Immediate Effects of the Lumbosacral Region Manipulation on Hip Passive Range of Motion in Patients with Low back pain. A Case Series.

Corresponding Author: **CDR Alexander Karl Brenner, PT, DPT, OCS**
Work Address:

BOP, FMC-Lexington
Chief Physical Therapist
3301 Leestown Road
Lexington, KY 40511

Mailing address:
123 Colonial drive, Versailles, KY 40383
Phone: 859-255-6812 Ext 5595
Fax: 859-253-8890
Email: abrenner@bop.gov

Abstract

This case series describes the immediate effects of the lumbosacral region manipulation on hip passive range of motion in 9 patients referred to physical therapy with a primary diagnosis of low back pain. All patients underwent bilateral hip range of motion measurements as part of a physical examination. Patients then received a unilateral lumbosacral region manipulation followed by post-manipulation hip range of motion measurements. Eight out of 9 patients (89%) demonstrated a mean increase of 7 degrees (95% CI 5-9 degrees) in hip internal rotation and a mean increase in total rotation of 10 degrees (95% CI 2-18 degrees) contralateral to the side of manipulation. These findings along with other observed clinically meaningful changes in hip range of motion suggest that there may be a regional interdependence between the hip and lumbar spine in patients with low back pain. It is plausible that other patients with hip range of motion deficits may benefit from the lumbosacral region manipulation to help improve these deficits.

Key Words: Manual Therapy, Regional Interdependence, Modified Oswestry

INTRODUCTION

Low back pain (LBP) is one of the most common reasons for patient visits to a physician's office. [1,2] Yet, attempts to identify effective interventions for individuals with LBP have been largely unsuccessful.[3,4] There is, however, some evidence demonstrating the efficacy of spinal manipulation in the treatment of LBP.[5-13] Several randomized trials have found spinal manipulation to be more effective than placebo or other interventions for patients with acute LBP [9,13] Flynn et al[13] developed a clinical prediction rule for one specific manipulative intervention, the lumbosacral region manipulation (LSM), used to treat patients with LBP.

The association between excessive or limited hip ROM and LBP is not clear. One reason for the ambiguity of this relationship may be because there is little agreement on what normal hip ROM should be. Normal values for hip internal and external ROM vary among different reports.[14,15] The American Academy of Orthopaedic Surgeons reported that hip internal and external rotation to be equal at 45 degrees while the Committee on Medical Rating of Physical Impairment describes more external rotation than internal rotation for normal individuals. Other studies have shown age and sex differences in hip ROM.[16-19] In a study with healthy subjects Boone and Azen[18] reported symmetrical but greater internal and external ROM in those subjects less than 19 years of age than in older subjects.

There is evidence that limited internal rotation is related to complaints of LBP. [14,20-23] Mellin et al[22] collected spinal and hip ROM measurements in male workers and found that limited internal rotation was significantly correlated with LBP. Chesworth et al[20] also

found that subjects with LBP demonstrated bilaterally greater hip external rotation than internal rotation. Vad et al[23] found that deficits in the lead hip correlated with a history of LBP in professional golfers. Barbee-Ellison et al[14] sorted healthy subjects and subjects with LBP into three categories based on their hip rotation ROM. They found that a significant proportion of subjects with LBP fell into category III where hip external rotation exceeded internal rotation suggesting some evidence for a relationship between hip joint flexibility and LPB. More recently Cibulka et al[24] concluded that patients with LBP associated with sacroiliac dysfunction demonstrated significantly more external hip rotation than internal rotation unilaterally, specifically on the side with a posterior rotated innominate.

Regional interdependence is a relatively new term that is used to describe how dysfunction and impairments in distant regions, both extremity and spine, may affect or contribute to a patient's primary complaint. If regional interdependence exists between the hip and the lumbar spine then it would make sense that treatments aimed at the lumbar spine could affect the hip or vice versa. There is evidence to support this supposition. [24-27] In a case study, Cibulka et al[25] treated a patient with LBP and decreased hip internal rotation by prescribing stretches and home exercises aimed only at hip rotation deficits found on the physical exam. After one month with this treatment regimen the patient reported no LBP. In another study, Cibulka et al[26] treated hip pain in runners with a lumbosacral manipulation technique and reported reduced hip pain.

