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**INTER-TESTER RELIABILITY OF THE MCKENZIE EVALUATION
IN ASSESSING PATIENTS WITH MECHANICAL LOW BACK PAIN**

By

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Submitted in partial fulfilment
of the requirements for the degree of
Master of Science

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ABSTRACT

Study design:

This study used two trained examiners to investigate the inter-examiner reliability of the McKenzie evaluation in diagnosis of mechanical low back pain.

Objectives:

The purpose of this study was to investigate inter-examiner agreement on diagnostic syndromes, sub-syndromes and principles of treatment determined using McKenzie techniques, on two occasions, about 2-3 weeks apart.

Summary of background data:

Reliability of the McKenzie approach for determining diagnostic syndromes and sub-syndromes of patients with mechanical low back pain remains unclear. Although previous studies provide some information, inconsistency of test protocols, criterion measures and the examination on McKenzie methods, preclude generalizations.

Methods:

Forty-five subjects, mean age = 47.3 , SD 14.2 years, with a history of acute, subacute, or chronic low back pain, with or without leg pain were studied. The examination was based on McKenzie methods and included taking history and having the subjects perform standard movements. On each test occasion, two examiners (McKenzie trained physical therapists) were randomly assigned as observer and assessor. The assessor directed the examination and asked the questions, while the observer watched and took notes. A third trained physical therapist /physical therapy student, the adjudicator, was present to apply the assessor's instructions which included occasional mobilization techniques. The adjudicator also collected the assessment forms. Subsequently, the patients received treatment from other physical therapists and returned for the second assessment approximately 2 to 3 weeks later. The Kappa statistic was used to measure inter-examiner agreement. Strength of agreement was interpreted using Landis and Koch's guidelines

Results:

The Kappa values ranged from 0.70, indicating “substantial” agreement on the first assessment to 0.92, indicating “almost perfect” agreement on the second assessment, for selecting the syndrome category. The Kappa values for sub-syndrome categories ranged from 0.88 on the first assessment to 0.81 on the second assessment, indicating “almost perfect” agreement.

The disagreements on the diagnostic categories did not occur within the McKenzie syndrome classification system, but occurred within sub-syndrome classification. Inter-examiner agreements on diagnostic categories in elderly was not as high as in younger individuals.

The examiners had “substantial” agreement on principle of treatment on both occasions ($K = 0.75$ to 0.80). The Kappa values ranged from 0.52 to 0.58, indicating “moderate” agreement for detection of lateral shift, 0.85 to 1.00, indicating “almost perfect” to “perfect” agreement on relevance of the lateral shift, 0.95 to 0.91, indicating “almost perfect” agreement on relevance of lateral compartment, and 1.00, indicating “perfect” agreement on detection of sagittal deformities.

Conclusions:

Qualified McKenzie trained physical therapists can be highly reliable with respect to selecting the diagnostic syndromes, sub-syndromes, and principles of treatment. These results emphasize the importance of detection of relevant lateral shift, lateral compartment, and sagittal deformities as essential components of the McKenzie evaluation in deriving the correct diagnostic category.

The presence of osteoarthritic changes at the facet joints and lateral structures coexisting with degenerative disc disease are thought to be the cause of slightly reduced inter-examiner reliability of the McKenzie evaluation in elderly.

Key Words: McKenzie, Low back pain, Evaluation, Reliability

DEDICATION

I would like to dedicate this thesis to:

Mr. Robin McKenzie, for his inspiration and tremendous contribution to the field of Spinal Mechanical Therapy and Diagnosis.

Two great teachers of mine, Mrs. Homa Daghestani, my literature teacher and Dr. G. H. Shahcheraghi, who believed in me before I believed in myself.

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Chapter 1

Introduction

The importance of establishing a clinical physical therapy diagnosis prior to treatment has received increased attention by physical therapists as a means of clarifying practice and facilitating communication between colleagues and patients (Sahrmann 1988, Jette 1989, Dekker et al 1993). Selecting a clear clinical diagnosis is important in establishing the rationale for management, the determination of prognosis, as well as the determination of change in status. Physical therapy approaches to diagnostic classification of patients with low back pain (LBP) have been developed based on the patient's anatomical, pathological, or clinical presentation. A number of frameworks for classifying LBP patients have been suggested (Saunders 1979, McKenzie 1981, Mooney 1983, Deyo 1986, Spitzer 1987, Porter 1989). A clinical picture of each diagnostic category is usually based on the involved anatomical structure (s), signs and symptoms or behavior of symptoms in response to certain test movements.

A standardized system of classification of spinal disorders has been recommended by the Quebec Task Force (QTF). The QTF recommendations support the concept of classification of the non-specific spinal disorders by utilizing pain patterns (Spitzer 1987). This system exhibits the following features: 1) biologic plausibility: the classification is compatible with current knowledge of vertebral physiology and pathology, 2) exhaustive classification: it encompass all clinical cases seen in occupational health, 3) mutually exclusive categories: the majority of clinical cases, at one point, shall fit in one and only one category; however, the patient may subsequently move into another category, 4) reliability: a given case of vertebral disorder shall be classified in the same manner by two or more practitioners, 5) clinical usefulness: it will facilitate the making of clinical decisions as well as the evaluation of care, 6) simplicity: its use will be simple and will neither call for complex paraclinical examinations nor encourage superfluous investigations.

According to the QTF, the most valuable diagnostic classification system is based on clinical signs and symptoms. The first four categories of the QTF classification are very similar to the pain pattern classification system adopted by McKenzie in 1972 (Appendix A). These categories describe the patients that are most commonly referred for conservative physiotherapy management of low back pain. McKenzie believes that the centralization of pain resulting from the performance of certain repeated movements or the adoption of certain positions, is the most reliable clinical sign and should be used as a guideline for diagnostic classification (McKenzie, 1981).

Review of the Literature

McKenzie Approach To Mechanical Therapy and Diagnosis

The majority of disabilities of the lumbar spine are thought to be mechanical, and thus can be treated in a mechanical manner (for Operational Terms, see Appendix B). Mechanical evaluation has been described by McKenzie using repeated end-range test movements and positions in multiple directions, both loaded and unloaded, while closely monitoring the response of the most distal pain (McKenzie 1981). Recent studies have indicated that a dynamic mechanical assessment that monitors the patient's pain response is helpful in identifying the direction of both beneficial and detrimental spinal movements, and exercise, for the low back pain patient (Donelson et al 1990 and 1991, Long 1995).

McKenzie spinal assessment is a dynamic, non-invasive and functional system for evaluation of the spine and includes objective and subjective elements. Physical therapists using the McKenzie system classify a patient's condition into one of the three syndromes: postural, dysfunction, or derangement (Appendix A). Postural syndrome is subdivided into sitting, standing, and lying sub-syndromes. Dysfunction syndrome includes flexion, extension, side flexion and multi-directional sub-syndromes. Adherent nerve root and nerve root entrapment are also considered to be caused by dysfunction. Derangement syndrome includes seven different sub-syndromes which are identified by location and presence/absence of deformities. Classification is based, in part, on the patient's previous history and on the information the therapist collects during assessment.

Critical determinants of the McKenzie classification system include observational analysis for the presence of a relevant lateral shift, kyphosis, or increased lordosis and changes in location and intensity of symptoms. The designation of patients to the appropriate categories is important because the treatment strategies for the three syndromes are specific to the mechanical diagnosis determined by the physical therapist. The efficacy of the McKenzie approach in treating patients with low back pain has been investigated by several researchers (Ponte et al 1984, Nwuga and Nwuga 1985). These authors concluded that the McKenzie approach was more effective in decreasing the patient's level of pain than the Williams protocol, which incorporates flexion exercises as the major component of treatment.

Although the systematic method of examination outlined by McKenzie is thought to minimize the variability between examiners, there is little documented evidence to support the reliability or validity of the McKenzie evaluation system in classifying patient conditions into diagnostic syndromes. Previous studies did not find the McKenzie system reliable in detecting either the lateral shift or end-range pain (Kilby et al 1990, Riddle and Rothstein 1993, Donahue et al 1996). Kilby and colleagues (1990), however, found the McKenzie method reliable in the examination of pain behavior and response to test movements. The authors reported a poor percentage of agreement with respect to selecting the diagnostic syndromes/sub-syndromes. Similarly, Riddle and Rothstein (1993) found that assessments of the syndromes present in low back pain patients are unreliable when using the McKenzie system.

Previous studies, however, have not used qualified McKenzie practitioners. McKenzie practitioners are individuals who have completed post-graduate training in McKenzie evaluation and treatment techniques for patients with mechanical spinal disorders. The McKenzie Institute offers a series of four sequentially organized courses (A-D) to teach practitioners the complete system of evaluation and therapy, including patient education, exercises and procedures for both patient generated and therapists generated forces. The completion of all four parts and the credentialing examination is recognition of attainment of a minimum level of competence in mechanical diagnosis and therapy. For those who wish to attain the highest proficiency with McKenzie system, a diploma program on

Mechanical Diagnosis and Therapy is offered in the United States. The results of the previous studies, therefore, may not apply to trained practitioners or be highly representative of the McKenzie evaluation system.

The Centralization Phenomenon

The concept of centralization is key to using McKenzie techniques. The term “centralization” was used by Robin McKenzie in 1956, to describe a change in the distal-most extent of the patient’s referred pain, in a proximal direction or toward the midline in derangement syndrome (McKenzie 1981). Centralization of pain is thought to result from a reduction in the degree of deformation or compression of the disc or nerve root, and movements and positions that cause centralization are therefore desirable to reduce pain. According to McKenzie (1981), when the disc protrusion reduces in size, it releases first the nerve root and then the dura matter, which results in a cessation of symptoms below the knee followed by a reduction in thigh pain and finally lumbar spine.

Movement of the distal-most symptom, further away from the midline into the periphery has been called “peripheralization”. Peripheralization of pain may result from increasing compression of the nerve root, as well as from increasing deformation of the articular structures. Repeated movements that peripheralize symptoms are therefore undesirable. According to McKenzie (1981), it is permissible for pain to increase centrally provided there is a reduction in the lateral or distal pain.

The concept of a centralization phenomenon has gained wide acceptance as a basis for evaluating, predicting prognosis and, planning the treatment of patients with pain of spinal origin. Long (1995) found that patients whose pain centralized as a result of certain positions/movements had significant decreases in their pain level. These patients were also characterized by a higher rate of return to work when compared to patients whose pain did not centralize (Long 1995). Thus, centralization may be a reliable predictor of outcome. Inability to centralize pain within a short period (i.e. three weeks) is thought to suggest the probability that surgical intervention may be necessary.

