known as the "superficial back line" (Williams & Selkow, 2019). There has been little research on the effectiveness of decreasing pain and increasing lumbar range of motion with manual muscle release techniques at the start of the superficial back line.

Chapter 3 is a case study assessing a 40-year old female with low back pain, stiffness, and decreased lumbar range of motion. An evaluation was performed to analyze any impairments and assess if the patient was a good candidate for the suboccipital release compared to a therapeutic exercise program alone. After initial intervention, a 3-minute manual suboccipital release was performed at the start of each treatment session, which totaled once a week for 4 weeks. At the end of Week 4, a follow-up and re-evaluation was done and revealed a significant increase in range of motion and decrease in pain.

Chapter 4 discusses the clinical significance and implications of the outcomes of this case study as well as the limitations and the possibilities for future research.

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CHAPTER 2

LITERATURE REVIEW

Low back pain (LBP) continues to be one of the most common problems treated in physical therapy clinics with 50-80% of adults experiencing low back pain at some point in their lives (Fatoye, Gebrye, & Odeyemi, 2019). There are many treatment approaches for this problem, including, but not limited to, (a) therapeutic exercises, (b) modalities, (c) stretching, (d) manual therapy, and (e) manual muscle release techniques, that have typically provided successful results (Kameda & Tanimae, 2019). These treatments are the common approaches for first time patients as they are conservative and easy to perform in an outpatient setting. But for the patients who do not see any improvements in their LBP, what else can be done? Although these treatments are typically effective, it takes effort from the patients to supplement their treatment programs by consistently performing their prescribed home exercises. These home exercises are vital to the healing process, and when patients fail to perform them, their treatment takes longer or may not work at all.

The use of a suboccipital release in the clinical setting is quick and effective and requires no action or effort on the part of the patient. The majority of patients also have found it to be very relaxing. To date, there has been no research done on the effects of a suboccipital release on patients suffering from low back pain. There are, however, multiple studies on the effectiveness of suboccipital releases on cervical spine pain and

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chronic headaches (Moraska et al., 2016). The fascia in the back, called the "superficial back line," begins at the base of the skull, which are the suboccipital muscles, and extends to the plantar surface of the foot, (Williams & Selkow, 2019). Anatomically, the low back musculature and fascia extends the entire length of the body, and therefore, attempting to release the tension in the muscles and fascia at the top of the kinetic chain may prove to be a quick, favorable, and enjoyable treatment for patients with LBP. This particular manual muscle release may prove to be an alternative to patients who have not seen progress with prior treatments.

Purpose

The purpose of this literature review was to compare the effectiveness of a suboccipital release as an intervention for patients with low back pain to the effectiveness of traditional physical therapy treatments.

Evidence Acquisition

Data Sources and Search Strategies

A literature review was conducted from January to February 2020 to research the effects of a suboccipital release on patients with low back pain. The databased used were MEDLINE, PubMed, Physiotherapy Evidence Database (PEDro), Cochrane Library, and Cumulative Index of Nursing and Allied Health Literature Plus (CINAHL). The search terms used in these databases were associated with my PICO (population, intervention, comparison, and outcomes) question. The population was patients with low back pain; the intervention was a manual suboccipital release; the comparison was traditional physical therapy treatments; and the outcome was decreased pain and/or increased range of motion (ROM) and increased scores on the Modified Oswestry Low Back Pain

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Disability Questionnaire. The search terms used for the patient population were “low back pain” or “lumbar spine pain” or “spine pain.” The search terms for the intervention were “suboccipital release” or “muscle release” or “manual muscle release.” The search terms used for the comparison were “physical therapy” or “physiotherapy” or “rehabilitation” or “manipulation” or “therapeutic exercise.” The search terms used for the outcomes were “decreased pain” or “reduced pain” or “increased range of motion” (ROM) or “increased flexion and extension ROM” or “increased Modified Oswestry scores.”

Study Selection

After review of the 231 articles, (a) duplicates, (b) articles not in English, (c) articles with no outcome data, and (d) non-research articles were excluded. The abstracts for the remaining 38 articles were reviewed and articles (a) unrelated to low back pain, (b) unrelated to suboccipital release, and (c) unrelated to muscle release techniques were excluded. Also excluded were articles that did not involve the target population and those that involved treatments that could not be performed feasibly by a single physical therapist. The remaining eight articles were found to be relevant to the PICO question and were included.

Assessment of Methodologic Quality

The studies included in this review were assessed for level of evidence based on the CEBM level of evidence scale. Then, the quality of each study was appraised using the appropriate appraisal form. The systematic review was appraised with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Randomized controlled trials (RCTs) were appraised with the Physiotherapy Evidence Database

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(PEDro) scale. The case report was appraised with the Case Reports tool (CARE), and the observational study was appraised with Strengthening the Reporting of Observational studies in Epidemiology (STROBE).

Evidence Synthesis

One author analyzed the literature search and approved the eight articles to be reviewed in full text, and all eight were included in the literature review. One article was a systematic review (Table A2); five articles were RCTs (Table A3); one article was an observational study (Table A4); and one was a case report (Table A4). All eight articles were appraised and given a CEBM level as well as a quality assessment (Table A1).

Systematic Review

The systematic review examined the effects of the addition of spinal manipulative therapy (SMT) versus "sham" spinal manipulative therapy to an already implemented physical therapy exercise and treatment program. The intervention included high velocity low amplitude (HVLA) and low velocity low amplitude (LVLA) manipulations. The majority of the trials compared SMT with recommended therapies.

This study concluded that moderate quality evidence implied SMT had similar effects to other recommended therapies for short-term pain relief and a small, clinically significant improvement in function (Rubenstein et al., 2019). High quality evidence implied that in comparison to non-recommended therapies, SMT resulted in small, not clinically greater effects for short-term pain relief and small to moderate clinically greater improvements in function. The evidence for sham SMT was too low quality, and therefore, should be considered uncertain (Rubenstein et al., 2019)

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Randomized Controlled Trials

The five RCTs examined the effects of different interventions including the following: (a) myofascial release, (b) ultrasound, (c) physical therapy exercises and modalities, and (d) classification specific versus non-classification specific treatments for low back pain.

