McKENZIE DIAGNOSIS AND THERAPY IN THE EVALUATION AND MANAGEMENT OF A LUMBAR DISC DERANGEMENT SYNDROME: A CASE STUDY

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ABSTRACT

Objective: To discuss the case of a patient whose lumbar disc derangement syndrome resolved after treatment that included McKenzie diagnosis and therapy, spinal mobilization, and spinal manipulation. Also, to give an overview of the McKenzie method in general, and more specifically for evaluation and management of derangement syndrome.

Clinical Features: The patient reported acute onset of left-sided low back pain and superior buttock pain while bending to tie her shoes. The most significant finding on initial McKenzie evaluation was that repetitive patient-generated left-side gliding movements greatly increased lumbar range of motion and decreased the buttock and low back pain, with the pain remaining better after completion of the movements.

Intervention and Outcome: The case was initially managed with instructions in patient-generated lateral side-gliding movements and spinal mobilization. After 5 treatment visits, the management was changed to patient-generated repetitive extension movements and spinal manipulation. The outcome was complete resolution as per Oswestry Low Back Pain and Disability Index and Visual Analog Scale, and complete resolution of symptoms except for mild pain with sitting over 2 hours.

Conclusion: This case demonstrated short-term resolution of acute low back pain and buttock pain with patient-generated forces, spinal mobilization and manipulation, and interferential electrical stimulation. McKenzie mechanical diagnosis and therapy may be a beneficial tool in the chiropractic practice. (*J Chiropr Med* 2003;2:60–65)

KEY INDEXING TERMS: Intervertebral Disc; Chiropractic Manipulation; Physical Therapy/Exercise Therapy

INTRODUCTION

In the 1950's the New Zealand physical therapist, Robin McKenzie began to develop a system of assessment and

treatment for mechanical back pain based on symptom response to spinal loading. In 1981 he published a book on mechanical diagnosis and therapy of the lumbar spine entitled *The Lumbar Spine, Mechanical Diagnosis and Therapy* (1), and in 1990 he published a book on mechanical diagnosis and therapy of the cervical and thoracic spine titled *The Cervical and Thoracic Spine, Mechanical Diagnosis and Therapy* (2).

McKenzie developed 3 major classifications of mechanical back pain: postural, dysfunction and derangement syndromes. The postural syndrome is defined as mechanical deformation of postural origin, causing pain of a strictly intermittent nature, which appears when the soft tissues surrounding the spinal segments are placed under prolonged stress. This occurs when a person performs activities which keep them in a relatively static position or when they maintain positions for any length of time. In other words, pain is produced by static positioning and not by movement. It is basically pain produced by overstretching of normal tissue. The definition of dysfunction syndrome includes overstretching of soft tissues that have been shortened or contain contracted scar tissue. Basically, McKenzie chose the term "dysfunction" instead of "adaptive shortening." He defines derangement as the situation in which the normal resting position of the articular surfaces of 2 adjacent vertebra is disturbed as a result of a change in the position of the nucleus pulposus between these surfaces. He further hypothesizes that alterations in the position of the nucleus pulposus may also disturb annular material creating various presentations of low back and leg pain. This case report focuses on the derangement classification.

McKenzie hypothesized that mechanical deformation due to derangement, by its very nature and definition, nearly always causes constant pain. In derangement, the adjacent joint surfaces are disturbed from their normal position so that some of the structures within and around the involved joint are under constant stress. The structures will be a source of constant pain until the stress is removed either by reduction of the derangement or by an adaptive lengthening. But not all patients with derangement have constant pain. There is a group

of patients who state that they have no pain at all as long as they are on the move, but will experience pain after they maintain a static position for a few minutes. Movement or a change of position brings about a short-lived resolution or decreased pain, which is soon felt again and necessitates a further change of position. The temporary relief is caused by reduction of stress on the structures causing pain, but at the same time other structures are placed under stress and rapidly become painful.

He also hypothesized that there are also patients in whom minor derangements are alternatively produced and reduced spontaneously and they experience intermittent pain based upon their activity level.

After the patient's history is taken and the standard physical examination is performed, McKenzie evaluation consists of observing the movement and symptom response while the patient performs up to 4 sets of 5 repetitive movements. These movements consist of extension in lying, flexion in lying, extension in standing, flexion in standing, and standing side gliding left and right (this produces combined lumbar lateral flexion and rotation, which McKenzie has concluded is better than evaluating the 2 movements separately) (Figures 1–5). The responses are recorded as same, increased, or decreased pain. If the pain *remains* decreased after completion of the repetitions this is called “better” and if the pain *remains* increased after completion of the repetitions this is called “worse.”