In a blinded study, the result of spinal assessment was compared with the findings of actual discogram in forty patients (Medcalf et al 1995). Four questions were addressed in

this study: 1) whether the pain was provoked by disc pathology, 2) what spinal level was painful, 3) whether the pathology was contained or non-contained, and 4) what the appearance of the axial map was with respect to location of annular fissure. The percentage value of agreement was high for all four questions. The authors concluded that dynamic disc injection outcomes can be predicted by McKenzie spinal assessment, and this tends to validate the dynamic internal disc model. According to this model, during movements of the spine a positional change of the nucleus pulposus takes place. Significant anterior movement of the nucleus occurs when the spine moves from flexion to extension. The reverse occurs when the spine flexes (Armstrong 1958, Shah et al 1978). A recent study by Medcalf et al (1995) strongly suggested a mechanical cause and effect relationship between the internal disc dynamics and symptom response patterns of centralization and directional preference. The McKenzie assessment performed by a “qualified” therapist is thought to be able to clarify whether the pathology is discogenic or not, and whether this discogenic pathology is contained or not. Accurate diagnosis, therefore, allows for the selection of those patients who fit the McKenzie dynamic internal disc model (for Operational Terms, see Appendix B) and who might be responsive to mechanical therapy, while excluding those who present with incompetent anulus and nonfunctional hydrostatic disc mechanism and would need further medical managements.

The correlation of information from the patient’s history, examination and test movements can enhance a clinical decision as to whether the patient is suffering from the postural, dysfunctional or derangemental syndrome. This differentiation is essential, as it indicates which principle of treatment should be used (McKenzie 1981).

McKenzie (1981) classified all spinal pain of mechanical origin in one of the three syndromes: 1) postural, 2) dysfunction, and 3) derangement.

Postural Syndrome

This syndrome has been attributed to mechanical deformation of soft tissues, as a result of postural stresses. Maintenance of certain postures and positions which place specific soft tissues under prolonged stress tends to eventually produce pain. The pain ceases only

with a change of position or after postural correction. Repeated end range test movements will not cause pain in patients with a postural syndrome.

Dysfunction Syndrome

This syndrome has been attributed to mechanical deformation of soft tissues, affected by adaptive shortening. Adaptive shortening leads to the loss of spinal movement in certain directions and causes pain to be produced before normal full range of movement is achieved. Thus, the dysfunction syndrome is characterized by intermittent pain and a partial loss of movement. The pain is brought on as soon as shortened structures are stressed by end range positioning or end movement and ceases almost immediately when the stress is released. In the dysfunction syndrome, the performance of repeated movements in the direction which stretches adaptively shortened structures will produce pain at the end range of movement, but the number of repetitions does not make the patient progressively worse.

Derangement Syndrome

McKenzie described this syndrome as a mechanical deformation of soft tissues as a result of internal derangement. Alteration of the position of the fluid nucleus within the disc, and possibly the surrounding annulus, causes a disturbance in the normal resting position of the two vertebrae enclosing the disc involved. Thus, the derangement syndrome is usually characterized by constant pain, although intermittent pain may occur depending on the size and location of the derangement. There is a partial loss of spinal movement, some movements being full range and others partially or completely blocked. In acute stages of derangement, kyphosis and scoliosis may be seen.

In the derangement syndrome, the performance of repeated movements in the direction that increases the accumulation of nuclear material is thought to result in a progressively increasing derangement and increasing or peripheralizing pain. The performance of repeated movements in the opposite direction will result in a reduction of the derangement and reduction or centralization of pain.

Relationship Between Type of Syndrome and Age

The “disc” is the most common cause of low back pain in young individuals (Mixer and Barr 1934). There is increasing evidence that arthritis of the facet joints is not the major cause of low back pain in an aged spine and although disc herniation is less frequent in elderly, the possibility of its occurrence should be given strong consideration (Mastrelli et al 1987, Tsuguo et al 1990, Tanaka et al 1993). Recent studies have shown that the nature of the disc herniation is somewhat different in the elderly. The histological findings reported by Tsuguo et al (1990) suggested explanations for the predominance of protrusions of the nucleus pulposus in patients who were less than sixty years old and of prolapse of the annulus fibrosus in the patients who are more than sixty years old. The protrusion of an atrophic nucleus in older discs is rare. However, the narrowing of the disc space and degenerative changes of the middle fibers of annulus predispose the disc to prolapse from the periphery without involving the nucleus. Controversy still exists as to whether the complaints and findings on examination of patients of this age group are due to disc derangement or bony entrapment caused by facet joint arthritis, lateral stenosis, or degenerative spondylolisthesis. Although the nature of disc prolapse is different in elderly people, the clinical signs and symptoms are similar in all patients who present with disc derangement (McKenzie 1981). Morris et al (1986) emphasized the important role of the clinical diagnosis in distinguishing the disc prolapse and bony entrapment. The predominant symptom in both groups was root pain with or without paresthesia. Most disc prolapses produced more root irritation signs such as restricted straight leg raising. The bony entrapment, however, produced more nerve root compression signs such as, muscle weakness, muscle wasting, sensory impairment, and diminished reflexes. The key feature in bony entrapment was reproduction of symptoms by activities that involved spinal extension.

During McKenzie evaluation the effects of test movements on centralization of symptoms are closely monitored to differentiate between nerve root irritation/compression caused by “disc derangement” and nerve root entrapment caused by “spinal stenosis” as a result of osteophytes or fibrosed extruded nucleus (McKenzie, 1995). The true

centralization phenomenon which is the case in the discogenic derangement, does not occur in the pure bony entrapment. The symptoms are reproduced or abolished by single movements and the range of movement does not change with repeated movements in spinal stenosis. In a reducible disc derangement (for Operational Terms, see Appendix B), however, range of motion changes as obstruction reduces by appropriate movements. It appears that in the older populations there is a higher chance that these two conditions coexist resulting in more ambiguity in the clinical presentation.

Careful examination is imperative to detect spinal departure from midline causing a lumbar scoliosis or lateral shift. There are reasons for the lumbar spine to depart even slightly from the midline, such as congenital anomaly or alteration in the position of the disc nucleus. McKenzie classified two kinds of shifts; primary and secondary. The primary lateral shift (for Operational Terms, see Appendix B) is caused by derangement. The lateral shift is referred to as secondary when it is caused by anomalies (McKenzie 1981).

The determination of McKenzie syndrome and sub-syndrome diagnostic categories is based on the examiner's observation of deformities in the sagittal and frontal planes. Relevance of these deformities to the patient's symptoms are determined using specific test movements, such as lateral glide movements.

Deformity and Relevance of Lateral Shift

Asymmetry is not atypical in the human spine and a great number of shifts about the lumbar area can be attributed to congenital or developmental anomalies, and may not be relevant to the patient's present symptoms.

Lateral shift is defined as occurring when the upper trunk and shoulders appear to be translocated in the frontal plane in relationship to the pelvic girdle (McKenzie 1981). Detection of the lateral shift and kyphosis can not be consistently made by the examiner's observation alone. Most often these shifts are not relevant to the existing problem and a qualified examiner can readily detect their significance by performing repeated test movements. It is imperative to detect a relevant lateral shift during the assessment because this affects the diagnostic category and consequently the treatment management.

Deformity of lumbar lateral shift is caused by the blockage of the side glide movement. The blockage of the side glide movement is defined as an inability to reverse the curve in the frontal plane by an active movement.

Donahue et al (1996) investigated the relationship between the side glide test and its effect on patients with lateral shifts. Although the Kappa value was high, ($K = 0.74$) for determination of the presence of a positive side-glide test with respect to pain behavior, the presence ($K = 0.00$) and the relevance ($K = 0.16$) of lateral shift were poorly determined. The poor correlation between the results of the side glide test and determination of presence and relevance of lateral shift among untrained therapists highlights the importance of training in interpretation of the components of the McKenzie evaluation system, such as side-glide test. The technique used in this study measured the lateral shift from L1 to S1. The instruments were a bubble level, a ruler and some adhesive markers. This measurement technique did not improve the reliability as compared to previous studies where information was obtained by visual estimate (Nelson et al 1979, Kilby et al 1990, Riddle and Rothstein 1993).

McKenzie described the lateral shift as the deviation of the trunk in relation to the pelvis (1981). A truer measure of trunk deviation, or shift, is the measurement between C7- S1 (Laslett 1996). Although Donahue et al (1996) claimed that they tested the McKenzie evaluation of the lateral shift, three limitations of their study should be noted: 1) they measured the shift from L1 to S1, 2) the obstruction to movement was not discussed, and 3) the side-glide test was performed to both sides in all subjects. As Laslett (1996) pointed out, the relevance of the lateral shift is confirmed only if an attempted correction of the shift is obstructed and influences the symptoms. The side-glide test in standing should be performed only towards the obstructed side to correct the shift.

Deformity in Sagittal Plane

The definition of a normal lumbar lordosis remains unclear to a large number of clinicians. Rosenberg (1975) pointed out that individuals of different genders and racial backgrounds tend to have varying degrees of lumbar lordosis in the lumbar spine. He reported that degenerative spondylolisthesis occurs five to six times more frequently in

women than man and three times more frequently in black females than females from other populations. He speculated that change in the amount of the lumbar lordosis is one of the predisposing factors in the development of degenerative changes in the black women.

Any spinal curve that can be actively reversed is not considered pathologic and is not called a deformity (McKenzie 1981). A kyphotic deformity is caused by blockage of extension. It is defined as the inability to actively reverse the curve in the sagittal plane. A lordotic deformity of lordosis is defined as a blockage in flexion and presents itself as inability to reverse the curve in the sagittal plane. Any fixed deformity in the frontal or sagittal planes requires passive overpressure and time for correction. The amount of overpressure or time required to reduce the derangement depends on the size of derangement (McKenzie 1995). It might be expected that improvement in detection of deformities would improve the inter-examiner reliability in other aspects of the evaluation such as, selecting the diagnostic categories.

Relevant Lateral Compartment

In the McKenzie evaluation system, the reported pain in derangements 3 and 5 is unilateral or asymmetrical, and is indicative of a posterolateral derangement. Sometimes this lateral derangement is not large enough to need any lateral movement to reduce it. In this case, the symptoms can be resolved simply by performing extension in the sagittal plane and the lateral compartment is considered to be irrelevant. If symptoms worsen or peripheralize with flexion and extension at the same time, the possibility of a relevant lateral compartment should be considered. McKenzie (1981) suggested that by closing the intervertebral foramen on the ipsilateral side of the blockage, the derangement is reduced more effectively. In some other cases, symptoms worsen with flexion, but do not worsen or improve with extension. If the examiner realizes that extension in the sagittal plane is not an effective movement (direction of preference), he/she should add some side glide - depending on the size of the derangement - to reduce the lateral compartment. In case of a large lateral compartment, too much side glide may compress the derangement and aggravate the symptoms.

Observer Error

Observer error is the bias or inaccuracy that the observer introduces. It is present in all situations in which the clinician obtains information by taking a history or performing a clinical examination. Observer error has been reported to be significant, especially in the area of back pain (Nelson et al 1979, Waddell et al 1982, McCombe et al 1989, Kilby et al 1990, Riddle and Rothstein 1993).

