Case Report

A mechanical diagnosis and treatment (MDT) approach for a patient with discogenic low back pain and a relevant lateral component: a case report

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Patients with a lateral lumbar shift are often managed with a frontal plane, manual correction first described by McKenzie. However, there is a subset of patients that require a frontal plane correction who do not demonstrate a lateral shift. Both of these patient groups have what is termed a relevant lateral component (RLC). The subset of patients who have an RLC, without a shift, has received very little attention in the literature to date. This case report describes a patient with no shift who had a remarkable disc extrusion identified by magnetic resonance imaging (MRI). The patient responded nicely to a combination of frontal and transverse plane loading strategies in six treatments using the mechanical diagnosis and treatment (MDT) evaluation and treatment system. The case report is unique in the literature in that it describes a patient with no apparent frontal plane, lumbar deformity that had documented evidence of a large disc extrusion and who responded to a variation of McKenzie's flexion-rotation mobilization. The centralization phenomenon was demonstrated immediately when a non-weight bearing, multiplanar, loading strategy was administered.

Keywords: Back pain, McKenzie, Mechanical diagnosis and treatment, Physical therapy, Relevant lateral component

Repeated motion testing is the hallmark of the mechanical diagnosis and treatment (MDT) system for patients with non-specific low back pain (LBP). This system has demonstrated reliability, especially when utilized by credentialed practitioners.¹⁻⁴ In an MDT examination, the centralization phenomenon has been studied extensively for its utility in determining which patients have conservatively manageable LBP, with or without radicular components. When centralization occurs during examination of a patient with axial and/or peripheral pain, the therapist is ostensibly applying the correct loading strategy for the reduction of extruded disc material, i.e., where there is no breach of the annular wall.^{5,6} A number of studies have demonstrated the value of using repeated sagittal motions to produce centralization in patients with low back and radicular pain.^{7,8} However, non-sagittal loading strategies are often required to manage a subgroup of patients with discogenic pathology. In the literature, these patients have been 'recognized' by the presence of a visible

lateral shift. However, this telltale finding is sometimes absent.

Patients requiring a frontal plane intervention are said to have a relevant lateral component (RLC).⁹ Hefford² reported that frontal plane interventions were required in as many as 40% of patients with lumbar spine derangements who had pain distal to the knee. Case report examples of patients with RLCs have been presented by others.^{10,11} In each of these cases, the lateral deformity was evident which made the diagnosis, classification, and intervention relatively straightforward. Both authors used the lateral shift maneuver to manage their patient's case. However, none of these studies addressed interventions for patients without a lateral shift who failed to respond to sagittal loading strategies. Fritz *et al.*¹² suggested, 'further research is needed to clarify the most effective intervention strategies for patients in the lateral shift-specific exercise classification.'

There is little information within the formal literature about managing patients who have a relative lateral component without a visible shift. Furthermore, there is evidence to suggest that practitioners are not able to reliably determine,

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through observation alone, whether or not a patient is shifted in the frontal plane.^{13–16} Several authors^{13,17,18} have looked at the interrater reliability of physical therapists to determine whether or not a lateral shift, or a RLC, existed in a group of patients with LBP. The percent agreement in these studies ranged from fair to good. In spite of the fact that an accurate assessment for the presence of an RLC is essential to subclassifying and managing patients in the MDT system, Razmjou *et al.*,¹⁷ noted that these cases are underreported in the literature.

This case report describes management of a patient with non-specific LBP and an RLC who was not visibly shifted and did not respond positively to sagittal plane loading strategies. In addition, the report provides remarkable documentation of the underlying pathology. Moreover, it shows the value of complementing findings from diagnostic imaging with a comprehensive clinical examination.

