1993

Interexaminer Reliability of the Mckenzie Algorithm for the Evaluation of Cervical Pain

Eric Rikio Sakamoto
University of North Dakota

Follow this and additional works at: https://commons.und.edu/pt-grad

Part of the Physical Therapy Commons

Recommended Citation
https://commons.und.edu/pt-grad/393

This Scholarly Project is brought to you for free and open access by the Department of Physical Therapy at UND Scholarly Commons. It has been accepted for inclusion in Physical Therapy Scholarly Projects by an authorized administrator of UND Scholarly Commons. For more information, please contact zeinebyousif@library.und.edu.
INTEREXAMINER RELIABILITY OF THE MCKENZIE ALGORITHM
FOR THE EVALUATION OF CERVICAL PAIN

by

Eric Rikio Sakamoto
Bachelor of Science in Physical Therapy
University of North Dakota, 1992

An Independent Study
Submitted to the Graduate Faculty of the
Department of Physical Therapy
School of Medicine
University of North Dakota
in partial fulfillment of the requirements
for the degree of
Master of Physical Therapy

Grand Forks, North Dakota
May
1993
This Independent Study, submitted by Eric Rikio Sakamoto in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

Eric E. Simunds
(Faculty Preceptor)

(Graduate School Advisor)

(Chairperson, Physical Therapy)
PERMISSION

Title  Interexaminer Reliability of the McKenzie Algorithm for the Evaluation of Cervical Pain

Department  Physical Therapy

Degree  Master of Physical Therapy

In presenting this Independent Study Report in partial fulfillment of the requirements for a graduate degree from the University of North Dakota, I agree that the library of this University shall make it freely available for inspection. I further agree that permission for extensive copying for scholarly purposes may be granted by the professor who supervised my Independent Study Report or, in her absence, by the Chairperson of the department or the Dean of the Graduate School. It is understood that any copying or publication or other use of this Independent Study Report or part thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of North Dakota in any scholarly use which may be made of any material in my Independent Study Report.

Signature  [Signature]

Date  5-16-93
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>vi</td>
</tr>
<tr>
<td>DEDICATION PAGE</td>
<td>vii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>viii</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>II. METHOD</td>
<td>10</td>
</tr>
<tr>
<td>Subjects</td>
<td>10</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>10</td>
</tr>
<tr>
<td>Procedure</td>
<td>12</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>13</td>
</tr>
<tr>
<td>III. RESULTS</td>
<td>15</td>
</tr>
<tr>
<td>IV. DISCUSSION</td>
<td>20</td>
</tr>
<tr>
<td>V. CONCLUSION</td>
<td>24</td>
</tr>
<tr>
<td>APPENDIX A: UND’s Institutional Review Board</td>
<td>25</td>
</tr>
<tr>
<td>APPENDIX B: McKenzie Lumbar Algorithm</td>
<td>33</td>
</tr>
<tr>
<td>APPENDIX C: McKenzie Cervical Spine Assessment Form</td>
<td>35</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>37</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>McKenzie's Treatment Principles</td>
<td>6</td>
</tr>
<tr>
<td>2.</td>
<td>Frequency Distribution of Diagnostic Syndromes Between Therapists</td>
<td>16</td>
</tr>
<tr>
<td>3.</td>
<td>Phi Coefficient Values Associated with the Diagnostic Syndromes Between Therapists</td>
<td>17</td>
</tr>
<tr>
<td>4.</td>
<td>Coefficient Alpha Values Associated with the Diagnostic Syndromes Between Therapists</td>
<td>18</td>
</tr>
<tr>
<td>5.</td>
<td>Percentage Agreement Values Associated with the Diagnostic Syndromes Between Therapists</td>
<td>19</td>
</tr>
</tbody>
</table>
ACKNOWLEDGMENTS

The author would like to express sincere appreciation to Erin Simunds, M.S., P.T., for her guidance, understanding, and encouragement as advisor during this research study. Without her assistance, this study would never have been dreamed of, much less completed.