Recently Flynn and colleagues[13] developed a clinical prediction rule which was validated by Childs et al[9] to help identify those patients who would most likely benefit from spinal manipulation. These authors demonstrated that a set of five clinical

predictors could predict successful symptom resolution following lumbar manipulation. One of these clinical predictors was having at least one hip with internal rotation greater than 35 degrees again suggesting a regional interdependence between the hip and lumbar spine. Fritz and colleagues[21] later published a study identifying those patients most likely to not respond to the same manipulation. Interestingly, hip internal rotation was again shown to be a factor. These authors concluded that patients with less discrepancy in hip internal rotation compared left to right were most likely not to respond to spinal manipulation.

Manual therapy consisting of joint mobilizations has been shown to be effective for increasing hip ROM, however, the effect of lumbar joint mobilizations and specifically the LSM on increasing or decreasing hip ROM is not known.[28] The term LSM is used because there is no evidence that this technique affects only a single segmental level of the lumbo-sacral spine. There is evidence to support the use of the LSM technique in the treatment of LBP [6,9,13] but there has been no research on the affect of this technique on hip ROM. Other studies have shown that manipulation has immediate effects on ROM in the surrounding joints. Studies by Cleland et al[10] and Flynn et al[29] both demonstrated that thoracic manipulation has immediate effects on cervical ROM suggesting that there is regional interdependence between the cervical and thoracic spines. It is plausible that regional interdependence exists between the lumbar spine and the hip and the LSM may affect hip ROM. Therefore, in this case series we measured the immediate effect of the LSM on passive hip rotation ROM in patients referred to physical therapy with a primary diagnosis of LBP.

CASE DESCRIPTION

Patients

This case series reports the immediate effect of LSM on hip ROM measurements in nine patients with a primary complaint of LBP who were referred to physical therapy from a primary care provider. All nine patients underwent a thorough history and physical exam by one physical therapist (AKB).

All patients were found to have a primary complaint of LBP without a history of hip or spine surgery, an ODI of at least 8% and no symptoms distal to the knee. Additionally, no history of osteoporosis or other potential contraindications to spinal manipulation were identified during the intake examination. Table 1 describes each patient's baseline characteristics.

Procedure

Prior to data collection, the author performed observer variability tests to establish the reliability of the hip passive ROM measurements. Reliability testing of inclinometer measurements of hip internal rotation (IR), external rotation (ER), and Flexion/Abduction/External Rotation - (FABER's) ROM was obtained on 20 healthy hip joints. Reliability testing for the inclinometer was conducted similar to the protocol described in the Barbee Ellison et al study and has been shown in other studies to be valid. The subjects were given non-restricting clothing to wear during testing. For hip rotation ROM, the subjects were placed in the prone position on a standard padded physical therapy treatment table, the hip to be measured was placed in 0 degrees of

abduction, and the contralateral hip was placed in about 30 degrees of abduction by the primary rater. The reference knee was flexed to about 90 degrees, and the leg was passively moved to produce hip rotation. Manual stabilization by the rater was used on the pelvis to prevent movement. Movement was stopped at the end of passive joint ROM or when pelvic motion occurred. The inclinometer was placed just proximal to the medial malleolus for internal rotation and just proximal to the lateral malleolus for lateral rotation measurements. FABERs ROM measurements were performed according to the protocol described in the Cliborne et al study[28]. The patient was placed supine, the heel of the lower extremity to be tested placed over the opposite knee. The hip joint was passively externally rotated and abducted by placing pressure over the ipsilateral knee, while stabilizing the contralateral innominate. The inclinometer was placed on the medial tibial condyle. Movement was stopped at the end of passive joint ROM or when pelvic motion occurred. The primary rater was blinded to the inclinometer readings and the measurements were all read and recorded by a different examiner. The subject was then placed in a seated position with legs freely hanging off the side of the table for 2 minutes. The measurements were then repeated as previously described.

The physical examination included neural screening, lumbopelvic and hip assessments and the recording of hip ROM measurements (internal and external rotation and FABERs) using a bubble goniometer. Barbee-Ellison et al[14] and others[25,27,28] have demonstrated the reliability and validity of inclinometer ROM measurements of the hip. Additionally, Cliborne et al[28] demonstrated acceptable reliability for FABERs ROM measurements.