Kilby et al (1990) investigated the inter-tester reliability between two therapists using a "McKenzie Algorithm". The authors indicated that they used the Kappa statistic only where numbers of observations allowed reliable interpretation by this statistic. The Kappa statistic, therefore, was used only for analyzing pain behavior such as centralization of the symptoms. Due to insufficient numbers of observations, percentage of agreement was used to analyze the agreement on the selection of derangement sub-syndromes, presence of end-range pain, and deformity of lateral shift, flat, or kyphosis. The level of total agreement among derangement sub-syndromes was reported to be 57%. There was also poor agreement on three questions that were related to end range pain, and the presence of a flat, kyphotic or lateral shift deformity. The percentage of agreement, however, did not correct for agreement due to chance. The investigators concluded that the "McKenzie Algorithm" was unreliable in detecting deformities and end-range pain, but was reliable in the examination of pain behavior and test movements. The lower inter-observer reliability in the detection of a flat or kyphotic lumbar spine is in agreement with findings of Nelson et al (1979) who found that classification of lordosis and tilt (lateral shift) had a high inter-tester error.

A recent study investigating the inter-tester reliability and the effect of post-graduate McKenzie training on outcomes, was published by Riddle and Rothstein in 1993. The methodology and inclusion criteria used, however, were misleading and inappropriate, and did not fit the McKenzie model. Specifically, the inclusion criteria: 1) complaint of low back pain and 2) permission of the therapist with respect to interference with treatment and recovery, were unspecified and vague. Riddle and Rothstein (1993) tested 363 patients and used 49 therapists, but only 16 therapists had partial training in McKenzie methods. These McKenzie trained examiners had taken at least one course in McKenzie

methods, which was considered to be sufficient by the authors. The terms used in the assessment forms to describe intensity, location and behavior of symptoms were inconsistent. As a result, range of motion test assessments could not be analyzed by the investigators and the inter-tester reliability of the trained examiners was as poor as that observed for untrained examiners. In addition, as the authors acknowledged, every patient completed two lengthy assessments involving a great deal of repeated movements, which could have biased the results. McKenzie (1981) suggested that repeated movements can result in a quick change in the derangement status, making their examination procedure questionable. The McKenzie evaluation is based on the centralization phenomenon which is affected by repeated test movements. Drastic changes in the location of the most distal symptoms can change the clinical picture and consequently the diagnostic sub-syndrome of the derangement. Simultaneous observation of these changes by the examiners is necessary for reaching the same conclusion with respect to selecting the diagnosis.

Intermittent pain, caused by mechanical deformation of the nociceptive receptor system is the main presenting symptom of the mechanical back pain (McKenzie 1981). A patient with low back pain of non-mechanical origin would not be expected to respond to the McKenzie model. Patients in whom no position or movement can be found to reduce or centralize pain patterns are excluded from treatment (McKenzie 1981). Patients with constant severe sciatica with neurological deficits are considered to be unsuited for any mechanical procedure as well.

The importance of proper training in achieving competency in using McKenzie methods for diagnosis and treatment should be emphasized. The International McKenzie Institute offers four progressively advanced courses. A six month period of clinical practice is mandatory between courses for the therapist to practice the evaluation techniques. The courses A and B focus on the theory and philosophy of the McKenzie approach. Advanced problem solving and practical workshops, emphasizing hands-on experience are the focus of parts C and D. A credentialing examination, taken after finishing part D, establishes a minimum standard of competency in the application of McKenzie methods of mechanical diagnosis and treatment.

This examination uses a multi-method approach to test the therapist's ability in history taking, performing examination, drawing conclusions and selecting the appropriate treatment. Written examination includes audio-visual presentations, case studies, chart evaluations, and practical part includes performance simulations. As noted, a major limitation of previous studies is the tendency not to use McKenzie credentialed examiners.

Purpose

The primary purpose of this study was to determine the inter-examiner agreement between two qualified McKenzie examiners in determining diagnostic syndromes, sub-syndromes and principles of treatment using McKenzie methods, in assessing patients with back pain, on two separate occasions.

The secondary purpose was to determine the inter-examiner agreement on the observation of sagittal and frontal plane deformities (i.e. detection of lateral shift, lordosis, kyphosis) and the effect of test movements on symptom behavior to clarify the relevance of these deformities to the patient's symptoms at the time of testing (i.e. relevance of lateral shift and lateral compartment).

Chapter 2

Methods

Subjects

A total of 46 consecutive patients (23-75 years of age, average age = 47.2, SD 14.2) with a history of acute, subacute or chronic low back pain agreed to complete two assessments, about 2-3 weeks apart. Their onset of back pain was either of a slow or sudden origin, with or without radiation into the lower extremities. Subjects were referred by general practitioners or specialists for assessment and treatment to the Outpatient Department at the Orthopaedic and Arthritic Hospital, Toronto, where the study was conducted.

Individuals meeting any of the following criteria, as determined via medical records, telephone interview, neurological screening before assessment or during formal examination were excluded: 1) previous spinal or hip surgery, 2) diagnosis of advanced spinal stenosis, tumor, or systemic disease, anomalies of weakness and instability such as fracture, rheumatoid arthritis, and advanced spondylolisthesis, grade 3 or more, 3) constant severe leg pain with neurological deficits as a result of severe nerve root compression such as muscle weakness, saddle anesthesia or bladder weakness, 4) individuals who did not understand directions used for evaluation, 5) individuals who were receiving Workers' compensation at the time of assessment, 6) individuals for whom no position or movement could be found to reduce or centralize pain, and 7) pregnancy. The sample is described in Table 1.

All subjects gave written informed consent prior to participating (Appendix C). The study received ethics approval from the University of Western Ontario and the Orthopaedic and Arthritic Hospital Human Ethics Research Committees (Appendix C).

Table 1. Characteristics of sample

Gender	Occasion 1	Occasion 2
Female	25	19
Male	20	15
Age group	Occasion 1	Occasion 2
55 years of age or older	17	13
< 55 years of age	28	21
Symptom Duration	Occasion 1	
Acute < 7 days	4	
Subacute >7 days <7 weeks	17	
Chronic >7 weeks	24	

Examiners

Two examiners, with 12 and 24 years of clinical experience performed the evaluations. The least experienced examiner (HR) had completed parts A-D and had received certification from the McKenzie International Institute in 1996. The more experienced examiner (RY) had been a faculty member of the McKenzie International Institute since 1986 and held a diploma in Mechanical Therapy and Diagnosis (1991). She had been an instructor of McKenzie courses for eight years (1989-1996).

Evaluation Instruments

Questionnaire: A history questionnaire based on the original McKenzie form was developed to standardize the format of the questions examiners asked the subjects (Appendix D).

Data Collection Form: Similarly, a data collection form based on the original McKenzie form (Appendix D) was developed. This form reflected McKenzie's description of the examination procedure and content of the form was similar to the original McKenzie form (Appendix D). The diagnostic categories, however, were expanded to sub-syndromes to facilitate use of the form (McKenzie 1981). This form was reviewed for accuracy by Robin McKenzie, the president of the McKenzie Institute International.

Procedures

Prior to data acquisition, the examiners reviewed the assessment forms and criteria. For practice, four patients were assessed using the proposed methodology and their results were reviewed by the two examiners. The data collected from these patients were not included in the final data set.

The two examiners were randomly assigned to be the observer and assessor using a computer generated sequence, so that each examiner was an assessor 50% of the cases on the first occasion. On the second occasion the role of the assessor was reversed so that the observer in the previous session acted as the assessor. The assessor examined the patient, while the observer watched and took notes. The examination consisted of taking a history (verbally), evaluation of the spinal range of motion, and completion of specified test movements. The subjects were only allowed to communicate with the assessor. The examiners were separated by a curtain so that they were unable to see each other during spinal assessment, but an independent adjudicator was able to see both of them (Figure 1) This adjudicator (staff physical therapist or physical therapy student) who had received training by one of the examiners, was present to demonstrate test movements or apply simple techniques such as giving overpressure or adding side glide in lying or standing. These are techniques routinely used in the process of examination to centralize the symptoms and to identify the "directional preference" (Appendix B). The adjudicator was also responsible for collecting the data forms and ensuring that examiners did not communicate with each other.

During the physical examination, the subjects stood against a bright wall with three vertical lines marked on it (Figures 2 and 3). Two pairs of footprints were used to mark

the location of patient's feet on the floor during postural appraisal and test movement performance. The subject's back was exposed to the level of the S1 spinal segment. Visual appraisal of the patient's posture was performed by the examiners from the same spot to determine the presence or absence of an observable lateral shift, defined as the deviation of the trunk in relation to the pelvis (Figures 2 and 3). The test movements provided the information regarding relevance of the lateral shift or existence of the relevant lateral compartment.

At the end of each assessment both examiners completed the data collection forms. The data collection forms were sealed in an envelope. Patients received physiotherapy treatment from other hospital staff therapists and returned for the second evaluation after two to three weeks. The same assessment procedures were followed on the second evaluation. Figure 4 illustrates the study protocol.

Treatment

The subjects were treated between first and second assessments by staff physical therapists at the Orthopaedic and Arthritic Hospital who were familiar with the McKenzie system (Courses A-C, please see Introduction). The original McKenzie forms (Appendix D) were completed on the initial examination by the assessor and were used for treatment purposes. A summary of the McKenzie diagnostic sub-syndromes, their clinical presentations, and principles of treatment was provided to the staff physical therapists as a source of reference for each sub-syndrome (Appendix A). The treating physical therapist was allowed to progress the treatment during the 2-3 weeks as required. The examiners and treating staff were instructed not to share their views about each case and not to review each other's forms until data collection for the entire study was complete.

Figure 1. Test setup - The curtain was pulled to separate the examiners and the adjudicator sat in the chair at the top right of the photograph.

Figure 2. Anterior view, later shift.

Figure 3. Posterior view, later shift.

Figure 4. Study Protocol

Data Analysis

Cases were numbered 1 through 46, indicating sequential order of entry into the study. Data from the data collection forms was entered into a computer spread sheet program by an independent reviewer (a staff physical therapist who was not previously involved in the study) at the end of data collection.

Because the Kappa statistic is designed to measure agreement among testers for mutually exclusive categories (Cohen, 1960), a decision was made a priori to analyze only the primary diagnosis in case the patient presented with underlying dysfunction or other non-mechanical conditions. The dysfunction syndrome is commonly seen in association with recurrent disc derangement. This condition occurs as a result of adaptive shortening in spinal structures. Non-mechanical conditions, such as sacroiliac joint inflammation or bony entrapment may also coexist with disc derangements. The primary diagnosis was defined as the major cause of the patient's symptoms.

Cohen's Kappa (K) was used to measure inter-examiner agreement in choice of diagnostic syndrome, sub-syndrome, principle of treatment, detection of sagittal or lateral plane deformities, and their relevance to the subject's present symptoms (Cohen, 1960). Strength of agreement was interpreted as follows: $K < 0.00$ = Poor, $0.00-0.20$ = Slight, $0.21-0.40$ = Fair, $0.41-0.60$ = Moderate, $0.61-0.80$ = Substantial, $0.81-1.00$ = Almost perfect (Landis & Koch, 1989). Percentage of agreement was calculated simply as: number of cases agreed on divided by total number of cases multiplied by 100 (Kilby et al 1990). This was done to compare the present data to previous studies that did not provide the Kappa values.