Of the five articles, three addressed the effects of the treatments listed above on patients with low back pain (LBP) and two addressed tension-type headaches. The first study used continuous ultrasound in addition to the normal exercise program prescribed by a physical therapist, and was compared to non-continuous ultrasound as interventions to decrease LBP. The results showed that both groups had improvement in (a) function, (b) lumbar range of motion (ROM), and (c) endurance. however, all three variables were significantly greater in the continuous ultrasound group (Ebadi et al., 2012).

The second study examined patients with tension-type headaches. Myofascial trigger point release was used on the cervical spine musculature versus placebo/detuned ultrasound. The results showed differences in headache frequency, but not for intensity or duration; however, headache frequency decreased from baseline for both groups (Moraska et al., 2016).

The third study examined the difference in pain scales, and LBP when physical therapy modalities were added to medical and exercise therapy. One group received medical treatment and exercise therapy, while the other group received the same but with physical therapy modalities included. The results showed that both groups significantly improved after treatment ($p < 0.01$) compared to before treatment values, as well as

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maintained the improvements at 3 months and one-year follow-ups (Sahin, Karahan, & Albayrak, 2017).

The fourth study examined the effects of positional release therapy versus myofascial trigger point release. The results showed that both techniques were effective in decreasing pain and disability in those with tension-type headaches. Myofascial release also was a better choice of treatment in reducing pain and disability in those with suboccipital muscle trigger points in tension-type headaches (Singh & Chauhan, 2014).

The final study compared classification specific versus non-classification specific treatments for LBP. Classification specific treatments are those that are typical of LBP patients done in the clinic, whereas non-classification specific treatments are those not normally done for LBP patients. The results showed that there were no differences in function between the two groups; however, long-term improvement in function was observed for both groups (Van Dillen et al., 2016).

Non-Randomized Controlled Trials, or Prospective Studies

One observational study and one case report were included in this review, and both addressed patients with low back pain (LBP). The observational study looked at graded exposure versus graded exercise combined with physical therapy exercise and also included the measurement of psychological variables based on the outcome measures. The results of this study showed physical therapy supplemented with graded exercise or graded exposure resulted in equal clinical outcomes for pain intensity and disability (George, Wittmer, Fillingim & Robinson, 2010).

The case report looked at multiple patients: (a) those with LBP, (b) those with leg pain (LP), and (c) those with LBP plus LP. The study compared the effects of active soft

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tissue release plus a trigger point block to an active soft tissue release alone. The results of this study showed symptom improvement in all three groups with active soft tissue release alone and active soft tissue release plus a trigger point block. Manual therapy with active soft tissue release and a trigger point block showed to be an effective treatment combination for low back pain and leg pain, but longer treatments (>3 months) were required for chronic cases (Kameda & Tanimae, 2019).

Summary of Results

In summary, research has shown multiple effective treatments for LBP. Physical therapy exercises and modalities have been proven effective, while manual muscle releases and techniques have proven themselves to be more significantly effective in lowering pain scales and improving functionality in LBP patients. Manual muscle releases, specifically in the cervical spine musculature, have also been proven effective in patient with tension-type headaches; therefore, this research has shown the variety of uses for this technique in clinical practice.

Discussion

Current literature has supported the use of (a) therapeutic exercises, (b) therapeutic modalities, and (c) manual muscle release techniques in increasing function and decreasing pain in patients with LBP. The incidence of LBP in the clinic is constant, and therefore new and quicker treatment options are essential. Although there are currently no studies on the effectiveness of a suboccipital release on patients with LBP, it may be helpful in reducing pain, increasing functionality, and increasing lumbar range of motion. The literature shows that manual muscle release/trigger point release have been effective options in treating LBP and can increase function and decrease pain (Kameda &

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Tanimae, 2019). The literature has supported the use of therapeutic exercises and modalities for decreasing pain and increasing function as well (Van Dillen et al., 2016; Ebadi et al., 2012; Sahin, Karahan & Albayrak, 2017). While the use of therapeutic exercises, modalities, and manual muscle release is effective, these options do not always work for every patient, and therefore, new, quicker treatment options need to be available in the clinic. There are significant gaps in the research when it comes to addressing the "superficial back line" for patients with LBP. It is common practice to address the musculature of the low back and legs for this condition; however, it is very uncommon to address the musculature of the upper back, neck, and head for this particular issue. There is currently no research on the effectiveness of manual muscle releases on the suboccipitals for patient with LBP, and for some, this treatment approach could instantly make a difference.

Conclusion

Low back pain continues to be one of the most frequently treated problems in the physical therapy clinic. For the most common treatment methods of therapeutic exercise, modalities, and manual therapy or manual muscle release, LBP patients have not always seen timely or lasting results from those methods. Thus, new, quicker and more effective treatment options are constantly sought after. Research has shown that manual muscle release techniques on the back, hip, or leg musculature are effective; however, it does not always provide lasting relief or improve overall function. Research is absent on the effects of manual muscle release on the suboccipitals for treating LBP; therefore, further studies are needed to determine its effectiveness.

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CHAPTER 3

CASE REPORT

Background and Purpose

Low back pain (LBP) is the second most common cause of disability in adults in the United States and over 80% of the population will experience an episode of LBP sometime in their lives (Freburger et al., 2009). There are multiple types of LBP. The first is "non-specific" or no known pathology; second is back pain from radiculopathy or stenosis; third is back pain referred from a source other than the spine; and the final type of back pain is referred from a source within the spine (Last & Hulbert, 2009). The focus of this case report is on "non-specific" LBP. As of now, the most recent literature has stated that, worldwide, LBP is the single most common cause of years lived with disability (Traeger, Buchbinder, Elshaug, Croft, & Maher, 2019).

Currently the literature has supported the use of (a) therapeutic exercises, (b) therapeutic modalities, and (c) manual muscle releases to treat LBP in the clinical setting (Last & Hulbert, 2009). While these treatment options have been satisfactory, they have not worked for every patient with LBP. Often, patients with LBP are hoping for quicker, more immediate results in the clinic to decrease their pain. While therapists are striving for long-term results, patients are more apt to consistently participate in their therapeutic treatments if they are experiencing immediate and lasting relief. Thus, quicker, more immediately effective treatment options are needed.