Special appreciation would also be extended to Cliff Lafreniere, P.T., for the utilization of his private practice (Great Plains Physical Therapy Clinic, Grand Forks, ND) to perform the research. Gratitude is also offered to Cliff Lafreniere, P.T., and Eris Smith, P.T., for performing all of the evaluations utilized in this study.

A special thank you is also extended to Richard Landry, Ph.D., for providing all of the statistical assistance.

The author is also grateful to the Hybrid Physical Therapy Graduate Students of 1993 for their assistance with this research study.
To My Family
ABSTRACT

The purpose of this study was to investigate the interexaminer reliability of the McKenzie algorithm. Thirty-one subjects (25 females and 6 males), ages 20 to 77, with reported neck pain participated in this study. Each subject was examined twice by two McKenzie trained physical therapists. The subjects were evaluated separately utilizing standard McKenzie Cervical Assessment formats and procedures. Upon completion of the assessment, each therapist used an adapted McKenzie cervical algorithm to classify each patient into one of the possible syndromes (Postural, Dysfunction, or Derangements 1-7). Only five diagnostic categories contained enough data to accurately examine reliability and, therefore, coefficient alpha was selected to analyze internal consistency between scores. The results of this study demonstrated fair to excellent interexaminer reliability (.736 to 1.00) for dysfunction and derangements 1, 3, and 7. The poor reliability found with derangement 4 may be attributed to difficulty in detecting wry neck or torticollis deformities. These results indicated that utilization of the McKenzie framework can produce a consistent and reliable diagnosis to promote correct treatment choices.
CHAPTER I

INTRODUCTION

Prevalence of musculoskeletal impairments in the United States transpire at a rate of approximately 124 in every 1,000 persons. Subcategories of back and spine impairments are the most frequently reported and represent 51.7% of all musculoskeletal impairments. According to the American Academy of Orthopaedic Surgeons (AAOS), in 1988 conditions associated with neck pain resulted in 227,000 hospitalizations with a reported 1.4 million patient days. The AAOS also indicates that approximately 5.2 million physician office visits were reported for conditions related to neck pain.\(^1,2\) Neck pain, with or without associated radicular upper extremity pain, occurs in 12% of the female population and 9% of the male population. It is also indicated that approximately 35% of the population can remember at least one incident of neck pain.\(^3,4\) These statistics reflect the importance of medical care, especially rehabilitative services, for sufferers of neck pain. Since the cervical spine has been identified as the pathological location for a sizable amount of upper extremity impairments,\(^5\) physical therapy intervention can be a viable method to provide relief for cervical pathology.\(^6\) However, like most health care professionals who deal with the cervical spine, the evaluation procedure and
subsequent treatment protocols prove to be invaluable for the overall management of cervical disorders.\textsuperscript{6}

In the field of physical therapy, there is a need for a reliable and objective method of performing cervical evaluations. This is particularly important because a concise, objective cervical evaluation is required for proper implementation of treatment procedures.\textsuperscript{7,8} The answer to this need may be through the use of Robin McKenzie's evaluation and diagnostic techniques. McKenzie has developed an alternative system of diagnosing based on an algorithm and careful observations of the mechanism of pain behavior. The interpretation of both the subjective and objective findings classify spinal pain into three possible syndromes: postural, dysfunctional, or derangement.\textsuperscript{9,10,11,12}