Patient Characteristics

The patient was a 40-year-old college professor and African-American female referred by a nurse practitioner (TH) with a diagnosis of a 'large' L5-S1 disc herniation and left S1 radiculopathy. The patient was 5'5" tall and weighed 224 pounds. During her initial presentation to the nurse practitioner in December 2009, she reported a visual analog score for pain at 6/10. The pain was located in the left buttock and posterior thigh. It had been present since early November (~5–6 weeks) and commenced, she believed, as a result of her participation in a weight-control exercise program. The program included wall sits, curl ups, wall push-ups, and side steps. She used elastic band resistance with some of the exercises. The pain began approximately 1 week after initiating the exercise program. It was worse when she bent forward, climbed stairs, or would lie prone. She noted that standing, sitting, and walking would inconsistently increase her pain. She also reported that the pain was generally worse early in the morning. It regularly disturbed her sleep. She reported a positive Valsalva sign; worse with coughing, sneezing, and during bowel movements. Fetal positioning, especially on the left side, was the position of greatest comfort. She denied any lower extremity weakness but did report paresthesias into the left posterior thigh.

Her straight leg raise produced minimal lower extremity symptoms at 90° on the left. Her lower extremity deep tendon reflexes were 2+ and equal with the exception of the left ankle jerk, which was graded at 1+. She also had circumferential numbness in the left calf and foot. She was given a Medrol dose-pack and referred to a physical therapist and certified MDT practitioner (BW).

Figure 1 T2 weighted sagittal magnetic resonance image of the patient's lumbar spine.

The patient's medical history was notable only for bipolar disorder and hypercholesterolemia. She was taking prednisone (Medrol dose pack) and Naproxen at intake to the physical therapy facility where she was seen. In addition, she was on a muscle relaxer (name she could not recall), Celebra, Lovastatin, and Abilify. She had no surgical history, reported no history of significant accidents or falls, and denied unremitting night pain. She had had physical therapy 2 years prior for a LBP problem that resolved with conservative care.

For the current episode of LBP, the patient had received physical therapy at another facility. The therapist at the first facility was also a credentialed MDT practitioner. The treatment the patient received from the initial physical therapy encounter consisted of extension-biased exercises, including repeated press-ups from prone (extension in lying) and repeated extension in standing. In addition, she received extension mobilization.⁹ The patient in this case study believed that the treatment aggravated her back and lower extremity symptoms and after 3–4 weeks of therapy she elected to stop treatment.

Examination

Initial examination

The initial physical therapy examination was performed in December, 2009 by a credentialed MDT physical therapist. The patient's pain was reported to be in the back and left lower extremity as described earlier. She reported no paresthesia or anesthesia. The patient scored 6/24 on the Roland-Morris Questionnaire. Her magnetic resonance imaging (MRI) (Fig. 1) showed a 'very large posterior disc extrusion' that essentially filled the entire spinal canal

on the left side. The extrusion compressed the cauda equina.

The therapist used the MDT examination system to evaluate the patient. Her posture was modestly slouched and featured a notable reduction of lumbar lordosis. No frontal plane shift was discernable. Her straight leg raise on the left was positive at 30°. This test produced concordant pain into the left lower extremity. She had 5/5 manual muscle test values in the lower extremities for all major muscle groups. No sensory deficits were noted. Spinal range of motion (ROM) measures were taken in standing and given qualitative values according to the MDT examination form (i.e., minimal, moderate, or major restriction in the sagittal and frontal planes). The patient had reduced ROM in all sagittal and frontal plane motions, most notably extension. Moderate limitations were noted in flexion and in side gliding to the right. A slightly greater (though judged ‘moderate’) loss of left side gliding was also noted. Flexion, extension, and side gliding to the right all increased the patient’s concordant lower extremity pain to some degree. Side gliding to the left (the patient’s painful side) abolished her pain. However, upon return to her upright posture, the symptoms were no better.

In light of the apparent peripheralization of the patient’s symptoms noted during sagittal ROM testing, the therapist elected to test the influence of repeated frontal plane (side-glide) maneuvers in order to determine if the centralization phenomenon and/or a directional preference existed. This clinical decision can be substantiated based on the patient’s earlier response to these frontal plane loading strategies (abolished/centralized her pain). A single repetition of side glide in standing (SGIS) to the left produced the same response as seen during ROM testing, i.e., abolished her pain, but she was no better after the single repetition. Accordingly, the patient’s response to repeated SGIS to the left was tested and the patient responded initially with almost complete resolution of the buttock pain after five repetitions. However, after eight repetitions, her buttock pain increased and the leftward SGIS test was stopped.