Chapter 3

Results

Forty six patients volunteered to participate in the study. Subject number 16 was excluded from the study due to multiple neurological findings. Subject number 28 was excluded from the second assessment because no position or movement was found to reduce or centralize his bilateral leg pain. Ten subjects did not return for the second evaluation due to personal reasons or other concurrent medical problems. As a result, data for 45 subjects (mean age = 47.2, SD = 14.4 years) were collected on the first assessment and 34 subjects (mean age = 46.94, SD = 15.3 years) on the second assessment.

Original history at the first assessment was as follows: four patients with acute, seventeen patients with subacute, and twenty four patients with chronic back pain. Seventeen patients (9 women and 8 men, 30 observations) were 55 years of age or older (Tables 1 and 2).

The Kappa values ranged from 0.70 to 0.92 for selecting the syndromes, 0.81 to 0.88 for selecting the sub-syndromes and 0.75 to 0.79 for selecting the principle of treatment. The Kappa values ranged from 0.52 to 0.57 for detection of lateral shift, 0.85 to 1.00 for relevance of the lateral shift, 0.90 to 0.95 for relevance of lateral compartment and 1.00 for detection of sagittal deformities. These Kappa values, their interpretations and the percent of agreements are presented in more detail in Tables 3 to 17.

Table 2. Number of choices

Global Variables	Number of Choices
Syndrome	4
Sub-Syndrome	15
Principles of Treatment	9
Specific Test Variables	Number of Choices
Presence of lateral Shift	2 (Yes/No)
Relevance of lateral Shift	2 (Yes/No)
Relevance of lateral compartment	2 (Yes/No)
Deformity of Sagittal Plane Kyphosis /Increased Lordosis	2 (Yes/No)

Syndrome Categories:

1. Postural 2. Dysfunction 3. Derangement 4. Other (non-Mechanical)

Sub-Syndrome Categories:

1. Postural 2. Flexion 3. Extension 4. Side glide 5. Multi-directional
 6. Adherent Nerve Root 7. Nerve Root Entrapment 8. Derangement #1
 9. Derangement #2 10. Derangement #3 11. Derangement #4
 12. Derangement #5
 13. Derangement #6 14. Derangement # 7 15. Other

Principles of Treatment:

1. Posture Correction 2. Prone position/sustained extension
 3. Correction of lateral shift 4. Flexion in sagittal plane 5. Flexion in step standing
 6. Extension in sagittal plane 7. Side glides in standing/ lying
 8. Extension with hip shifted to one side 9. Other

ABBREVIATIONS USED IN TABLES

ANR: Adherent Nerve Root

Cor: Correction

D: Derangement

Dx: Diagnosis

ED: Extension Dysfunction

Fo: Frequency of Agreement

Fc: Frequency of Agreement by Chance

FD: Flexion Dysfunction

Ext: Extension

Flex: Flexion

MDD: Multi Directional Dysfunction

NRE: Nerve Root Entrapment

Oth: Other

Pos: Postural

SG: Side Gliding in Standing/Lying

SGD: Side Glide Dysfunction

Step Flexion: Flexion in Step Standing

Tot: Total

Table 3. Summary table of Kappa Coefficients (present study)

Global Variables	Kappa Value	Percent of Agreement	Interpretation
Syndrome			
First Assessment(n=45)	0.70	93%	Substantial
Second Assessment(n=34)	0.92	97%	Almost Perfect
Sub-Syndrome			
First Assessment	0.88	91%	Almost Perfect
Second Assessment	0.81	85%	Almost perfect
Principle of Treatment			
First Assessment	0.75	84%	Substantial
Second Assessment	0.80	88%	Substantial
Specific Test Variables	Kappa Value	Percent of Agreement	Interpretation
Presence of Lateral Shift			
First Assessment	0.52	78%	Moderate
Second Assessment	0.58	82%	Moderate
Relevance of Lateral Shift			
First Assessment	0.85	98%	Almost Perfect
Second Assessment	1.00	100%	Perfect
Relevance of Lateral Compartment			
First Assessment	0.95	98%	Almost Perfect
Second Assessment	0.91	97%	Almost Perfect
Deformity of Sagittal Plane			
First Assessment	1.00	100%	Perfect
Second Assessment	1.00	100%	Perfect

Table 4. Frequency of classification (agreement) for the type of syndrome (first assessment)

Examiner 2 (HR)

Diagnosis	Postural	Dysfunction	Derangement	Other	Total
Postural					1
Dysfunction		2			2
Derangement			39		39
Other		2	1		3
Total	1	4	40	0	45

Examiner 1 (RY)

$$F_o = 1 + 2 + 39 = 42 \quad F_c = (1/45) + (2 \times 4)/45 + (40 \times 39)/45 = 34.87$$

$$K = (42 - 34.87) / (45 - 34.87) = 6.41 / 8.41 = 0.70$$

Substantial agreement, Percent Agreement = $42/45 = 93\%$

Table 5. Frequency of classification (agreement) for the type of syndrome (second assessment)

Examiner 2 (HR)

Diagnosis	Postural	Dysfunction	Derangement	Other	Total
Postural					0
Dysfunction		2		1	3
Derangement			25		25
Other				6	6
Total	0	2	25	7	34

Examiner 1 (RY)

$$F_o = 2 + 25 + 6 = 33 \quad F_c = (3 \times 2)/34 + (25 \times 25)/34 + (7 \times 6)/34 = 19.79$$

$$K = (33 - 19.79) / (34 - 19.79) = 0.93 \text{ Almost Perfect Agreement}$$

Percent Agreement = $33/34 = 97\%$

Table 6. Frequency of classification (agreement) of the type of sub-syndrome (first assessment)

Examiner 2 (HR)

Dx	Pos	FD	ED	SGD	MDD	ANR	NRE	D 1	D 2	D 3	D 4	D 5	D 6	D 7	Oth	Tot
Pos	1															1
FD																0
ED			1													1
SGD																0
MDD					1											1
ANR																0
NRE																0
D1								8								8
D2																0
D3								1		19						20
D4											3					3
D5												8				8
D6																0
D7																0
Oth					1	1							1			3
Tot	1	0	1	0	2	1	0	9	0	19	3	8	1	0	0	45

Examiner 2 (HR)

$$F_o = 1 + 1 + 1 + 8 + 19 + 3 + 8 = 41$$

$$F_c = (1/45) + (1/45) + (2 \times 1)/45 + (8 \times 9)/45 + (20 \times 19)/45 + (3 \times 3)/45 + (8 \times 8)/45 = 11.75$$

$$K = (41 - 11.75) / (45 - 11.75) = 0.88 \text{ Almost Perfect Agreement}$$

$$\text{Percent Agreement} = 41/45 = 91\%$$

Table 7. Frequency of classification (agreement) of the type of sub-syndrome present (second assessment)

Examiner 2 (HR)

Dx	Pos	FD	ED	SGD	MDD	ANR	NRE	D 1	D 2	D 3	D 4	D 5	D 6	D 7	Oth	Tot
Pos																0
FD																0
ED			1		1										1	3
SGD																0
MDD																0
ANR																0
NRE																0
D1								5		1						6
D2																0
D3										11						11
D4										1						1
D5												7				7
D6																0
D7																0
Oth			1												5	6
Tot	0	0	2	0	1	0	0	5	0	13	0	7	0	0	6	34

Examiner 2 (HR)

$$F0 = 5 + 11 + 7 + 5 + 1 = 29$$

$$F_c = (3 \times 2)/34 + (6 \times 5)/34 + (11 \times 13)/34 + (7 \times 7)/34 + (6 \times 6)/34 = 7.76$$

$$K = (29 - 7.76) / (34 - 7.76) = 0.81 \text{ Almost Perfect Agreement}$$

$$\text{Percent Agreement} = 29/34 = 85\%$$

Table 8. Frequency of classification (agreement) of the principle of treatment (first assessment)

Examiner 2 (HR)

Principle of Treatment	Pos Cor	Prone/Sustained Ext	Lat Shift Cor	Sagittal Flex	Step Flex	Sagittal Ext	SG	Ext with Hip Shifted	Oth	Total
Pos Cor	1									1
Prone/Sus Ext		1				2				3
Lat Shift Cor			3							3
Sagittal Flex										0
Step Flex										0
Sagittal Ext						23		2		25
SG				1			1			2
Ext with Hip Shifted								9		9
Other			1	1						2
Total	1	1	4	2	0	25	1	11	0	45

Examiner 2 (HR)

$$F_o = 1 + 1 + 3 + 23 + 1 + 9 = 38$$

$$F_c = (1 \times 1)/45 + (3 \times 1)/45 + (3 \times 4)/45 + (25 \times 25)/45 + (2 \times 1)/45 + (9 \times 11)/45 = 16.49$$

$$K = (38 - 16.49)/(45 - 16.49) = 0.75 \text{ Substantial Agreement}$$

$$\text{Percent Agreement} = 38/45 = 84\%$$

Table 9. Frequency of classification (agreement) of the principle of treatment (second assessment)

Examiner 2 (HR)

Principle of Treatment	Pos Cor	Prone/Sustained Ext	Lat Shift Cor	Sagittal Flex	Step Flex	Sagittal Ext	SG	Ext with Hip Shifted	Oth	Total
Pos Cor	3									3
Prone/Sus Ext								1		1
lat shift cor							1			1
Sagittal Flex										0
Step Flex										0
Sagittal Ext						20		1		21
SG							1			1
Ext with Hip Shifted								4		4
Other						1			2	3
Total	3	0	0	0	0	21	2	6	2	34

Examiner 2 (HR)

$$F_o = 3 + 20 + 1 + 4 + 2 = 30$$

$$F_c = (3 \times 3)/34 + (21 \times 21)/34 + (1 \times 2)/34 + (4 \times 6)/34 + (2 \times 3)/34 = 14.17$$

$$K = (30 - 14.17)/(34 - 14.17) = 0.80 \text{ Substantial Agreement}$$

$$\text{Percent Agreement} = 30/34 = 88\%$$

Table 10. Frequency of classification (agreement) on assessment of presence/absence of lateral shift (first assessment)

Examiner 2 (HR)

Observation	Lateral Shift Present	Lateral shift Absent	Total
Lateral Shift Present	10	1	11
Lateral Shift Absent	9	25	34
Total	19	26	45

Examiner 2 (HR)

$$F_o = 10 + 25 = 35 \quad F_c = (11 \times 19)/45 + (34 \times 26)/45 = 24.29$$

$$K = (35 - 24.29)/(45 - 24.29) = 0.52 \text{ Moderate Agreement}$$

$$\text{Percent Agreement} = 35/45 = 78\%$$

Table 11. Frequency of classification (agreement) on assessment of presence/absence of lateral shift (second assessment)

Examiner 2 (HR)

Observation	Lateral Shift Present	Lateral shift Absent	Total
Lateral Shift Present	7	3	10
Lateral Shift Absent	3	21	24
Total	10	24	34