The first syndrome is the Postural Syndrome. Patients are usually 30 years old or younger, have sedentary occupations, and lack regular exercise. They develop pain which appears locally, symmetrically, and usually adjacent to the center of the spinal column. The pain is gradually provoked by mechanical deformation of soft tissues (i.e., ligaments) and develops when spinal segments are subjected to prolonged static loading at the end ranges of movement. Pain from postural origin is never induced by movement, never referred, and never felt as constant pain. Movements are usually normal and pain can only be reproduced as patients adopt poor postural patterns for a prolonged period of time.\textsuperscript{9,10,11,12}
In the second syndrome, the Dysfunction Syndrome, patients have developed shortening of soft tissues around the spinal segments with subsequent loss of spinal mobility. A common patient profile is a person over 30 years of age, with poor postural habits, and who does not engage in regular exercise. Adaptive shortening of spinal ligaments, apophyseal joints, and spinal musculature can occur as a direct result of this lifestyle. Adaptive shortening and reduced spinal mobility may also develop in the patient who has experienced trauma with secondary scar tissue formation. In either profile, the pain is provoked by spinal movement and overstretching of the shortened soft tissues. The pain is generally located near midline and is only produced at the end ranges of motion. The pain from dysfunction is never referred into the arm unless adherence of a nerve root is present.\textsuperscript{9,10,11,12}

The final syndrome is the Derangement Syndrome which implies an anatomical disruption and displacement of the material within the intravertebral disc.\textsuperscript{9,10,13} Patients are usually between the ages of 12 to 55 years old who report a sudden onset of pain with a significant loss of functional capabilities.\textsuperscript{9} The symptoms may be felt locally, adjacent to the center of the spinal column, or may radiate distally in the form of pain, paraesthesia, or numbness. Pain may alter its location, be frequently constant in nature, and may cause the patient to have difficulty finding a position that relieves the symptoms. Three observations that clearly define the derangement syndrome are:\textsuperscript{9,10}
1) pain is produced or increased with repeated movements in one direction
2) pain with repeated motion in one direction is accompanied by a loss of movement in the opposite direction
3) motion loss is improved rapidly with repeated movements in the same direction

While the mechanism behind derangement of the intervertebral disc is not fully understood, McKenzie believes that the hydrostatic properties of the disc predisposes it to displacement through repeated motion.\(^9,10\) During symmetrical and axial loading, Vogel\(^14\) and Stahl\(^15\) state that the nucleus pulposus expands and is only retained by the elasticity of the annulus fibrosis. Upon removal of the pressure, the nucleus pulposus returns to its initial central form and location. However, during asymmetrical loading, the central part of the disc, containing the nucleus pulposus, will migrate toward the area with the least pressure. Therefore, with the execution of forward bending there will be a posterior migration, with backward bending an anterior migration, and with lateral flexion the migration will occur to the contralateral side. This theoretical construct characterizes gradual disc prolapse as an outcome of repeated off-center loading.\(^13\)

Treatment for each syndrome is specific and is based on McKenzie’s principles of spinal flexion and extension. The extension principle stretches anterior passive visco-elastic structures and forces the nucleus pulposus
anteriorly while the flexion principle stretches posterior inert tissues and forces the nucleus pulposus posteriorly. McKenzie advocates a treatment approach for these syndromes which encourages the patient to develop a self-treatment strategy. The applications of McKenzie's treatment principles are illustrated in Table 1.

Predictive patterns in patient responses to treatment movements and positions have emerged. The most intriguing response to the McKenzie program was the reported "centralization" of the patient's pain during the evaluation and treatment sessions. Centralization, according to McKenzie, refers to a rapid change in the perceived location of pain from a distal or peripheral location to a more proximal or central area. Patients who are recovering from low back or leg pain episodes, in time, obtain a slow variable regression of peripheral pain towards its origin, the center of the back. Donelson, Murphy, and Silva studied patients with low back pain and found that the centralization phenomena occurred frequently in patients with leg pain when treated by the McKenzie approach. The patients who reported centralized pain had a high incidence of good to excellent treatment outcomes. Less favorable outcomes occurred with patients whose pain did not centralize using the McKenzie evaluation/treatment plan. These methods are safe, reproducible, and would appear to be quite effective when performed by an examiner trained in the McKenzie treatment program.
Table 1.--McKenzie’s Treatment Principles