Manipulation Intervention

Each patient in this case series received a unilateral LSM. The decision to perform spinal manipulation, as well as which side to aim the intervention, was based on clinical findings during the physical exam. If the patient complained of unilateral LBP then the manipulation was performed on that side. If the pain was located centrally then the side to be manipulated was determined by the therapist based on his clinical judgement.

The treating therapist had 8 years of experience in manual and manipulation physical therapy interventions. The LSM was performed by having the patient assume a supine position on the plinth. The patient was then placed into left sidebending with right rotation of the torso. Grasping the patient's left scapula while maintaining the sidebending, the patient was then rotated towards the therapist. When the pelvis lifted from the table a smooth HVLA thrust was introduced through the ilium anterior-to-posterior aimed at the lumbo-sacral region (Figure 1). Following manipulation the patient is reassessed. We routinely measure pain, lumbar and hip motion during this assessment, however, for brevity only hip motion is reported in this paper.

OUTCOMES

Of the 9 patients described in this series, 6 received manipulation on the left side and 3 received manipulation on the right side. Based on our experience, we determined that a difference of 5 degrees or greater is clinically meaningful. Pre and Post manipulation measurements are recorded in Tables 2 and 3. Eight out of the 9 patients demonstrated at least a 5 degree increase (mean 7 degrees; 96% CI 5-9 degrees) in contralateral hip internal rotation and a mean total contralateral hip motion change of 10

degrees (95% CI 2-18 degrees) immediately following the LSM (Figure 2). Several patients demonstrated dramatic immediate changes in individual hip ROM but these changes did not appear predictable across all 9 patients. Five of the 9 patients had a 5 degree or more decrease in at least one of the 3 range of motion measurements. The greatest change in individual hip rotation ROM occurred in patient 1 who demonstrated a 25 degree increase in contralateral FABER following manipulation. No other patients in this series had similar outcomes. Other than changes seen in patient 1, FABER ROM appeared to be the least effected by the LSM in these 9 patients. Several other patients in this study demonstrated clinically meaningful changes in hip rotational ROM following manipulation; however, these changes appeared to be unpredictable.

DISCUSSION

The results in this case series suggest with a low level of evidence that the LSM causes immediate changes in hip rotation ROM. In these 9 subjects, the LSM increased contralateral hip internal rotation.

Although the LSM has been shown by several studies to be beneficial in the treatment of LBP and hip pain, the mechanism of how it works is still not known. One mechanism that was reported by Suter et al[29] demonstrated that manipulation decreases quadriceps muscle inhibition and increases knee extensor torque in patients with anterior knee pain. It is possible that in our patients the LSM decreased inhibition in the hip rotator musculature resulting in the observed increases in ROM. It has been suggested by other authors that manipulation may influence soft tissue structures, such as joint capsules, muscles, and ligaments, tendons, and postural neuromuscular reflex

pattern[29,30] George et al[31] recently published an abstract indicating that manipulation of the lumbar spine resulted in decreased temporal summation of pain at the lower extremity and trunk. A reduction in temporal pain of the lower extremity following manipulation in our patients might also help explain why increases in ROM were observed at the hip.

Several studies suggest a regional interdependence between the lumbar spine and hip joint. In several of these studies limited hip internal rotation was correlated to LBP.[14,20,22-24] Barbee-Ellison et al[14] proposed three hip patterns seen among normal patients and those with reported LBP. These authors reported that a significantly greater proportion of patients with LBP demonstrated a pattern III, in which total external rotation ROM is greater than internal rotation ROM. All 9 patients in this study fell into pattern III of the Barbee-Ellison classification. It is possible that because all 9 patients in this series had limited hip internal rotation ROM we were able to more easily see a change in this particular ROM.

In this series a unilateral LSM appears to affect ROM in both hips but the majority of these changes in ROM seem unpredictable. The only ROM measurement that appeared to be predictable and consistent in these 9 patients was hip internal rotation and total hip rotation contralateral to the side that was manipulated. To the author's knowledge, this is the first evidence to suggest that the LSM may have a greater effect on the contralateral side to manipulation. The reason for this observation is unknown.