Examiner 2 (HR)

$$F_o = 7 + 21 = 28 \quad F_c = (10 \times 10)/34 + (24 \times 24)/34 = 19.88$$

$$K = (28 - 19.88)/(34 - 19.88) = 0.58 \text{ Moderate Agreement}$$

$$\text{Percent Agreement} = 28/34 = 82\%$$

Table 12. Frequency of classification (agreement) on assessment of relevance of lateral shift (first assessments)

Examiner 2 (HR)

Side Glide Assessment	Lateral Shift is Relevant	Lateral Shift not Relevant	Total	Examiner 2 (HR)
Lateral shift is Relevant	3		3	
Lateral Shift not Relevant	1	41	42	
Total	4	41	45	

$$F_o = 3 + 41 = 44 \quad F_c = (3 \times 4) / 45 + (42 \times 41) / 45 = 38.52$$

$$K = (44 - 38.52) / (45 - 38.52) = 0.85 \text{ Almost Perfect Agreement}$$

$$\text{Percent Agreement} = 44 / 45 = 98\%$$

Table 13. Frequency of classification agreement on assessment of relevance of lateral shift (second assessment)

Examiner 2 (HR)

Side glide Assessment	Lateral shift is Relevant	Lateral Shift not Relevant	Total	Examiner 2 (HR)
Lateral shift is Relevant	1		1	
Lateral Shift not Relevant		33	33	
Total	1	33	34	

$$F_o = 1 + 33 = 34 \quad F_c = 1 / 34 + (33 \times 33) / 34 = 32.05$$

$$K = (34 - 32.05) / (34 - 32.05) = 1 \text{ Perfect Agreement}$$

$$\text{Percent Agreement} = 34 / 34 = 100\%$$

Table 14. Frequency of classification (agreement) on assessment of relevance of lateral compartment (first assessment)

Examiner 2 (HR)

Side Glide Assessment	Relevant Lateral Compartment	Irrelevant Lateral Compartment	Total
Relevant Lateral Compartment	14		14
Irrelevant Lateral Compartment	1	30	31
Total	15	30	45

Examiner 2 (HR)

$$F_o = 14 + 30 = 44 \quad F_c = (15 \times 14) / 45 + (30 \times 31) / 45 = 25.33$$

$$K = (44 - 25.33) / (45 - 25.33) = 0.95 \text{ Almost Perfect Agreement}$$

$$\text{Percent Agreement} = 44 / 45 = 98\%$$

Table 15. Frequency of classification (agreement) on assessment of relevance of lateral compartment (second assessment)

Examiner 2(HR)

Side Glide Assessment	Relevant Lateral Compartment	Irrelevant Lateral Compartment	Total
Relevant Lateral Compartment	6		6
Irrelevant Lateral Compartment	1	27	28
Total	7	27	34

Examiner 2(HR)

$$F_o = 6 + 27 = 33 \quad F_c = (6 \times 7) / 34 + (27 \times 28) / 34 = 23.47$$

$$K = (33 - 23.47) / (34 - 23.47) = 0.91 \text{ Almost Perfect Agreement}$$

$$\text{Percent Agreement} = 33 / 34 = 97\%$$

Table 16. Frequency of classification (agreement) on assessment of presence/absence of deformity in sagittal plane (first assessment)

Examiner 2 (HR)

Observation	Deformity of Reduced Lordosis/ Kyphosis Present	Deformity of Increased Lordosis Present	No Deformity in Sagittal Plane	Total
Deformity of Reduced Lordosis/ Kyphosis Present	1			1
Deformity of Increased Lordosis Present				
No Deformity in sagittal Plane			44	44
Total	1		44	45

Examiner 2 (HR)

$$F_o = 1 + 44 = 45 \quad F_c = 1/45 + (44 \times 44)/45 = 43.04$$

$$K = (45 - 43.04)/(45 - 43.04) = 1 \text{ Perfect Agreement}$$

$$\text{Percent Agreement} = 45/45 = 100\%$$

Table 17. Frequency of classification (agreement) on assessment of presence/absence of deformity in sagittal plane (second assessment)

Examiner 2 (HR)

Observation	Deformity of Reduced Lordosis/ Kyphosis Present	Deformity of Increased Lordosis Present	No Deformity in Sagittal Plane	Total
Deformity of Reduced Lordosis/ Kyphosis Present				
Deformity of Increased Lordosis Present				
No Deformity in sagittal Plane			34	34
Total			34	34

Examiner 2 (HR)

$$F_o = 34 \quad F_c = (34 \times 34) / 34 = 34$$

K = 1 Perfect Agreement

Percent Agreement= 100%

Chapter 4

Discussion

Tests were completed without incident. As noted in the results, 45 subjects were tested on the first occasion and 34 of these subjects were retested on the second occasion.

Type of Syndrome

Examiners agreed on 42 syndrome diagnostic categories on the first assessment ($K = 0.70$, indicating substantial agreement, percent of agreement = 93%) and on 34 syndrome diagnostic categories on the second assessment ($K = 0.92$, indicating almost perfect agreement, percent of agreement = 97%). They disagreed on three syndrome diagnostic categories on the first assessment and on one on the second assessment. All of these disagreements were categorized as "other" by one examiner, and either "dysfunction" or "derangement" by the second examiner. The "other" category was defined as non-mechanical or inflammatory low back pain that did not fit the McKenzie model. In other words, the disagreements did not occur within the McKenzie syndrome classification system. The McKenzie system of classification is clearly defined with respect to pain pattern and behavior. Sometimes a patient with mechanical back pain caused by disc derangement presents with underlying dysfunction. This however, does not mean that the primary cause of pain can fit in two syndrome categories at one point.

Previous studies (Table 18) categorized the patient's condition into nine syndromes: postural, dysfunction, and seven derangements (Kilby et al 1990, Riddle and Rothstein 1993, Donahue et al 1996). McKenzie, however, identified only three mechanical syndromes; 1) postural, 2) dysfunction, and 3) derangement. He divided each of these syndromes into separate sub-syndromes according to location of the pain and presence or absence of the spinal deformities (McKenzie 1981). As a result, previous studies have not correctly used the McKenzie classification system, and the present study is the first to correctly address the reliability of determining syndromes.

Table 18. Summary table of Kappa coefficients (previous studies)

Authors	Variable	Kappa Value	Percent of Agreement	Interpretation
Kilby et al (1990)	Derangement Subsyndromes		57%	No Interpretation
Kilby et al (1990)	Presence of Lateral Shift		55%	No Interpretation
Kilby et al (1990)	Presence of Sagittal plane deformities		80%	No Interpretation
Riddle & Rothstein (1993)	Syndrome/ Sub-syndrome	0.26	39%	Fair
Riddle & Rothstein (1993)	Presence of Lateral Shift	0.26	60%	Fair
Riddle & Rothstein (1993)	Syndrome/ sub-syndrome (partially trained PTs)	0.15	27%	Slight
Donahue et al (1996)	presence of lateral shift	0.00	43%	Slight
Donahue et al (1996)	Relevance of lateral shift	0.16	47%	Slight

Type of Sub-Syndrome

The examiners agreed on 41 sub-syndrome diagnostic categories ($K = 0.88$, percent of agreement = 91%) for the first assessment and on 29 sub-syndrome diagnostic categories ($K = 0.81$, percent of agreement = 85%) for the second assessment, indicating "almost perfect" agreement on both occasions. Kilby et al (1990), reported 57% agreement on derangement sub-syndromes. Riddle and Rothstein (1993) reported a Kappa value of 0.26 (percent of agreement = 39%) for selecting the diagnostic syndrome and sub-syndromes. This can be interpreted as "fair" inter-examiner agreement (Table 18).

In the present study, there was disagreement on four sub-syndrome categories on the first assessment and on five categories on the second assessment. Three disagreements among the sub-syndromes were within the same syndrome category. The remaining five disagreements were among "other" and "dysfunction or derangement" syndromes. Therefore, the examiners did not select their sub-syndromes from different syndrome categories and the disagreements did not occur within the McKenzie syndrome classification system.

There seems to be a considerable overlap among diagnostic syndrome and sub-syndrome categories identified by untrained examiners in previous studies (Riddle and Rothstein 1993). Although these authors provided general criteria for classification into syndromes and sub-syndromes, there appears to have been a great amount of confusion between these categories. For example, of 22 subjects who were diagnosed with "postural syndrome" by one untrained examiner, the diagnoses of derangement 1, 2, 3, 4, 6, and 7 were made by the second examiner on 11 subjects. The other 11 "postural" syndromes were categorized as "dysfunction" by the second examiner. In the present author's opinion, minimal knowledge is required to know that in "postural" syndrome there is no referred pain, no deformities, and no pain with test movements. It is surprising how the second examiner in the Riddle and Rothstein (1993) study reached the diagnosis of derangement 2, which presents with a severe deformity of kyphotic lumbar spine and painful blocked extension, derangement 4 or 6 which present with the deformity of the lateral shift with or without leg pain, associated with a painful blocked side glide, derangement 7, which presents with the deformity of increased lordosis and painful blocked flexion. As a result,

the lack of training and/or knowledge of McKenzie criteria makes previous results questionable.

The data from partially trained examiners of the same study (Riddle and Rothstein 1993) had far less variability between examiners with respect to selecting the diagnostic syndromes and sub-syndromes. For example, these partially trained therapists did not categorize a patient with "postural" syndrome into the "derangement" syndrome and most of the disagreements were among the derangement sub-syndromes consistent with the results of the present study. The poor understanding of the definition of diagnostic syndromes and sub-syndromes among untrained examiners can clearly result in low inter-examiner reliability.

Relationship Between Type of Syndrome and Age

In the present study 38% of the subjects (9 women and 8 men, 17 observations on the first assessment and 13 observations on the second assessment) were 55 years of age or older. The examiners agreed on 14 observations in elderly on the first assessment and on 12 observations on the second assessment with respect to their "syndrome" categories. There was agreement on 13 observations in elderly on the first assessment and on eight on the second assessment with respect to the "sub-syndrome" diagnostic categories. The agreement on syndrome category was 100% in individuals less than 55 years of age (28 observations on the first assessment and 21 on the second assessment). The examiners agreed on 28 observations on the first assessment and on 19 on the second assessment with respect to sub-syndrome diagnostic categories in the younger age group. Interestingly, all the four disagreements for selecting the syndrome categories (three on the first assessment and one on the second assessment) were seen in older subjects (59-72 years of age) who presented with unclear patterns of centralization. With respect to selecting the sub-syndrome categories, examiners disagreed on nine observations. Seven of these observations (four on the first assessment and three on the second assessment) were in elderly.

These results indicate that inter-examiner agreements on diagnostic categories in elderly were not as high as in younger individuals. This is thought to occur as a result of

multiple confounding problems in the elderly, such as osteoarthritic changes at the facet joints and lateral structures in association with annular prolapse and degenerative disc diseases. Therefore, the reliability of the McKenzie methods with older patients may be lower than younger patients.