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Manual muscle release techniques have been consistently used in the clinical setting to treat LBP (Kameda & Tanimae, 2019; Kodama et al., 2019). However, these techniques are, of course, typically focused on the low back, hip, or gluteal muscles. It is not wrong to address those muscles first in these types of patients, but in patients who continually cease to progress in their treatments or do not experience any same-day relief, new treatment options are necessary.

Anatomically, the musculature and fascia of the low back extend as one unit from the cranium, (base of the skull), to the plantar surface of the foot, and is addressed as the "superficial back line" (Williams & Selkow, 2019). That being said, addressing one area in the middle of the superficial back line (SBL) might not be the most effective treatment method. Instead, the potential of treating at the beginning of the SBL, the suboccipitals at the base of the skull, may prove to be a more successful method. Treating at the beginning of the SBL by relaxing the entire line from the top down may not only be a quicker option, but ultimately may provide immediate relief in patients with LBP. Currently, there are gaps in the literature about addressing the beginning of the SBL (i.e., at the suboccipitals) with a manual muscle release for treatment of LBP. The purpose of this case was to examine the effectiveness of manual suboccipital release treatment on patients with low back pain.

Case Description: Patient History and Systems Review

A 40-year-old female patient presented to physical therapy suffering from consistent, non-specific low back pain with no known cause. The patient reported the pain had lasted "years" and was unable to determine any specific timeline. The patient was a middle school teacher, and her job involved extended periods of standing as well as

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carpooling in the evening with extended periods of sitting. She attempted chiropractic interventions, massage, and Pilates, but had no improvements. The patient's symptoms included (a) pain while sleeping, (b) pain in the mornings upon waking, and (c) pain with sneezing. She also reports feeling inflexible in her back and experiencing muscle spasms in the low-mid back during the day. She reported that her back "loosens up" throughout the day, but ultimately returned to the painful state upon conclusion of her day. She reported having radiographs taken at her chiropractic appointments but was never given results. She also denied any numbness/tingling or radiating pain into the lower extremities and pointed to the central part of her lumbar spine when asked where her pain location was.

She reported having no known prior injuries to the back and presented with no pertinent medical or surgical history. She admitted to seeking physical therapy as a "last resort," as no other treatments had helped her to this point. Upon evaluation of the patient, findings with respect to neurological, gastrointestinal, endocrinological, cardiopulmonary, and integumentary were normal. Patient goals for physical therapy included (a) minimal onset of back pain throughout the day during work, (b) no pain with sneezing, and (c) being able to sleep through the night without difficulty. The Modified Oswestry Disability Scale (ODI), was given to the patient on the initial visit to determine her perceived disability. The ODI consists of 10 questions that address activities of daily living (ADLs) such as personal care, sitting, standing, sleeping, etc. (Fairbank & Pynsent, 2000). Each question is given a score between 0 and 5, with 0 being the least amount of pain/difficulty, and 5 being the most pain/difficulty. Her disability score on the initial visit was 26%, which correlates to "moderate disability" (Fairbank & Pynsent, 2000).

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Clinical Impression #1

Although the cause of the patient's pain was unknown, the symptoms present, and mechanisms of pain made the patient a good candidate for physical therapy intervention. The patient's primary problem was pain and stiffness in the low back. After completing the subjective exam, the main purpose was to determine the cause of her low back pain. The patient denied any neurological/radicular symptoms in the lower extremities, thus lowering the potential of a disc-related/nerve issue. At this stage of her encounter, it was not unreasonable to hypothesize that she is suffering from (a) lumbar facet issues, (b) consistent muscle strain and overuse of the low back, (c) arthritis of the low back, and/or (d) extreme hypomobility of the lumbar region. Examination of impairments included (a) posture, (b) squatting motion, (c) lumbar active range of motion and accessory mobility, (d) manual muscle testing of lower extremities, (e) flexibility testing, and (f) palpations. Due to the propensity of weakness in core strength with low back pain, abdominal strength testing was also taken into account (Akhtar, Karimi, & Gilani, 2017).

Examination

Postural Assessment

In static standing, patient had pain in the low back. Observation of the patient in anatomical position revealed the patient had (a) an elevated right iliac crest, (b) decreased lumbar lordosis, and (c) slight posterior pelvic tilt.

Squat Assessment

The patient was instructed to align her feet shoulder-width apart and perform her version of a squat. Upon completing this motion, she had (a) decreased range of motion

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through the squat, (b) bilateral subtalar collapse at the foot, and (c) flat-back posture throughout the motion.

Lumbar Active Range of Motion and Accessory Mobility

Range of motion in the lumbar spine was observed with forward and backward bending, and right and left rotation, and measurements were taken with two inclinometers while in standing. Flexion range of motion was normal, whereas in extension (backward bending) range of motion was severely limited at zero degrees. Right and left rotation were equal, and the patient reported feeling "stretching and tightness with all motions" that were measured. Accessory mobility of L1-L5 was observed in the prone position. Upon performing posterior to anterior (PA) mobilizations to L1-L5, the patient was found to have hypomobility throughout all five segments.

Manual Muscle Testing (MMT) of Lower Extremities

Manual muscle testing (MMT) was done in a sitting position on bilateral lower extremities, which included (a) hip, (b) knee, (c) ankle, and (d) core/abdominals. Hip flexion was measured in sitting, with the left leg being slightly weaker than right. Hip extension was measured while prone and determined to be equal bilaterally. Hip abduction was measured in side-lying and determined to be equal bilaterally. Knee flexion and extension were measured in sitting and had equal measures bilaterally in both positions. Finally, ankle plantarflexion and dorsiflexion were measured in sitting and had equal measures bilaterally in both positions. Core strength was measured in supine with both legs extended and raised to approximately 80˚ of hip flexion; the patient was asked to slowly lower both legs to neutral while maintaining her low back pressed into the table

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and her core tightly activated throughout. Her core strength received a measure of "good" and had room for improvement.