A main parameter of evaluation is observing for centralization or peripheralization of the symptoms. *Centralization* is proximal or toward midline movement of the symptoms and *peripheralization* is distal or away from

Figure 1. Extension in lying.

Figure 2. Flexion in lying.

Figure 3. Extension in standing.

midline movement of symptoms. For example, referred pain in the leg that begins to recede to only the buttock would represent centralization. McKenzie has observed that the centralization phenomenon only occurs with derangement. Centralization has been shown to be a strong predictor for positive outcome of conservative care (3–7).

Rapid increase of range of motion with a movement and/or rapid decrease of range of motion with the opposite movement may also be observed. On examination, the patient with lumbar derangement often exhibits a deformity that most often manifests as flattening of the lumbar lordosis or a compensatory scoliosis. There is always loss of movement and function, and the movement loss is almost always asymmetrical. There may also be a right or left deviation of movement in the sagittal plane (if present, usually during flexion). Crite-

Figure 4. Flexion in standing.

Figure 5. Right-side gliding (named in relation to shoulders).

ria for improvement (derangement reduction) include cessation of symptoms, symptoms centralize, symptoms decrease in intensity, symptoms become intermittent, symptoms decrease in frequency, or symptoms remain unchanged but range of motion increases.

Derangement is further divided into 7 classifications according to symptom location and presence of spinal deformity. The seven classifications of derangement are shown in Table 1. Notice that going from D1 to D6, even numbered classifications have the criteria of deformity and odd numbered classifications do not contain deformity. Also be aware that in general, D6 is the most difficult to treat and D1 is the easiest to treat. In fact, McKenzie believes that patients with a derangement one can treat themselves. It must be appreciated that many variations of the derangements are possible and not all patients will fit into the system.

CASE REPORT

A 30-year-old female with a 5-day history of left-sided low back pain and left superior buttock pain that began acutely as she was bending over to tie her shoes sought care. She initially had 2 days of pain referring into the left anterior-lateral thigh that had resolved by the time of presentation. Sitting, bending, sitting to standing, and sleeping on her back, increased the pain. She had received mild relief using NSAID's and by lying prone. She was driving 4 hours round trip for a job consisting of extensive sitting and computer usage. This extensive amount of sitting was significantly aggravating the pain and she was placed on total temporary disability for 5 days in order to decrease the amount of sitting time. She

TABLE 1
CLASSIFICATION OF DERANGEMENTS

CLASSIFICATION	AREA OF BACK PAIN	BUTTOCK AND THIGH PAIN	DEFORMITY AND LEG PAIN
DERANGEMENT ONE	CENTRAL OR SYMMETRICAL PAIN ACROSS L4L5	RARELY BUTTOCK OR THIGH PAIN	NO DEFORMITY
DERANGEMENT TWO	CENTRAL OR SYMMETRICAL PAIN ACROSS L4L5	WITH OR WITHOUT BUTTOCK AND/OR THIGH PAIN	WITH DEFORMITY OF LUMBAR KYPHOSIS
DERANGEMENT THREE*	UNILATERAL OR SYMMETRICAL PAIN ACROSS L4L5	WITH OR WITHOUT BUTTOCK AND/OR THIGH PAIN	NO DEFORMITY
DERANGEMENT FOUR	UNILATERAL OR ASYMMETRICAL PAIN ACROSS L4L5	WITH OR WITHOUT BUTTOCK AND/OR THIGH PAIN	WITH DEFORMITY OF LUMBAR SCOLIOSIS
DERANGEMENT FIVE	UNILATERAL OR ASYMMETRICAL PAIN ACROSS L4L5	WITHOUT OR WITHOUT BUTTOCK AND/OR THIGH PAIN	WITH LEG PAIN EXTENDING BELOW KNEE
DERANGEMENT SIX	UNILATERAL OR ASYMMETRICAL PAIN ACROSS L4L5	WITH OR WITHOUT BUTTOCK AND/OR THIGH PAIN	WITH LEG PAIN EXTENDING BELOW THE KNEE AND DEFORMITY OF LUMBAR SCOLIOSIS
DERANGEMENT SEVEN (ANTERIOR DERANGEMENT)	SYMMETRICAL OR ASYMMETRICAL PAIN ACROSS L4L5	WITH OR WITHOUT BUTTOCK AND/OR THIGH PAIN	WITH DEFORMITY OF ACCENTUATED LUMBAR LORDOSIS

* MAY BE PROGRESSION OF DERANGEMENT ONE OR MAY BE A PRIMARY

denied any lower extremity pain, paresthesia or weakness at the time of initial presentation. The Oswestry Low Back Pain and Disability Index showed moderate disability at 34% and the Visual Analog Scale was marked at 22mm for present pain and 25mm for average pain (the patient may not have marked the VAS correctly as she presented with the appearance of considerably more pain).