Principles of Treatment

Examiners agreed on 38 principles of treatment on the first occasion ($K = 0.75$, indicating substantial agreement) and on 30 principles of treatment on second occasion ($K = 0.80$, indicating substantial agreement). The major disagreements on this component of evaluation were on those observations where examiners did not agree on the diagnostic sub-syndrome. These findings not only confirm the consistency among trained examiners with respect to selecting the appropriate treatment, but also reinforce the fact that training has a positive impact on the final outcomes. In other words, a wrong diagnosis made by an untrained practitioner will lead to an ineffective if not harmful treatment. In the present study the treating therapists used the assessor's evaluation on occasion one to guide treatment. Neither of the examiners treated any of the patients in this study.

The level of training in application of McKenzie methods varied among therapists and treatment period varied from one session to five sessions, depending on the availability of the staff therapists, the patient's response, and other circumstances. For these reasons, the effectiveness of the McKenzie treatment was not studied. Future studies should use trained therapists to provide treatment and address the efficacy of McKenzie treatment in the knowledge that assessments are reliable. The efficacy of treatment has not been addressed in previous reliability studies.

Deformity of Lateral Shift

The presence of the lateral shift is determined during the postural examination. Assessment of the lateral shift is an important part of the McKenzie evaluation system for classification and also for selecting the appropriate treatment principles.

During the postural appraisal of the present study, examiners agreed on the presence of the lateral shift 78% of the time ($Kappa = 0.52$) on the first assessment and 82% of the time ($Kappa = 0.58$) on the second assessment. The Kappa value reported by Riddle and

Rothstein (1993) for detection of lateral shift was only 0.26 and the percent of agreement was 60%. Kilby et al (1990) reported 55% agreement between therapists with respect to detection of lateral shift. Donahue et al (1996) reported 43% agreement ($K=0.00$) on the presence of lateral shift (Table 18).

Aside from using qualified examiners, the significant improvement in agreement noted in the present study may be attributable to using the three vertical lines on the wall behind the patient during postural appraisal (Figures 2 and 3) and measurement of trunk deviation between C7-S1 versus L1-S1 as it was measured by Donahue et al (1996). Lateral shift as it was described by McKenzie (1981) is the deviation of trunk in relation to pelvis and should be measured between C7-S1 not L1-S1. Detection of small lateral shifts between L1-S1 is very difficult using the unaided human eye. For this reason, Donahue et al (1996) used instruments (bubble level, ruler, and adhesive markers) to examine the presence, direction, and magnitude of the lateral shift more consistently. However, this did not appear to improve the ability to detect these shifts.

Relevance of Lateral Shift

Observational analysis of the presence of lateral shift is the first step in detecting the frontal plane spinal deformities. The more important step is to determine whether the detected lateral shift is relevant to the patient's current complaints or not. It is imperative to detect a relevant lateral shift during the assessment because this affects the diagnostic category and consequently the treatment management. If the lateral shift is missed either by the observation or during the test movements, the lateral compartment would not be addressed and treatment might be inappropriate.

In the present study the relevance of lateral shift was assessed with side-glide test movements and centralization phenomena were carefully monitored during these movements. In the present study the examiners agreed 98% of the time ($K= 0.85$, indicating almost perfect agreement) on the first assessment and 100% of the time ($K= 1$, indicating perfect agreement) on the second assessment (Table 18). Donahue et al (1996) reported 47% agreement ($K= 0.16$) on the relevance of the lateral shift. The side-glide test was used by these authors to examine the relevance of the lateral shift. Therapists were

able to reliably determine the alteration of the location and intensity of the pain with this test ($K = 0.74$), but they were not able to interpret and use this information for detection of minor shifts/lateral compartments. For detection of smaller shifts which sometimes present only with the painful obstruction to one side, the centralization phenomenon should be monitored closely (Laslett 1996). The side-glide test was examined in both directions which should not be the case in patients with obvious shifts. The side-glide test has to be done toward the obstructed side to correct the deviation (McKenzie 1996).

The poor results of the previous studies (Kilby et al 1990, Riddle and Rothstein 1993, Donahue et al 1996) are not surprising because the examiners either relied on the observational analysis only or the blind examination of bilateral side-glide movements for the relevance of the lateral shift. The results of the present study emphasize the importance of training on analyzing the symptom behavior during the evaluation procedure.

Relevance of Lateral Compartment

In the present study the examiners agreed 98% of the time ($Kappa = 0.95$), on the first assessment and 97% of the time ($Kappa = 0.91$) on the second assessment. This indicates "almost perfect" agreement on both occasions. Although this component of the examination is very important clinically in arriving at the correct syndrome and sub-syndrome classifications, and also in determining the principles of treatment, it has not been addressed in previous studies. If symptoms worsen or peripheralize with both flexion and extension movements, the possibility of a relevant lateral compartment, lateral blockage or an unnoticeable shift should be considered (McKenzie 1996).

Deformity in Sagittal Plane

The examiners in the present study agreed on 100% of the subjects with respect to detection of the deformity of kyphosis/lordosis on both occasions. The percent of agreement reported by Kilby et al (1990) was 80% for detection of the flat or kyphotic lumbar spine. The number of observations, however, was only five and was considered insufficient for any statistical analysis. In the present study, of the 79 observations completed over two occasions, only one case presented with "deformity" of kyphosis.

Although it may be argued that homogeneity of the sample may have artificially inflated the Kappa value, the imbalance in Kappa table cells (Tables 16 and 17) is due to confined definition of the sagittal plane deformities described by McKenzie (1981) and also thought to be attributable to low prevalence of the derangements 2 and 7, not homogeneity of the sample in general. The key point here is understanding the definition of the "deformity" versus decrease in the amount of the lumbar arch which is commonly seen in the normal population. Deformity of kyphosis in the lumbar spine occurs in the presence of a large posterior derangement (McKenzie 1981) as a result of blockage in extension and inability to actively reverse the curve. A person who can actively increase or decrease the amount of lumbar arch is not considered to have deformity.

Improved Inter-Examiner Reliability on The Second Assessment

In the present study, there was a trend toward increased inter-examiner agreement on the second assessment on all variables except the sub-syndrome categories and relevance of lateral compartment. Improvement occurred despite the fact that the examiners switched assessor-observer roles on the second assessment and also the subject's clinical picture may have changed due to treatment intervention or passage of time. This improvement may have occurred as a result of giving the opportunity to the observer of the first assessment to communicate with the subject on the second assessment. The history-taking part of the examination was consistent between examiners because the examiners used the same questionnaire. The assessor, however, had more flexibility during the objective part of the examination which included the test movements. To avoid giving clues to the assessor, the author eliminated any questioning of the observer during the examination. This emphasizes the importance of the direct communication between patient and examiner. In the present study only the adjudicator was allowed to apply the therapist's techniques to the patient and assessors did not touch the patients.

The Kappa value declined slightly on the second assessment for selecting the sub-syndrome categories and detection of relevant lateral compartment. These declines, however, were not enough to change the interpretation of agreement (Table 18). The change may be related to losing 11 patients on the second assessment.

Conclusion

Qualified McKenzie therapists using the McKenzie evaluation system can be highly reliable in reaching the same conclusion with respect to classifying patients into diagnostic syndromes, sub-syndromes, and selecting the principles of treatment. The high inter-tester agreement on single components of the evaluation procedure such as presence and relevance of the sagittal and frontal plane deformities, emphasizes the importance of training on interpretation of pain behavior that leads to selection of the correct diagnosis.

The systematic method of McKenzie evaluation appears to minimize the variability between examiners. This system, however, may not have the same reliability or effectiveness when used by untrained examiners. The poor understanding of the implications of the test movements and the definition of the diagnostic syndromes and sub-syndromes among untrained examiners can result in low inter-examiner reliability.

Inter-examiner reliability was slightly lower in examination of elderly subjects as compared with younger individuals. The unclear pattern of centralization indicating the presence of multiple problems, such as osteoarthritic changes at the facet joints and lateral structures in association with annular prolapse and degenerative disc diseases may be responsible for lower inter-examiner reliability.

Limitations

The present study involved only two examiners who were trained in the application of McKenzie evaluation system. As a result, generalization to untrained examiners or examiners with low levels of training can not be made.

Although subjects in the present study received treatment between the two assessments, the author did not examine the effectiveness of the treatment or attempt to relate this to the level of treating therapist's training for two reasons: 1) the number of treatments varied from one to five according to availability of the treating therapists and, 2) the initial treatment principle was determined by the assessor not the treating therapist.

Future Research

Future research needs to address the following:

- 1) Comparison of old and young subjects, tested by the same examiners.
- 2) Comparison of examiners with different levels of training, testing the same subjects.
- 3) Examination of the effectiveness of the McKenzie treatment using a standardized treatment protocol.

Appendix A

Diagnostic Syndromes, Sub-Syndromes and Their Clinical Presentations (McKenzie, 1981)

1. Postural Syndrome

Clinical Presentation:

Age: Usually 30 years and under

Poor posture, no movement loss

Intermittent, local pain, better when on the move

Test movements can not reproduce the pain originated from postural syndrome, pain can be reproduced by maintenance of position or posture

Principle of Treatment:

Correction of posture (sitting, standing, and lying)

2. Dysfunction Syndrome

a. Flexion Dysfunction Syndrome

Clinical Presentation:

Age: usually over 30, unless trauma or derangement is the causative factor

May present with poor posture, always has a loss of movement or function

Intermittent pain, only at end range of flexion, no time factor. No pain during movement/no radiation

Test movements: Repeated movements reproduce pain at end range of flexion/not worse as a result. Not progressively worse/no rapid changes

Principle of Treatment:

Correction of posture

Flexion principle

- flexion in sagittal plane, lying, standing
- flexion in step standing in the presence of deviation in flexion
- extension to reduce chance of recurrence when derangement is the cause of dysfunction

b. Extension Dysfunction Syndrome

Clinical Presentation:

Age: usually over 30, unless trauma or derangement is the causative factor

Poor posture, always present with a loss of movement or function

Intermittent pain, only at end range of extension, no time factor

No pain during movement/no radiation. Difficulty sleeping in prone position

Test movements: Repeated movements reproduce pain at end range of extension/not worse as a result. Not progressively worse/no rapid changes

Principle of Treatment:

Correction of posture

Extension principle

- extension in sagittal plane (lying, with belt fixation)

c. Side-glide Dysfunction Syndrome

Clinical Presentation:

Age: usually over 30, unless trauma or derangement is the causative factor

Poor posture, always present with a loss of movement or function

Intermittent pain, only at end range of side glide, no time factor

No pain during movement/no radiation

Test movements: Repeated movements reproduce pain at end range of side glide/not worse as a result. Not progressively worse/no rapid changes

Principle of Treatment:

Correction of posture

Lateral principle

- ipsilateral sideglide in standing

d. Multi-directional dysfunction

Clinical presentation and principles of treatment depend on the direction of dysfunction (please see single plane dysfunctions)

e. Adherent Nerve Root

Clinical Presentation:

Intermittent sciatica

Test movements: Flexion in standing increases leg pain, flexion in lying has no effect on pain. Repeated extension has no effect. End range pain/pain during movement, depending on severity of adherence. Repetition does not necessarily worsen symptoms

Principle of Treatment:

Flexion principle

- flexion in sagittal plane
- asymmetrical flexion (in lying and in step standing, temporary peripheralisation may occur, since scared nerve root is being stretched)
- extension to reduce chance of recurrence of derangement

f. Nerve Root Entrapment (McKenzie)

Clinical Presentation:

Constant radicular pain

Test movements: Repeated flexion may reduce the pain temporarily, no better as a result. Range increases temporarily. Repeated extension has no effect.