Palpation/Flexibility

The patient complained of muscle stiffness throughout, so palpation of multiple areas was deemed necessary. Upon palpation, increased tone was observed in bilateral paraspinals and piriformis. Patient reported having tenderness to palpation in these areas, as well as her right iliopsoas. Flexibility of her hamstrings was measured with the 90/90 hamstring flexibility test and were found to be within normal limits.

Special Tests

Evaluation of the patient determined the necessity of special testing, which included the Thomas Test and the Prone Instability Test (PIT). The Thomas Test looks at the flexibility of the iliopsoas and quadriceps muscles. It is performed with the patient standing at the end of the table and slowly lying back while hugging one leg to the chest. The leg that is left extended is slowly dropped off the end of the table under the control of the therapist and the range of motion is observed. Upon completing this test, the patient showed positive findings of tight iliopsoas muscles bilaterally, but normal length in bilateral quadriceps. The second special test performed was the PIT to determine if muscle weakness and instability in the low back was a contributing factor. The patient lies face down over the table at the waist. The patient's hips and legs are off the table and both feet are touching the ground. The patient is initially asked to grasp the sides of the table and lift the legs off the ground while maintaining extended knees. Then the patient relaxed the legs and a PA mobilization was performed over the most painful lumbar

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vertebrae and the patient was asked to perform the same previous motion. The patient presented a negative result on this test.

Overall, the patient was an excellent candidate for physical therapy intervention. She would benefit from stretching and strengthening as with a typical treatment program, but due to increased hypomobility and stiffness along the paraspinals and low back musculature, manual muscle release techniques would be extremely beneficial to her.

Clinical Impression #2

Looking at the data gathered from the examination, it was determined that the patient had (a) postural misalignments, (b) movement faults, (c) decreased range of motion and accessory mobility in the lumbar spine, and (d) muscle stiffness and tightness. Due to the nature of these findings, the patient was deemed an excellent candidate for this treatment approach.

The prognosis for this patient was determined to be in the fair to good range due to (a) her failed attempts at previous treatments, (b) her inability to limit her time in standing, and (c) the overall length of time she has had the low back pain. After objectively examining the patient, the main issues found that could be contributing to her low back pain were (a) tight paraspinal and iliopsoas musculature, (b), decreased lumbar range of motion and decreased lordosis, and (c) an elevated iliac crest on the right. After identifying these issues, the therapist believed she would greatly benefit from the planned treatments. The primary goal was to decrease the tone and tightness in the paraspinals and iliopsoas, so as to decrease the consistent elevation in the right iliac crest. Secondarily, increasing flexibility and range of motion in the lumbar spine as well as working to restore proper lumbar lordosis were important to her treatment plan as well.

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For the initial phases of her treatment, is was determined that she needed to focus on (a) stretching the paraspinal and iliopsoas muscles, (b) increase strength in the core/abdominals and the gluteus medius and maximus, and (c) receive muscle release techniques to help with flexibility. Range of motion of the lumbar spine was taken with two inclinometers at the start and finish of each treatment session. The Modified Oswestry Disability Index (ODI) was given at the initial evaluation and was given once more at the cessation of treatment. Subjective pain scores were measured prior to and after each treatment session via the Numerical Pain Rating Scale (NPRS). Based on the patient's current condition, two treatment sessions per week for four weeks was determined to be sufficient.

Intervention

The objective of this case report was to examine the effects of a manual muscle release technique on patient with low back pain. The primary intervention performed was a 3-minute manual suboccipital release. Due to other contributing factors (see Figure B1), other interventions were performed after investigating the outcomes of the suboccipital release (see Table B1). According to Kodama et al. (2019), the analgesic effects of "myofascial trigger-point release" compression may be mediated through its effects on the central nervous system. This shows the effectiveness of myofascial trigger point releases on how the nervous system processes pain, and therefore, how it can reduce the sensation of pain. Due to (a) the patient suffering from non-specific low back pain, (b) her perceived low back muscle stiffness, and (c) a decrease in lumbar range of motion with 40° of flexion and 8° of extension, these symptoms further supported the use of manual muscle release techniques for her treatments.

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The muscle release technique was performed on the sub occipital region, which lies at the base of the skull near the hairline. The patient was placed in supine with support at the knees to reduce further aggravation of the low back. The patient's head was cradled in both hands, supported at the base of the skull with both palms and at C1-C5 with digits 2-5, and was given instruction to relax as much as possible. Once this was accomplished, both hands were used to apply the release. The distal phalanges of digits 2-5 were used to apply the pressure of the release on the suboccipital muscles. The release was held for 3 minutes total; however, after each minute the distal phalanges were slightly adjusted or repositioned in more lateral areas of the suboccipital muscles so as to reach all areas of the muscles (see Figure B3). This treatment was performed once per session.

Outcomes

Active lumbar flexion and extension range of motion, numerical pain rating scale (NPRS), and the Modified Oswestry Disability Index (ODI) were used as outcome measures. Range of motion and NPRS were used to measure immediate effects of the suboccipital release, while the ODI was used to measure lasting effects, as it was administered at the start and conclusion of the study. Two inclinometers, one at the T1 level, and the second at the S2 level, and maintaining her feet shoulder-width apart were used to maintain a standard in measuring lumbar range of motion.

In total, the case report covered five treatment sessions with the patient. She was instructed in the treatment plan formulated by the evaluating therapist, which consisted of (a) stretching and therapeutic exercises (see Table B2) as well as (b) receiving the 3-

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minute manual suboccipital release within each session. At each session, the patient was asked about the compliance of her home exercise program, (see Table B3).

Active Lumbar Range of Motion

Active lumbar range of motion with two inclinometers was used to track progress before, during, and after treatment. According to Saur, Ensink, Frese, Seeger and Hildenbrandt, "correlation of [lumbar spine] measurements taken radiographically and by inclinometer demonstrated an almost linear correlation for measurements of the total lumbar range of motion ($r = 0.97$; $p < 0.001$)" (1996, p. 1335). The minimally clinically important difference (MCID) for range of motion is >/= 5°.

The patient was initially measured with 40° of flexion and 8° of extension, and stated she felt stiffness and tightness with both motions. At the 4-week final visit, the patient was measured with 53° of flexion and 32° of extension and reported feeling "less stiffness and tightness" with each motion. The patient gained well over 5° of flexion and extension range of motion; therefore, this outcome was deemed a meaningful and important change for the patient.