Clinical Impression

At this juncture, the therapist had seemingly uncovered a RLC in a patient with no apparent lateral shift. Furthermore, the sagittal plane loading strategies had produced undesirable responses. Positive, though not lasting, changes were evident in the frontal plane. In the MDT system, the provisional classification for this patient is a unilateral/asymmetrical, above-knee derangement.⁹ In that system, proper management for this patient is to introduce a frontal plane component after exhausting the sagittal plane loading strategies. Even though the therapist had not

Figure 2 Positioning and mobilization used to facilitate frontal and transverse plane loading strategies.

explored the non-weight bearing repeated sagittal motions, the clinical reasoning supporting frontal plane exploration was further validated by the often overlooked mechanical response that must accompany the proximal migration of symptoms in order to have true centralization.^{8,9,19} When this occurs, in the context of a single session, and is accompanied by proximal migration of the symptoms, there is little doubt that the patient has a reducible derangement. The patient had in fact exhibited a progressive increase in her left side glide before the eighth repetition of that loading strategy began to exacerbate her symptoms.

Intervention

The therapist chose to introduce left lumbar side bending by placing the patient over a pillow in a left lateral recumbent position. He used a non-weight bearing position because, as noted, the weight bearing side glide produced an increase in her symptoms after eight repetitions. Transverse plane motion was also introduced via repeated right rotation from the left side bent position (Fig. 2). This combined motion abolished the patient’s pain completely and restored considerable ROM in the sagittal plane when the patient was tested again in standing. The treatment introduced by the therapist is equivalent to the flexion–rotation mobilization⁹ with the notable difference being that the motion is coming from below (i.e., via the lower extremities) in the latter method. The patient was sent home with instructions in posture considerations and a single home exercise, replicating the repeated right rotation in left side lying 6–8 times a day.

Outcome

Reexamination

The patient returned three days later with almost no pain. She described only mild morning ‘stiffness’. Any pain she experienced was readily manageable by doing the repeated rotation in side lying. Her ROM

Figure 3 Prone-prop positioning used to introduce sagittal loading strategy with frontal plane (L) side bending introduced

measures remained much improved. She performed the self-mobilization on this second visit and was then assessed for her response to the prone (sagittal) intervention of static prone-on-elbows positioning. However, given the patient's presentation with the relative lateral component, the therapist elected to have the patient introduce this sagittal loading strategy with the 'figure 4' position (Fig. 3) which introduces a component of left lumbar side bending. Both the self-mobilization and the sagittal positioning interventions abolished her pain and produced positive mechanical responses by improving her lumbar extension in weight bearing. Once again, the patient was instructed to avoid forward bent positioning or activities.

At visits 3, 4, and 5 (1, 4, and 5 weeks after the initial visit), the patient continued to demonstrate the ability to control symptoms, as described above. However, she also retained the need to address the RLC. This was evidenced by the fact that exclusively sagittal motions peripheralized her symptoms. However, by the fourth visit, this pain was produced only at end-range of extension. Her home exercise program was not changed.

At her sixth and final visit (6 weeks since the initial evaluation), the patient was able to extend in standing with no pain. Her only complaint was morning low back 'stiffness'. Pain was not an issue; in fact, she reported no pain for a period of three weeks. Her lumbar ROM was full and painless. She had initiated a walking program and had reached the goals of climbing stairs, donning socks, and lifting

common household items without pain. Her Roland Morris Questionnaire (RMQ) score was 2/24. The minimally important clinical difference for the RMQ has been shown to be five points for the entire scale; however, Stratford *et al.*²⁰ showed that smaller changes, even 1–2 points can be significant when initial RMQ scores are low, as in this case.

The patient was seen on two more occasions by the nurse practitioner following discharge from physical therapy. The first visit was 3 days later and subsequently in March 2010; over 2 months later. On the first visit, she reported no pain and very intermittent tingling in the left lower extremity. At the last visit, she was symptom-free with the exception of mild LBP. Her daily activities at that final visit were unimpaired.