Principle of Treatment:

Usually not responsive to mechanical therapy due to deficient hydrostatic system of the disc.

3. Derangement Syndrome

a. Derangement One

Clinical Presentation:

Central/symmetrical pain, rarely buttock or thigh pain

No deformity

Test movements: Repeated flexion increases the pain, it may peripheralize, it remains worse as a result. Repeated extension reduces and centralizes the pain, it remains better as a result.

Principle of Treatment:

Correction of posture

Extension principle

-extension in sagittal plane

b. Derangement Two**Clinical Presentation:**

Usually constant central or symmetrical pain, with or without buttock or thigh pain

Deformity of lumbar kyphosis

Test movements: Repeated flexion progressively increase/peripheralize the pain. Pain remains worse as a result. Repeated extension may not be possible if major disc derangement and severe kyphosis exists. Time factor is very important in derangement two. Pain decreases with prone lying in flexed position, derangement reduces gradually by increasing the extension in unloaded position.

Principle of Treatment:

Correction of posture

Extension principle

-extension in lying with pillow under stomach

-prone position, sustained extension

c. Derangement Three**Clinical Presentation:**

Unilateral or asymmetrical pain, with or without buttock and/or thigh pain.

No deformity

Test movements: Repeated flexion increases the pain, pain may remain worse as a result. Repeated extension usually decreases the pain, if unsuccessful, extension with side glide decreases the pain.

Principle of Treatment:

Same as for derangement #1

If not responsive, add side glide

d. Derangement Four**Clinical Presentation:**

Usually constant unilateral/asymmetrical pain, with or without buttock and/or thigh pain, deformity of lumbar scoliosis

Test movements: Repeated flexion increases/peripheralizes the pain, remains worse as a result. Repeated extension increases/peripheralizes the pain, remains worse as a result.

Correction of lateral shift decreases/centralizes the pain. Repeated extension decreases the pain after lateral shift is corrected.

Principle of Treatment:

Correction of lateral shift (lumbar scoliosis)

Same as derangement #1 once centralization is achieved

Correction of posture

e. Derangement Five**Clinical Presentation:**

Unilateral/asymmetrical pain, with or without buttock or thigh pain.

No deformity of sciatic scoliosis. Leg pain extending below knee joint (constant/intermittent sciatica)

Test movements: Repeated flexion increases/peripheralizes pain, worse as a result.

Repeated extension decreases/centralizes pain, better as a result.

Principle of Treatment:

Extension principle

-sagittal plane

-add side glide if not responsive or worse

Correction of posture

f. Derangement Six**Clinical Presentation:**

Unilateral/asymmetrical pain, with or without buttock or thigh pain

Leg pain extending below the knee (usually constant sciatica)

Deformity of sciatic scoliosis

Test movements: Repeated flexion increases/peripheralizes the pain, worse as a result

Repeated extension increases/peripheralizes the pain, worse as a result. Correction of lateral shift decreases/centralizes the pain. Repeated extension decreases the pain after lateral shift is corrected.

Principle of Treatment:

Correction of lateral shift

Add lateral shift if lateral compartment still present

Same as derangement #1 once centralization is achieved

Correction of posture

g. Derangement Seven

Clinical Presentation:

Symmetrical/asymmetrical pain, with or without buttock and/or thigh pain

Deformity of accentuated lordosis

Test movements: Repeated extension increases/peripheralizes the pain, worse as a result.

Repeated flexion decreases/centralizes the pain, better as a result.

Principle of Treatment:

Flexion principle

-flexion in sagittal plane

-flexion in step standing in case of marked deviation in flexion

Correction of posture

4. Other (not a McKenzie category)

Non-mechanical / inflammatory low back pain

Further examination and investigation is required

Principle of Treatment:

Treatment to be provided according to the diagnosis. May require further investigations conducted by the family physician. Treating therapist to follow up.

Appendix B (Operational Terms)

Centralization Phenomenon: The term "centralization" describes a change in the distal-most extent of referred pain in a proximal direction or toward the midline. Movement of the distal-most symptom, further away from the midline has been called "peripheralization" (McKenzie 1981).

Diagnostic Category: A general term that applies to either syndrome or sub-syndrome category.

Directional Preference: The direction of movement that centralizes the most distal symptoms (McKenzie 1981).

Disc Derangement: Disturbance of the intervertebral disc mechanism (McKenzie 1981). The state of derangement may vary from a slight increased pressure to a large herniation.

Dynamic Internal Disc Model: In the presence of intact anular wall and hydrostatic disc mechanism, an offset load on the disc in the specific direction of spinal movement can apply a reductive force on the displaced nuclear content, directing it toward its original central location. This alleviates stress on the symptom-generating anulus/nerve root, thereby centralizing the pain. According to this model, if multiple directions of testing only peripheralize the distal pain, the anulus is incompetent and/or the hydrostatic mechanism is nonfunctional.

End Range Pain: Pain appears until end range is reached. Pain is released when end range is released (McKenzie 1981).

Intermittent Pain: This is the primary presenting symptom of the mechanical back pain and refers to a pain which is not felt every single moment of the day.

Acute: Severe pain less than 7 days, Subacute: Moderately severe pain, which has been present more than 7 days but not longer than 7 weeks, and Chronic: Mild to moderate pain which continues more than 7 weeks.

Lateral Shift: Displacement of the trunk in relation to pelvic in the frontal plane. To determine if a lateral shift is present the examiner views the patient from behind and front while the patient is in standing position. If the trunk is shifted to the right relative to pelvic, this is a right lateral shift (McKenzie 1981).

Loaded and Unloaded Tests: Loaded test movements are applied to any tests that are done in upright positions such as sitting, standing, and bending. Unloaded tests are tests that are done in lying position such as supine flexion or prone extension.

Mechanical Low back Pain: This kind of low back pain is caused by the mechanical deformation of nociceptive receptor system and can be reduced or abolished by certain positions and movements (McKenzie 1981). A non-contained frank disc herniation with or without disc sequestration may be associated with constant pain which will not be reduced or abolished by positions or movements (symptoms do not centralize).

Mechanical Therapy: Mechanical therapy is described as application of certain movements or positions to reduce the pain. Mechanical therapy of the postural syndrome is reduction of abnormal stresses from the ligamentous structures by improving the posture. Mechanical therapy of the dysfunction syndrome is through improving the flexibility of the adaptive shortened structures by performing repetitive movements in the direction of stiffness. Mechanical therapy for the discogenic low back pain involves reduction of mechanical deformation of the discs as a result of reducing the stresses on the discs through appropriate spinal movements.

Most Distal Symptoms: These symptoms are either referred or radiated depending on the structure being irritated or compressed. During the spinal mechanical evaluation the examiner monitors these symptoms to reduce the derangement.

Neurological deficits include the following: 1) bowel and bladder dysfunction, paresthesia in the genital area, 2) severe myotomal weakness and dermatomal sensory changes (general cogwheel weakness or giving way which is usually indicative of functional overlay, was not considered pathologic), and 3) absent asymmetrical reflexes.

Overpressure: Application of passive pressure applied by the therapist at end range of movement. The overpressure is given as a part of the assessment or treatment to reproduce pain or to reduce the derangement.

Relevant Lateral Shift: A relevant lateral shift is a shift that is related to the patient's present symptoms. In other words patient's symptoms centralize from the leg or buttock to the lumbar spine when attempt is made to correct the deformity of the lateral shift (McKenzie 1981).

Side Glide: The movement that takes place when the patient laterally displaces his/her shoulders relative to the pelvic. This movement is different from side bending because the shoulders remain parallel to the ground. Blockage in side glide movement may be as a result of a posterolateral disc derangement or a dysfunction in the lateral plane.

Systemic disease: Any diseases that involve more than one organ system in the body, such as Rheumatoid Arthritis.

The UNIVERSITY of WESTERN ONTARIO

Vice-Provost • Health Sciences • Health Sciences Centre

REVIEW BOARD FOR HEALTH SCIENCES RESEARCH INVOLVING HUMAN SUBJECTS

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THE REVIEW BOARD HAS EXAMINED THE RESEARCH PROJECT ENTITLED:

"Inter-tester reliability of the modified McKenzie evaluation in assessing patients with mechanical low back pain."

REVIEW NO: E5749

AS SUBMITTED BY: Dr. Dr. J. Kramer, Physical Therapy, Elborn College

AND CONSIDERS IT TO BE ACCEPTABLE ON ETHICAL GROUNDS FOR RESEARCH INVOLVING HUMAN SUBJECTS UNDER CONDITIONS OF THE UNIVERSITY'S POLICY ON RESEARCH INVOLVING HUMAN SUBJECTS.

APPROVAL DATE: 5 February 1995 (UWO Protocol, Letter of Information & Consent)

AGENCY:

TITLE:

Bessie Borwein
Bessie Borwein, Chairman

c.c. Hospital Administration

R. C. Sharman

APPENDIX C

56

Please refer to:

(416) 967-8538

Direct line:

Fax: (416) 967-8593

ORTHOPAEDIC AND ARTHRITIC HOSPITAL
43 Wellesley Street East
Toronto, Ontario, Canada M4Y 1W1

January 17, 1997

Ms. Helen Razmjou
Department of Rehabilitation Services
Orthopaedic & Arthritic Hospital

Dear Ms. Razmjou:

Re: Research Proposal - Inter-Tester Reliability of the Modified
McKenzie Evaluation in Assessing Patients with Mechanical
Low Back Pain (Project #127-97)

On behalf of the Research Committee, I am pleased to confirm approval of the above proposal. As discussed with you, a small pilot study of two or three patients was felt to be useful to ensure that the "testers" are at the same level of expertise.

Yours sincerely,

Roger C. Sharman
President & CEO

RCS/amm

Please refer to:

Direct line:

Fax: (416) 967-8593

ORTHOPAEDIC AND ARTHRITIC HOSPITAL
43 Wellesley Street East.
Toronto, Ontario, Canada M4Y 1H1

INFORMED CONSENT FOR CLINICAL STUDY

Title of Study: Inter-Tester Reliability of the McKenzie Evaluation In
Assessing Patients With Mechanical Low Back Pain

I have read the enclosed letter of information, have had the nature of the study explained to me and I agree to participate. Any questions have been answered to my satisfaction.