Numerical Pain Rating Scale (NPRS)

Prior to and after treatment, the NPRS (Shirley Ryan Ability Labs, n.d.) was used to define the patient's subjective pain level. The 10-point scale, ranging from 0-10 with 0 being no pain and 10 being the worst pain imaginable, the patient was asked to identify her current level of pain. From the Shirley Ryan Ability Labs (n.d.), a shift of at least 2 points is deemed a meaningful change for the patient and is shown to have an interrater reliability agreement of 100%.

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Initially, the patient subjectively stated that both flexion and extension motions in the lumbar spine created 5/10 pain. She also reported stiffness and tightness with each motion. At the 4-week final visit, the patient subjectively reported that flexion motion created 3/10 pain, and extension motion created 1/10 pain. Each rating dropped at least 2 points on the NPRS, therefore, making this change meaningful to the patient.

Modified Oswestry Disability Index (ODI)

At initial evaluation and post-treatment, the patient was asked to fill out the Modified Oswestry Disability Index (ODI) for her low back pain. According to Shirly Ryan Ability labs (n.d.), the MCID is unknown, as "different calculations have yielded widely different threshold values." (2013, Rehabilitation Measures Database). At initial evaluation, the patient scored a 13/50 on the ODI, which calculates to 26% disabled. At the 4-week final visit, the patient was given the same ODI and scored a 12/50, which calculates to 24% disabled. Unfortunately, since her disability scored only dropped by 2%, this is not enough of a change to deem a significant clinical improvement.

Discussion

The purpose of this case study was to examine the effectiveness of a manual suboccipital release on lumbar range of motion and pain in a patient with non-specific low back pain. As noted in the Outcomes section, a change of at least 5° in lumbar range of motion and a change of at least 2 points in the NPRS is deemed important and clinically significant; therefore, the patient did have important and clinically significant changes by post-treatment. As for the Modified Oswestry Disability Index, MCID values were not found and, based on the 2% change in the patient's scores, this was presumably not a clinically significant change.

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It is difficult to say whether or not the suboccipital release was the main factor in the patient's change in outcomes. Although the patient received the treatment first thing each session, she was also given a therapeutic exercise program during treatment and performed stretches each session. Lastly, she was given a home exercise program that consisted of stretching and core exercises in order to supplement her recovery outside of the clinic. The suboccipital release was not intended to be the sole treatment option for the patient; rather, it was aimed to supplement her current treatment program It was also meant to reduce pain and stiffness in her low back so as to allow her to tolerate treatment for longer periods at each session. The suboccipital release was done at the start of each treatment session in hopes of reducing the patient's current pain and increase her lumbar range of motion by releasing the tension in the fascia of the superficial back line. By doing so, her ability to participate in her therapeutic exercises pain-free improved. This technique was also implemented as a way to incorporate mild relaxation before each treatment in hopes of influencing the patient's mood towards participating as well as returning for the rest of her therapy sessions.

The research available on suboccipital release focused on its effectiveness with headaches and cervical spine issues; therefore, more research is needed on its effects on other parts of the body. Clinicians could benefit from continued studies on this topic so as to provide easier and quicker treatment options in the clinic.

The strengths of this particular study include consistency of the clinician performing the treatments as well as collecting the data. This limits any issues with intrarater reliability. But the study still has its limitations: (a) only one patient was

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evaluated for this study; (b) the patient performed only five treatment sessions; and (c0 the patient lacked consistency in her home exercise program.

Overall, the application of a suboccipital release on patients with low back pain proved to be immediately effective in increasing lumbar range of motion as well as decreasing numerical pain rating scale scores. Long-term effectiveness is still questionable as the Modified Oswestry Disability Index score remained almost the same.

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CHAPTER 4

DISCUSSION

Low back pain continues to be one of the most common injuries seen in the physical therapy clinic. The lifetime prevalence of low back pain is as high as 84%, with 11-12% of the population being disabled by low back pain (Balague, Mannion, Pellise & Cedraschi, 2012). There are myriad treatment options for patients with low back pain; however, it has been difficult to have a positive response from every patient. Patients with chronic or nonspecific low back pain often have struggled to see any lasting results from treatments. While therapeutic exercises has been one of the standard treatments for chronic low back pain, the effects have been small and it remains unclear which type of patients benefit more from this treatment (Middelkoop et al., 2010). The use of myofascial release techniques has become more prevalent in the clinics to treat these types of patients. Studies have shown significant improvements in both pain and disability when this technique is utilized (Arguisuelas et al., 2017). While the use of myofascial release techniques is almost always targeted at the site of pain, the idea of using this technique in areas above the site of pain have not yet been studied. The superficial back line, the "line" of muscle and fascia that begins at the base of the skull and extends to the plantar surface of the foot, plays a key role in the posterior kinetic chain of the body. Addressing the beginning of this line, which consist of the muscles at

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the base of the skull named the suboccipitals, may show to be more effective at treating low back pain and stiffness versus treating at the exact site of pain.

Upon review of the literature, research has shown multiple treatment methods have been effective for low back pain; however, not for every patient. Articles on the use of modalities, therapeutic exercises, and manual muscle release techniques were analyzed and used for this case report. Due to the use of suboccipital releases on headache and cervical spine pain, two research studies on headaches were included in the review in order to show the effectiveness of a suboccipital release in the general clinic setting (Singh et al., 2014). The use of ultrasound was deemed effective as well as therapeutic exercises as both treatments have demonstrated that patients had decreases in pain and disability in patients with low back pain. The most important research was that of manual muscle release techniques (Kameda & Tanimae, 2019). This research demonstrated that the treatment technique is, in fact, effective on low back pain; therefore, this treatment could also be effective on the suboccipitals in those patients with low back pain.

The case study aimed to look at the effectiveness of a suboccipital release on a patient suffering from low back pain and stiffness. Upon initial evaluation, multiple impairments were found; however, the low back was the primary area of treatment as it proved to be the cause of the underlying impairments. The 3-minute suboccipital release treatment was applied at each treatment session prior to the patient's exercises in order to give her the most benefit during her exercise program; ultimately the intervention resulted in clinically significant changes in range of motion and pain. The limitations of this study include: (a) only having 5 treatment sessions to implement the intervention; (b) having no control group, and (c) only having one patient with nonspecific low back pain,

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compared to patients with a more specific diagnosis. Other outcome assessments could have been helpful in allowing the patient to better gauge her progress.