Discussion

This case report presents a patient that had a large disc extrusion identified through MRI that created a RLC. The patient had a remarkable response to a combination of frontal and transverse plane loading strategies. Patients who have a positive response to loading strategies are described as having a directional preference and can be sub classified accordingly.^{9,12} Fritz *et al.*,¹² for example, portrayed this in a clinical commentary on treatment-based classification of non-specific LBP. Patients with a directional preference were classified into a 'specific exercise' sub group, depending on whether repeated flexion, extension, or lateral shifting led to an improvement of the patient's symptoms and increased ROM. A criterion for patients who fit into the specific exercise/lateral shift classification is a 'visible frontal plane deviation of the shoulders relative to the pelvis'. This reflects the tendencies in the literature to date; that is, to associate patients requiring a frontal plane intervention with those who present with an obvious shift. The current patient, even without a visible shift, most likely belonged in the lateral shift sub classification described by Fritz *et al.*,¹² given that she responded to non-sagittal loading strategies. The therapist's utilization of MDT loading strategy principles, i.e., effectively performing a lateral recumbent version of the flexion-rotation mobilization,⁹ provides potential evidence for some discretion in the clinical application of those principles.

Santolin²¹ presented a case study on a patient with similar findings to the current patient. Moreover, the patient had no visible shift, had poor response to sagittal loading strategies, and was classified in the original MDT system as a Derangement three (D3). The patient, however, had no lower extremity symptoms and no imaging to confirm the presumed diagnosis. In addition, the patient was managed with a multimodal intervention strategy, including spinal

manipulation and electrical stimulation modalities. Inasmuch, the patient might have been classified, in the treatment-based classification proposed by DeLitto *et al.*,²² into a mobilization/manipulation subgroup or an exercise/lateral shift subgroup. Since both intervention strategies were used it is difficult to substantiate which intervention actually contributed to the relief seen in this case study.²⁰

A 'dynamic internal disc model' has been proposed in the literature,⁶ the basis of which was originally set forth by McKenzie.⁵ In that model, if the annulus is competent and the disc's hydrostatic properties are intact, then the requisite elements are in place for centralization to occur. Donelson *et al.*⁶ demonstrated the model's validity on 63 patients with back pain and 'variable degrees of lower extremity pain and altered sensation'. In that study, patients who centralized had demonstrated annular competence (91% of 23 patients with a positive discogram) and intact hydrostatic properties of the involved disc.⁶ In view of the dynamic internal disc model and given the MRI findings on the current patient, it is conceivable that the patient's response to the interventions were founded upon application of the appropriate loading strategies in a non-herniated (extruded) disc. Annular competence was apparently intact, in spite of the dimensions of the extrusion.

One must consider the influence of the oral steroid. Given that the patient was started on a Medrol dose pack 4 days prior to the initial evaluation by the therapist, it is likely that a combination of mechanical and chemical influences on the disc are to be credited with the ultimate resolution of this case. Nonetheless, there is at least indirect evidence that the loading strategies' influence was meaningful, if not significant, especially when considering that the patient had had a course of extension-based interventions previously that resulted in an unsatisfactory outcome. The patient demonstrated the same poor response to sagittal plane loading strategies with both physical therapists. It was not until the novel, non-sagittal loading strategies were implemented that the patient began to experience meaningful and lasting relief of symptoms. This led to the appropriate sub classification and interventions within the context of the MDT system.

Limitations

Specific conclusions may not be drawn from a single case study design. The outcomes reported in this case may have been consequent to the natural history of her pathology. The classification assumptions presented in this case are not incontrovertible. Even though the patient's symptoms were seemingly concordant with the magnetic resonance imaging, the authors cannot say unequivocally that the

patient's pain was related to the MRI findings. Accordingly, the assumptions presented related to the influence of the loading strategies cannot be proven in the context of a single case report.

Conclusion

This case outlines a treatment approach for a large disc extrusion identified through MRI using a combination of a frontal and transverse plane loading strategy. Future studies should investigate the influence of loading strategies on a large group of patients with discogenic pathology validated by discography. Non-sagittal interventions should be explored for their utility in managing patients with and without concordant discography findings. Randomization of patients with non-specific LBP into groups receiving MDT and non-MDT based interventions would offer potential insight into the value of the former in managing this patient population. Finally a randomized, controlled trial that considers the presence or absence of lateral shifts and/or RLCs would potentially provide a meaningful analysis of which patients are best suited for the interventions outside the sagittal plane.

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