A physical examination was performed. Palpable pain was noted at the left superior sacral area. Range of motion was measured with an inclinometer. Lumbar flexion and extension were restricted at 80° and 20° respectively, and both motions reproduced the low back pain. Lumbar left lateral flexion was restricted at 20° and both left and right lateral flexion reproduced the low back pain. Left Kemp's test reproduced the low back pain. Left Bechterew's reproduced the left-sided back pain, but did not produce any lower extremity pain. Both left and right Yeoman's Test reproduced the left-sided low back pain. Straight leg raising was pain free at 90° bilaterally. No deformities were noted. No neurological testing was performed because there were no lower extremity symptoms and no clinical red flags. SLR and Bechterew's were negative. Side lying passive extension revealed left L4L5 and L5S1 extension restriction with reproduction of the symptoms.

McKenzie evaluation was then performed. Repetitive extension and flexion in both lying and standing reproduced the pain but did not make it better or worse (*remaining* better or worse). Left side gliding in standing (patient pushing the pelvis from left to right; side gliding is named in relation to the shoulders) was painful and significantly restricted. Repetitive left side gliding greatly increased the side gliding movement and decreased both the low back pain and the left superior buttock pain, with the pain remaining better after completion of the movements. This decrease of buttock pain that remained better represented centralization of symptoms. Even if the low back pain increased with the decrease of buttock pain, this would still represent the centralization phenomenon, because of the decrease of the peripheral symptoms. Radiographs were not performed because no clinical red flags were present.

Treatment was begun with the functional diagnosis of McKenzie classification of Derangement Three. In Derangement Three the disturbance within the disc is thought to be located more postero-laterally than the postero-central position of Derangement One. This may be a progression of Derangement One, but it can also be the primary site of derangement.

In office treatment began with Grade IV mobilization, which consists of slow repetitive movement of the joints to the end range of passive movement but not into the para-physiological space, and interferential electrical stimulation for 8 visits over the first 2 weeks. The mobilizations were performed into left lateral bending and extension with the patient in a side-lying position. The patient was also instructed in the performance of 8–10 standing left side gliding movements to be performed every 2 hours. They were to be performed by moving the pelvis to the right while moving the shoulders to the left while keeping the shoulders parallel to the ground. The patient was instructed that if needed, she could use a left hand contact on the left side of her pelvis to gain further movement of the pelvis to the right. On the fifth visit there was no reproduction of symptoms with side gliding. The patient was re-evaluated with repetitive sagittal movements and it was found that repetitive extension movements decreased the symptoms and they remained better. The patient was then instructed to start prone and standing lumbar extensions consisting of sets of 8–10 repetitions every 2 hours. The exercises were to be done prone when possible, and in the standing position otherwise.

After the first 2 weeks, the patient was seen 4 more times and was then treated with lumbar extension manipulation to L4L5 and L5S1, again in side lying, and instructed to continue the home extension movements. She then received a progress examination. She reported no symptoms except mild pain and stiffness with more than 2 hours of sitting. Oswestry Low Back Pain and Disability Index showed no disability at 0% and the Visual Analog Scale was marked at 0 mm for present and average pain. The patient was then scheduled for a follow-up visit. She did not return for the follow-up and we were unable to reschedule her.

DISCUSSION

The derangement protocols were originally developed with the premise that the movements were repositioning the disc material. Early studies showed that lumbar flexion moved the nucleus pulposus posteriorly and lumbar extension moved the nucleus pulposus anteriorly (8,9). Some more recent studies do not show this pattern, especially with degenerated discs (10–12). This does not affect the clinical use of the McKenzie protocol, because the direction of treatment is always based on changes of symptoms during evaluation, which can occur with either flexion, extension, or lateral side gliding. McKenzie evaluation of lateral shift component and classifying patients with low back pain into McKenzie syndromes has shown to be reliable (13–15).