Future research is needed to determine the relationship between the suboccipitals and low back pain in order to support the rationale for treatment. Additional research is necessary to determine the long-term effects of this treatment, as well as the efficacy of implementing this treatment on other types of low back pain diagnoses. Lastly, more research is needed on the duration of treatment needed and whether longer or increased pressure during the suboccipital release would enhance the patient's treatment outcome.

In conclusion, this study supported the use for a suboccipital release on a patient with nonspecific low back pain as an effective treatment for the immediate increase in lumbar range of motion as well as immediate decrease in pain scales. Therapists should consider the suboccipitals and superficial back line as a potential factor in patients with low back pain. Treating this area may show immediate gains in lumbar range of motion, and an overall decrease in pain.

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APPENDIX A

TABLES AND FIGURES FROM CHAPTER 2

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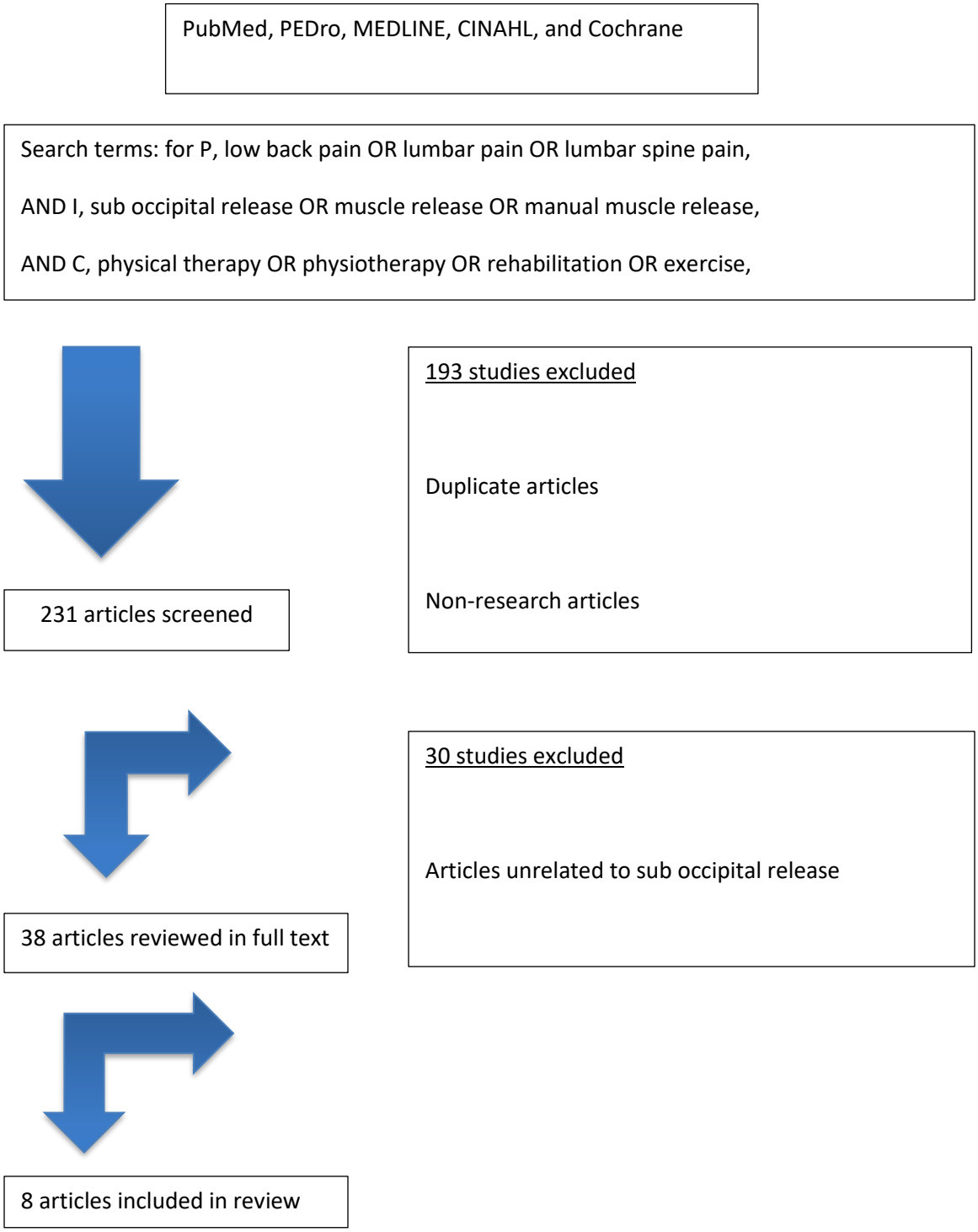

Figure A1. Search strategy.

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Table A1

CEBM Quality Ratings of Individual Articles

Study	CEBM Level of Evidence	Quality
Ebadi et al.	2	8/10 PEDro
George et al.	3	18/22 STROBE
Kameda et al.	4	88% CARE
Kodama et al.	2	10/10 PEDro
Rubenstein et al.	1	100% PRISMA
Sahin et al.	3	80% PRISMA
Singh et al.	2	5/10 PEDro
Van Dillen et al.	2	7/10 PEDro

Note. CEBM, Center for Evidence-Based Medicine; PEDro, Physiotherapy Evidence Database; STROBE. Strengthening the Reporting of Observational studies in Epidemiology; CARE, Case Report; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta Analyses.

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Table A2

Systematic Reviews

Study	Design/Study type	Outcomes measured	Follow-up	Participants and setting	Intervention (I) and Comparison (C)	Results
Rubenstein, Zoete, Van Middelkoop, Assendelft, De Boer, & Van Tulder (2019)	Systematic review & Meta Analysis	Pain and back specific functional status	Follow-ups 1, 3, 6, and 12 months post randomization	Pts had to be 18+ years old, and of the research trials chosen, 50% of the patients in the trials had to have lasting pain >3 months	I: addition of spinal manipulative therapy (HVLA & LVLA) C: "sham" spinal manipulative therapy added to traditional PT tx program	SMT had similar effects as recommended therapies, but SMT seemed to be better than non-recommended therapies in regards to short term functioning.