Signed _____

Dated _____

CONTACT PERSON: Helen Razmjou
Tel: (416) 967-8626

Please refer to:

Direct line:

Fax: (416) 967-8593

ORTHOPAEDIC AND ARTHRITIC HOSPITAL
43 Wellesley Street East
Toronto, Ontario, Canada M4Y 1H1

INFORMATION FOR VOLUNTEERS

Title of Study: Inter-Tester Reliability of the Modified McKenzie Evaluation in Assessing Patients With Low Back Pain

Investigators: Helen Razmjou, Physical Therapist, Orthopaedic and Arthritic Hospital, Toronto, Ontario
Dr. John Kramer, Department of Physical Therapy, University of Western Ontario, London, Ontario
Riki Yamada, Senior Physical Therapist, York County Hospital, Newmarket, Ontario

Low back pain is a common problem seen by physicians and physical therapists. In order to determine if a patient has improved with treatment, therapists must have a reliable way to test patients with low back pain. The McKenzie evaluation is one type of standardized test that is commonly used at the Orthopaedic and Arthritic Hospital. However, the degree of reliability among therapists using this type of evaluation is unclear. This information is very important to us in knowing how to assess patients with low back pain more effectively.

If you agree to participate in this study, you will be examined by two therapists before your treatment program starts and again by the same two therapists two weeks later. One of the therapists who will act as the tester will tell you what to do during the test and you can ask her questions. The other therapist will watch as you are tested. However, the therapist who is only observing the test will also be evaluating your back problem. A third individual will be in the room with you to assist in completing the assessment forms.

The evaluation to be performed is the same one that would be used if you were not participating in this study, and were being tested by only one therapist. The evaluation will take about 45-60 minutes. You will be asked to expose your back so that the therapists can see your back. You will then be asked to perform some movements such as bending forward and backward in standing and similar movements in lying position. You will be asked to report to the therapists if these movements change your symptoms.

The results of your evaluation will be given to the therapist who is responsible for your treatment program. After two weeks of treatment, you will again be tested by the same two testers. If you require further treatment, this will be provided by your therapist. There are no known risks associated with the assessment and treatment other than those associated with routine physiotherapy care.

Participation in this study is completely voluntary. You have the right to withdraw at any time without affecting your health care. The names of all the patients who participate will be kept confidential and your personal records will be seen only by those individuals involved in the study or participating in your treatment.

Should you have any questions, please feel free to contact Helen Razmjou at the following phone number: (416)967-8626

Appendix D

Medical History questionnaire:

- 1- How old are you? What is your occupation? What does your job involve?
- 2- Where have you been feeling your pain since the problem first started? Can you show it to us? Use a finger and trace out your pain. How far down does it go?
- 3- Do you have any other symptoms such as pins and needles sensation and numbness?
- 4- In the past 24 hours where have your symptoms been?
- 5- How did your pain start? When did it start?
- 6- Are your symptoms getting better, worse, or have remained unchanged?
- 7- Is your pain constantly there or it comes and goes? Is there any time of the day that you don't feel the pain?
- 8- I am going to go over a list of activities and positions. All I need to know is which one make your back or (the most distal symptoms) worse? or better?
a. bending b. sitting/rising c. standing d. walking e. lying
- 9- What position do you normally sleep in?
- 10- Does the pain prevent you from falling asleep? does it interrupt your sleep?
- 11- How do you feel first thing in the morning before you get out of the bed?
- 12- Do you feel better or worse or no different as the day progresses?
- 13- Do your symptoms get worse with cough/sneeze/strain when you go to the bathroom?
- 14- Is your bladder functioning normally (difficulty initiating urine stream/frequency)?
- 15- What about your walking? Have you had any difficulty with your balance?
- 16- When was the very first time you felt the pain (first episode of back/leg pain)?
How many episodes of back pain have you had? How long does each episode last?
- 17- Have you had any treatment for your back pain? What type of treatment?
Any result?
- 18- Have you had any X-rays taken during this episode (to rule out any serious pathology)?
- 19- Are you taking any medication at present time?

20- Have you had any weight loss recently (was it intentional)?

21- Have you had any recent surgery done?

22- Have there been any accidents/injuries that may have contributed to your pain?

Appendix D**The data collection form****Name:****Age:****Subject #**

OBSERVATION

1- Is there any lateral shift?

a. Yes

b. No

2- Is this shift relevant to the existing problem?

a. Yes

b. No

3- Is there a deformity of fixed lumbar lordosis/ kyphosis?

a. Yes

b. No

MECHANICAL ANALYSIS

Subjective Information

Aggravating Forces:

a. Loaded

b. Unloaded

c. Static

d. Dynamic

e. Flexion

f. Extension

g. Side glide

Easing factors:

a. Loaded

b. Unloaded

c. Static

d. Dynamic

e. Flexion

f. Extension

g. Side glide

Pre-Test Status		
Pain Characteristics		
	Nature	
1- Pain:		a. Constant b. Intermittent
	Location	
1- Pain:		a. Central/symmetrical b. Unilateral/Asymmetrical
3- Pain below knee, relevant to existing problem?		a. Yes b. No
Test Movements		
	Direction	
1- Flexion:		a. Produces b. Abolishes c. Increases d. Decreases e. Centralizes f. Peripheralises g. No effect
2- Extension		a. Produces b. Abolishes c. Increases d. Decreases e. Centralizes f. Peripheralises g. No effect
3- Possibility of relevant lateral compartment involvement?		a. Yes b. No

Time Effect

4- Effect of time factor?

- a. Yes
- b. No

Range

5- Pain during movement?

- a. Flexion
- b. Extension
- c. Side glide

6- End range pain?

- a. Flexion
- b. Extension
- c. Side glide

After Test Effects

Dynamic

1- Repeated flexion in standing?

- a. Better
- b. No better
- c. worse
- d. No worse

2- Repeated extension in standing?

- a. Better
- b. No better
- c. Worse
- d. No worse

3- If required/ side glide in standing?

- a. Better
- b. No better
- c. Worse
- e. No worse

4- Repeated flexion in lying?

- a. Better
- b. No better
- c. worse
- d. No worse

5- Repeated extension in lying?

5- Repeated extension in lying?

- a. Better
- b. No better
- c. Worse
- d. No worse

6- If required, repeated side glide in lying?

- a. Better
- b. No better
- c. Worse
- d. No worse

Static

1- Preference in resting in flexion?

- a. Yes
- b. No

2- Preference in flat prone lying?

- a. Yes
- b. No

3- Preference in lying prone with pillow under stomach?

- a. Yes
- b. No

4- Preference in side-lying/semiprone?

- a. Yes
- b. No

CONCLUSION

1. Postural Syndrome**2. Dysfunction Syndrome**

- a. Flexion Dysfunction
- b. Extension Dysfunction
- c. Side glide Dysfunction
- d. Multi-directional
- e. Adherent Nerve Root
- f. Nerve Root Entrapment

3. Derangement Syndrome

- a. Derangement #1
- b. Derangement #2
- c. Derangement #3
- d. Derangement #4
- e. Derangement #5
- f. Derangement #6
- g. Derangement #7

4. Other

- Non-mechanical lumbar disorder or Inflammatory Low back pain
- Resolved mechanical low back pain (used for second assessment)

PRINCIPLE OF TREATMENT

1. Posture Correction	a. Yes
b. No
2. Prone position/with pillow under stomach/sustained extension	a. Yes
b. No
3. Correction of lateral shift	a. Yes
b. No
4. Flexion in sagittal plane	a. Yes
b. No
5. Flexion in step standing	a. Yes
b. No
6. Extension in sagittal plane	a. Yes

b. No

7. Side glides in standing/lying

a. Yes

b. No

8. Extension with hip shifted to one side

a. Yes

b. No

9. Other (to be specified by the assessor)

The McKenzie Institute Lumbar Spine Assessment

Date _____
 Name _____
 Address _____
 Date of Birth _____ Sex: M / F
 Occupation _____
 Postures / Stresses _____
 Telephone _____
 Referral: GP / Orth / Self / Other _____
 Off work because of current episode? Yes / No Since _____

Symptoms this episode to be marked on body diagram

HISTORY

Describe relevant symptoms _____
 Present since _____ Improving / unchanging / worsening
 Commenced as a result of: _____ or no apparent reason

Symptoms at onset back / thigh / leg _____

Constant Symptoms: back / thigh / leg Intermittent Symptoms: back / thigh / leg
 Worse: bending sitting / rising standing walking lying
 am / as day progresses / pm when still / on the move
 other _____

Better: bending sitting standing walking lying
 am / as day progresses / pm when still / on the move
 other _____

Disturbed sleep? Yes / No Sleeping postures: prone / sup / side (R / L) Surface: firm / soft / sag / w. bed

Cough / sneeze / strain: +ve / -ve Bladder: normal / abnormal Gait: normal / abnormal _____

Previous Episodes: 0 1-5 6-10 11+ Year of first episode: 19 _____

Previous history: _____

Previous treatments: _____

X-Rays: Yes / No _____

Gen. Health: Good / Fair / Poor _____

Medications: Nil / NSAID / Analg / Steroids / Anticoag / Other _____

Recent or major surgery: Yes / No _____

Accidents: Yes / No _____ Unexplained weight loss: Yes / No _____

EXAMINATION

POSTURE
 Standing: Good / Fair / Poor Sitting: Good / Fair / Poor Lateral Shift: Right / Left / Nil
 Other Observations:

MOVEMENT LOSS

Flexion	Extension	Side Gliding (R)	Side Gliding (L)
____	____	____	____
____	____	____	____
____	____	____	____
____	____	____	____
____	____	____	____

Deviation in Flexion: Right / Left / Nil
 Deviation in Extension: Right / Left / Nil

TEST MOVEMENTS: Describe effects on present pain - produces, abolishes, increases, decreases, centralizes, peripheralizes, better, worse, no better, no worse, no effect

Describe pretest pain standing: _____
 Rep FIS _____
 FIS _____
 Rep FIS _____
 FIS _____
 Describe pretest pain lying: _____
 Rep EIS _____
 EIS _____
 Rep EIS _____
 EIS _____

FTL _____
 Rep FTL _____
 FTL _____
 Rep FTL _____
 Rep EIL _____
 EIL _____
 Rep EIL _____
 EIL _____
 Rep SCS (R) _____
 SCS (R) _____
 Rep SCS (L) _____
 SCS (L) _____
 Rep SCS (L) _____
 SCS (L) _____

STATIC TESTS *If required*

Sitting Slouched _____
 Standing Slouched _____
 Lying prone in extension _____
 Sitting erect _____
 Standing erect _____
 Long sitting _____
 Reflexes _____
 Dural signs _____

NEUROLOGICAL

Motor Deficit _____
 Sensory Deficit _____
 Hip Joint: _____
 SI Joint: _____

CONCLUSION

Posture _____
 Dysfunction _____
 Derangements No. _____
 Trauma _____

PRINCIPLE OF TREATMENT

Posture Correction _____
 Extension _____
 Flexion _____
 Lateral _____
 Other _____

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IMAGE EVALUATION TEST TARGET (QA-3)

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