In this patient, the rationale for the repetitive movement treatment was to purportedly reposition the nuclear material toward the center of the disc. McKenzie treatment forces are divided into 1) static patient forces, 2) dynamic patient forces, 3) therapist generated forces, which include mobilization and manipulation. McKenzie recommends the treatment forces be used in the above order only resorting to therapist generated forces only after unsatisfactory results with patient generated forces. This concept is called the "progression of forces." I chose to initiate mobilization and manipulation at the onset of treatment in this case because of the significant amount of literature showing benefit of manipulation with acute low back pain.

In the McKenzie protocol, sagittal plane movements of flexion or extension are most commonly used to correct derangements or dysfunction. Coronal plane movements consisting of side gliding are most commonly used to correct lateral deformities, or after unsatisfactory results with sagittal plane movements. Lateral deformities, such as antalgic leans, are usually reduced first before sagittal movements are initiated. This is accomplished by patient generated side gliding movements or mobilization/manipulation if patient generated movements are not successful. Treatment is divided into 1) reduction of derangement, 2) maintenance of reduction, 3) recovery of function, and 4) prevention of recurrence. Recovery of function will usually consist of repetitions into the direction opposite to the one that reduced the derangement and will usually be flexion. This is done on the premise that it will enhance the quality of the developing collagen in the healing disc material. Flexion exercise should be commenced when full maximum extension in lying is painless, even though the patient may describe a "strain" pain in this position. Several extension movements to prevent possible recurrence of the derangement should always immediately follow the flexion movements.

McKenzie maintains that once nuclear material has escaped through the annular wall, the inherent hydrostatic mechanism is no longer intact, and internal derangement of the disc cannot be reduced significantly by movements of the spinal column. In other words, if no positions or movements can be found that make the symptoms "better," the patient will not likely benefit from the McKenzie protocol. On the other hand, movements of the spinal column can be utilized to reverse internal derangement of the disc as long as the integrity of the disc wall is maintained. April et al showed that the McKenzie assessment process may reliably differentiated a competent (no escape of nuclear material through annular wall) from an incompetent (escape of

nuclear material through annular wall) annulus in symptomatic discs, discogenic from nondiscogenic pain, as well as superiority to magnetic resonance imaging in distinguishing painful from nonpainful discs (16).

Recently, several randomized trials have been performed on McKenzie therapy. Rosenfeld et al has shown McKenzie therapy to be more effective than standard therapy on patients with acute and sub-acute whiplash related disorders (17). Kjellman et al found no definite evidence of treatment efficacy of a McKenzie therapy group and a general exercise group over a control group, however, there was a tendency toward a better outcome with the 2 active alternatives compared with the control group (18). Petersen et al showed that the McKenzie method and intensive dynamic strengthening training seem to be equally effective in the treatment of patients with subacute or chronic low back (19). Cherkin et al, in a flawed study, concluded that for patients with low back pain, the McKenzie method of physical therapy and chiropractic manipulation had similar effects and costs, and patients receiving these treatments had only marginally better outcomes than those receiving the minimal intervention of an educational booklet (20). Freeman and Rossignol do an excellent job in describing the flaws of the Cherkin study and suggest that because of the methodologic weaknesses just outlined, the results from Cherkin et al's study are uninterpretable, and thus, no conclusions can be drawn from this study about the relative effectiveness of McKenzie therapy, manipulation, and the use of a booklet for reduction of low back pain (21).

Limitations of this case study include making any specific conclusions concerning the efficacy of patient generated movements, spinal manipulation and mobilization, or interferential electrical stimulation, because the techniques were used simultaneously and thus the results could have been achieved by any one of the modalities individually or in combination. The results could also have been due to natural history of the condition, or a placebo effect. There was no long term follow-up to ascertain if the patient remained pain-free in the long term. A better future case study protocol in the future would be to follow the McKenzie recommendation to initially use only patient generated forces, only introduce clinician generated forces if there was unsatisfactory results with the patient generated forces, and to include a longer term follow-up of the patient's response to treatment.

CONCLUSION

This paper has attempted to give an overview of the McKenzie model in general and in the treatment of

lumbar derangement syndromes specifically, and has given a case report of successful short-term resolution of derangement syndrome using patient generated movements, spinal mobilization, and spinal manipulation. Hopefully this article will not only give clinicians another treatment tool, but it will be another way to empower our patients in the treatment and prevention of low back pain.

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