Note. SMT, spinal manipulative therapy; HVLA, high velocity low amplitude; LVLA, low velocity low amplitude.

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Table A3

Randomized Controlled Trials

Study	Design/Study Type	Participants And Setting	Intervention (I)	Comparison (C)	Outcomes Measured	Results
Ebadi, Ansari, Naghdi, Jalaei, Sadat, Bagheri, & Fallah (2012)	Randomized Control Trial (RCT)	N = 23 patients per group, one control and one testing group; male/female breakdown not given. Participants recruited from 3 Univ hospitals	Continuous US along with current exercise tx program from PT	Placebo (non-continuous) US along with current exercise tx program from PT	Function, global pain (VAS), lumbar ROM and holding time of Sorensen test.	Both groups had improvement in function ($p<.001$), Lumbar ROM and Sorensen test holding time not stat sig. ($p>.05$), and improvement in function, ROM and endurance time was sig. greater in continuous US group ($p<.05$)
Moraska, Stenerson, Butryn, Krutsch, Schmiege, & Mann (2016)	Randomized placebo-controlled clinical trial (RCT)	N = 56, "mostly female, Caucasian, and working", avg age 33.5yo	Myofascial trigger-point release massage to cervical spine musculature	Placebo, or detuned ultrasound	Headache pain was recorded in a daily headache diary. Self-report of perceived clinical change in headache pain and pressure-pain threshold at Myofascial trigger points in the upper trap and suboccipital muscles.	Group differences in headache frequencies, but not for intensity or duration. However, headache frequency decreased from baseline for both massage and placebo, but no difference felt in either one.

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Table A3, continued

Study	Design/Study type	Participants and setting	Intervention (I)	Comparison (c)	Outcomes measured	Results
Şahin, Karahan & Albayrak (2017)	Randomized Control Trial (RCT)	N = 104, 38 male & 66 female, age range 34-62 years old, who had CLBP >12 weeks without any neurological symptoms	Physical therapy exercise tx, medical tx, and PT modalities	Medical and exercise therapy alone	VAS, ODI, and ILBP disability index before treatment and at two weeks, three months, and one year after treatment.	In both groups, the VAS, ODI, and ILBP disability index significantly improved after treatment ($p<0.01$), compared to before treatment values. There were statistically significant differences in the VAS, ODI, and ILBP scores at three months and one year after treatment between the physical therapy group and control group ($p<0.05$).
Singh & Chauhan (2014)	Randomized, comparative study (RCT)	N = 28; male and female subjects, between 25-45yo, 14 in group A, 14 in group B	Positional release therapy	Myofascial trigger point release.	VAS and HDI	The study concluded that both techniques are effective in improving the pain and disability in subjects with tension-type headaches. The study shows that myofascial release is a better choice of treatment in improving pain and disability in those with suboccipital muscle trigger points in tension type headaches.

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Table A3, continued

Study	Design/Study type	Participants and setting	Intervention (I)	Comparison (c)	Outcomes measured	Results
Van Dillen, Norton, Sahrmann, Evanoff, Harris-Hayes, Holtzman, Strube (2016)	Prospective, Randomized, controlled clinical-trial (RCT)	N = 101, 47 in CS group and 54 in NCS group with no specifics on male or female. All participants were between 18 and 60 yo.	Classification specific treatments	Non-classification specific treatments	Modified Oswestry Index, exercise and performance training adherence.	There were no differences in function between the two treatment groups (CS and NCs). Long-term improvement in function was observed in both groups, however.

Note. CLBP, chronic low back pain; PT, physical therapy; VAS, visual analogue scale; ODI, Oswestry disability index; ILBP, Istanbul low back pain; HDI, headache disability index; CS, classification specific; NCS, non-classification specific; US, ultrasound; ROM, range of motion.

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Table A4

Case Reports

Study	Design/Study type	Participants and setting	Intervention (I)	Comparison (c)	Outcomes measured	Results
George, Wittmer, Fillingim, & Robinson (2010)	Quasi-Experimental Clinical Trial (Observational)	N = 33 patients, 15 in Graded Exercise, 18 in graded exposure. 16 males, and 17 females. Approx. age 46 years old.	Graded exposure and secondary study looked at the association of changes in psychological variables to changes in outcome measures.	Graded exercise in a traditional PT ex program	VAS, Modified Oswestry, and psychological factors	Physical therapy supplemented with graded exercise or graded exposure resulted in equivalent clinical outcomes for pain intensity and disability.
Kameda & Tanimae (2019)	Retrospective case-control study	N = 36 in LBP group, 16 in LP group, and 29 in LBP + LP group. Mean age was 63.1yo.	Active soft tissue release and trigger point block	Active soft tissue release alone	NRS for pain	Results of the study showed symptom improvement in all three groups with active soft tissue release alone and active soft tissue release + a trigger point block. The gluteus medius was the major myofascial trigger point in all groups. Manual therapy with active soft tissue release and a trigger point block is an effective treatment combination for low back pain and leg pain, but longer treatments are required in chronic cases.

Note. VAS, visual analogue scale; LBP, low back pain; LP, leg pain; NRS, numerical rating scale.

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APPENDIX B

TABLES AND FIGURES FROM CHAPTER 3

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Figure B1. Timeline.