Fritz et al[21] published a study on the factors related to the inability of

individuals with LBP to improve following spinal manipulation. They found that those subjects with less discrepancy in hip internal rotation measured left to right did not respond favorably to spinal manipulation. Similarly, Flynn et al[13] and Childs et al[9] both found that one clinical predictor for success with manipulation was having at least one hip with internal rotation greater than 35 degrees. Interestingly, in this case series, the patients with the most discrepancy in hip internal rotation left to right demonstrate the most dramatic changes in hip PROM following the LSM. Patients 1 and 3 had 15 and 14 degree discrepancy respectively prior to manipulation. These two patients demonstrated the greatest overall change post manipulation. The reason for this is unknown.

Flynn et al[12] recently published a study investigating whether or not the audible pop is necessary to achieve success following spinal velocity thrust manipulation in individuals with LBP. The authors concluded that there was no relationship between an audible pop during the LSM and improvement in ROM, pain, or disability in individuals with nonradicular LBP. In this series we recorded whether or not an audible pop was observed following manipulation. These data are recorded in Table 1. It appears that it did not matter whether or not an audible pop occurred in order to observe differences in hip ROM in these 9 patients.

CONCLUSION

Eighty-nine percent of the patients in this case series demonstrated clinically meaningful changes in contralateral hip internal rotation following spinal manipulation. Several other meaningful changes in hip ROM were also observed although there

appeared to be no predictable pattern to these changes. Future research should investigate the long-term outcomes associated with these observed changes in hip ROM following lumbosacral manipulation. A future study examining a clinical prediction rule for those patients who will most likely show improvement in hip rotation range of motion following manipulation may also be beneficial for clinicians.

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Figure 1 Lumbosacral Region Manipulation
(Adapted with permission from *Orthopaedic Manual Physical Therapy Management of the Lumbar Spine, Pelvis, and Hip Region* [CD-ROM]. Louisville, KY: Evidence in Motion, LLC; 2002.)

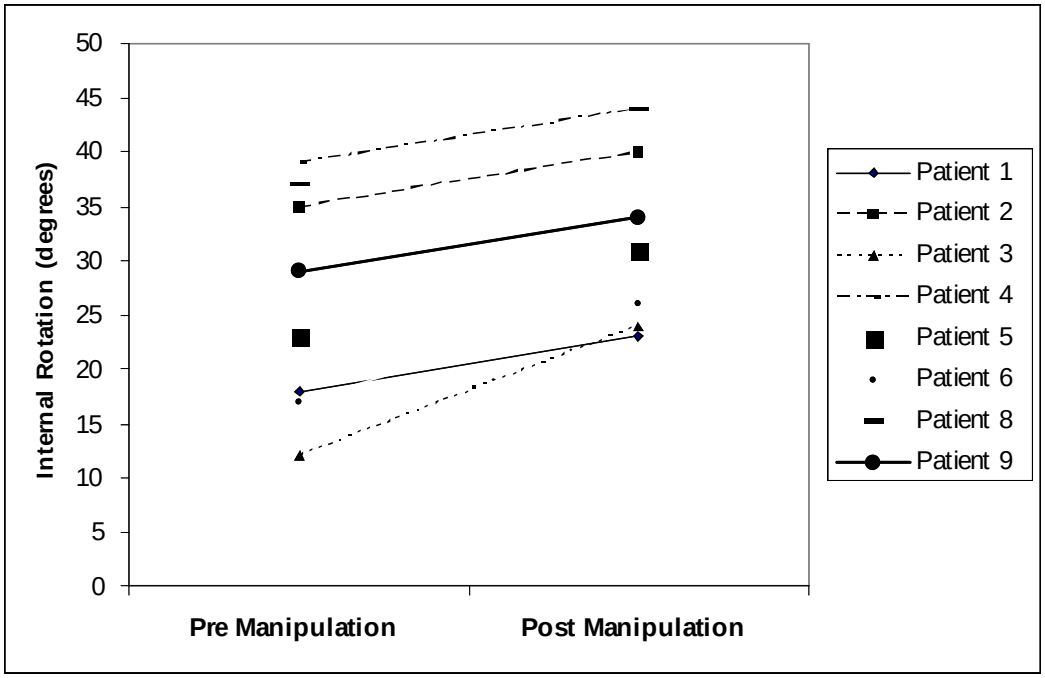

Figure 2 Post-manipulation contralateral Hip Internal Rotation Measurements