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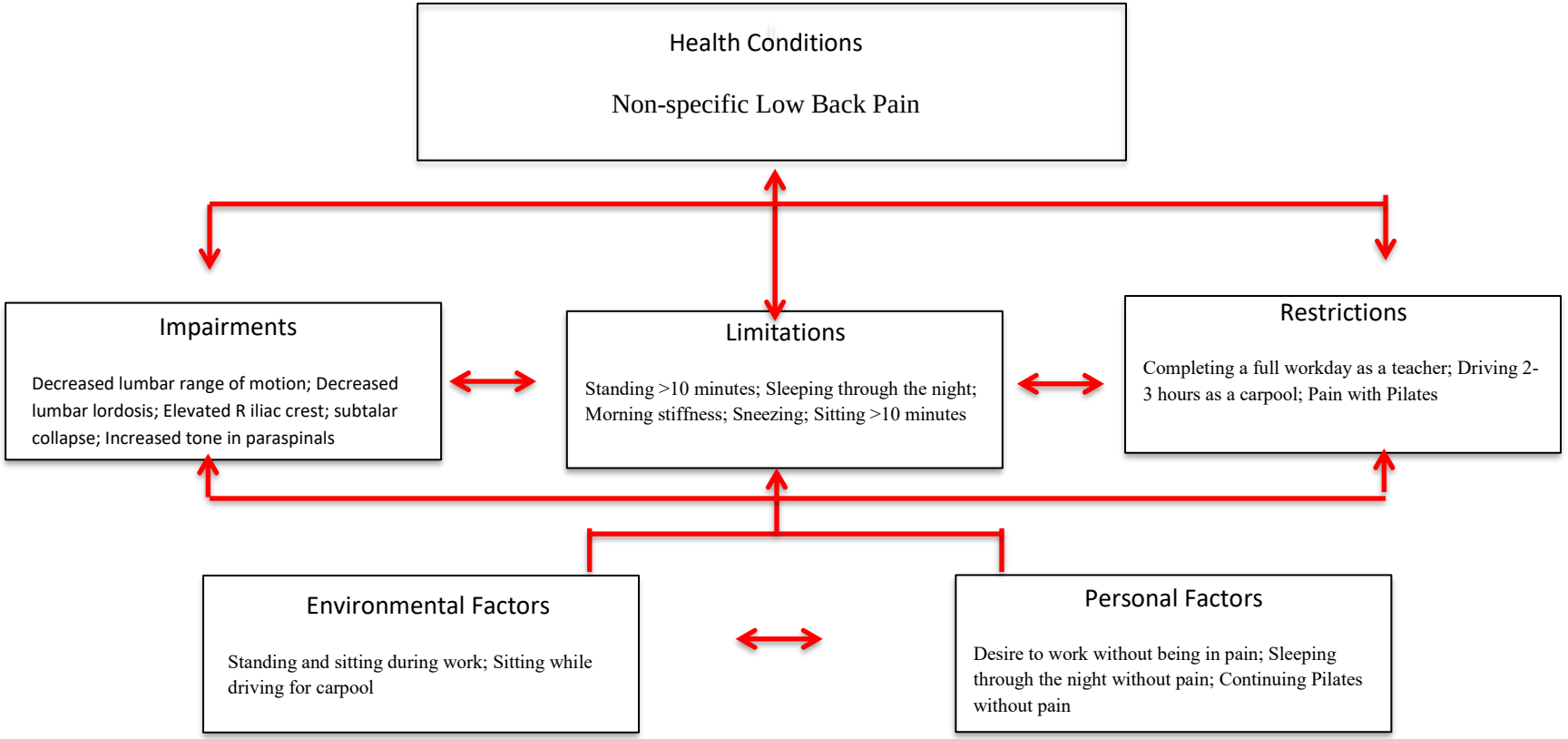

Figure B2. International classification of functioning (ICF) model.

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Figure B3. Suboccipital release positioning.

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Table B1

Intervention Timeline with Clinical Reasoning

Timing	Short-Term Goals	Clinical Challenges	Changes to Treatment Program
Initial Evaluation to treatment day 1	Increase lumbar ROM	Significant hypomobility at L2-L5 vertebrae; stiff paraspinal muscles	Use of manual Sub Occipital release to decrease paraspinal tone
	Decrease lumbar lordosis	Posterior pelvic tilt; tone in lumbar paraspinals; inability to activate glute max musculature	Use of manual therapy to reduce tone in paraspinal, iliopsoas, & piriformis musculature; core & glute max activation exercises
	Decrease iliac crest elevation	Tightness in iliopsoas musculature	Manual muscle release on iliopsoas muscle; Hip flexor stretching
	Decrease paraspinal stiffness	Tone in paraspinals from T12-L5	Use of manual sub occipital release; Stretching of the lumbar paraspinals, piriformis, and hip flexor musculature

Note. ROM, range of motion.

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Table B2

Treatment Program – Suboccipital Release Done after Heat Application

Exercise	Description	Frequency/Repetitions
Moist heat pack	Patient lying supine with knees supported on bolster	10 minutes
Double Knees to Chest	Patient lying supine, hugs one knee at a time, then hugs both knees together	3 x 30 second hold for each stretch
Hip flexor stretch	Patient kneeling on one knee, hands on hips in "lunge" position, leaning forward with hips to stretch iliopsoas muscle	2 x 30 second hold for each leg
Piriformis stretch	Patient lying supine, knees bent. One leg crossed over the other with lateral ankle just above knee	3 x 30 second hold for each leg
Posterior pelvic tilts with bridge	Patient lying supine, knees bent. Patient tilts pelvis up and toward the head, then lifts hips and buttock off table to create a "bridge"	10 x 10 second hold in bridge position
Supine clams	Patient lying supine on table with red TheraBand looped around both legs just above the knees. Patient abducts knees against resistance	3 x 10 repetitions
Self-Myofascial Release	Patient uses lacrosse ball against wall to massage stiff and painful areas	6 – 8 minutes

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Table B3

Home Exercise Program

Exercise	Description	Frequency/Repetitions
Hamstring stretch	Patient instructed to do in standing with leg straight out on chair, or use a beach towel as a strap for deeper stretching	3 x 30 second hold each leg / 2x a day / 3x a week
Squats	Patient instructed to do squats in standing focusing on the gluteus maximus activation	2 x 10 repetitions / 2x a day / 3x a week
Segmental spine roll	Patient instructed to stand, then segment by segment, slowly flex the spine forward all the way to the cervical spine. Then, slowly roll back "up", or into extension	1 x 5 repetitions / 2x a day / 3x a week
Glute squeezes	Patient instructed lye in supine, knees bent and squeeze gluteus muscles together and hold	2 x 10 repetitions with a 10 second hold / 2x a day / 3x a week

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