<table>
<thead>
<tr>
<th>DIAGNOSIS</th>
<th>PRESCRIBED TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postural Syndrome</td>
<td>Postural correction (lying, sitting, and standing) and the assessment and modification of functional activities.</td>
</tr>
<tr>
<td>Flexion Dysfunction</td>
<td>Flexion principle, postural correction, and stretching of shortened tissues. Treatment will be at end ranges.</td>
</tr>
<tr>
<td>Extension Dysfunction</td>
<td>Extension principle, postural correction, and stretching of shortened tissues. Treatment will be at end ranges.</td>
</tr>
<tr>
<td>Posterior Derangement</td>
<td>Extension principle, reduction and maintenance of the derangement, recovery of function, and prevention. Treatment principles progress from mid-range to end-range as the patient improves.</td>
</tr>
<tr>
<td>Anterior Derangement</td>
<td>Flexion principle, reduction and maintenance of the derangement, recovery of function, and prevention. Treatment principles progress from mid-range to end-range as the patient improves.</td>
</tr>
</tbody>
</table>
Table 1.--McKenzie's Treatment Principles (cont.)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherent Nerve Root</td>
<td>Flexion principle. Treatment will be at end ranges.</td>
</tr>
<tr>
<td>Sacroiliac Joint Problems</td>
<td>Strapping or appropriate therapist intervention. Treatment will be at end ranges.</td>
</tr>
<tr>
<td>Hip Joint Problems</td>
<td>Appropriate stretching techniques or appropriate therapist intervention.</td>
</tr>
<tr>
<td>Inconclusive</td>
<td>Further medical investigation.</td>
</tr>
</tbody>
</table>
McKenzie’s evaluation and treatment program is further supplemented with the utilization of an algorithm for the classification of the three syndromes. An algorithm is described as any method or procedure of computation, usually involving a series of steps as in long division (Hanks and McLeod, 1987) and is a useful way to simplify often seemingly complicated problems. The goal of the McKenzie algorithm is to find a systematic method of spinal pain assessment while reducing examiner error. The McKenzie algorithm categories spinal pain into the three syndromes and relies heavily upon the behavior of the pain with repeated movements or reported peripheral symptoms in order to determine the specific syndrome. The algorithm should be referred to after the patient has been thoroughly evaluated. In many cases, the subjective portion of the examination can determine the theoretical origin of the pain.\textsuperscript{9,10}

Although studies have proven that the McKenzie Program is an effective treatment for low back pain,\textsuperscript{16,17,18,19,20,21} the reliability and the validity of the evaluative procedures have not been fully supported by current literature. Kilby et al\textsuperscript{22} investigated the reliability of the McKenzie algorithm for the low back area. Forty-one low back pain patients were evaluated by a physical therapist with a second physical therapist observing the initial assessment. An adjudicator collected the therapists’ conclusions independently. Agreement between the therapists was calculated using the kappa statistic unless insufficient data occurred and then percentage agreement was used. Results indicated that all but three questions from the McKenzie algorithm were within
10 percent of perfect agreement. The exceptions revolved around the detection of a flat lumbar spine (80% agreement), of end range pain (70% agreement), and of a lateral shift (55% agreement). The total agreement for all diagnoses was 58.5 percent, while the agreements within the derangement categories was 57 percent. However, if derangements 3 and 4 and derangements 5 and 6 were collapsed into two categories which accommodates for inconsistencies when detecting a lateral shift, diagnostic agreement within the derangement syndrome improved to 74.2 percent. It appears that centralization and reduction or abolition of spinal pain may be reliably expounded. However, the subtle signs (flat lumbar spine, end range pain, and a lateral shift) which solidify diagnostic decisions may increase interexaminer error.\textsuperscript{22}

McKenzie has hypothesized that the centralization phenomena also occurs in the cervical spine and that methodical evaluation of these symptoms will also indicate diagnostic information based on the three syndromes.\textsuperscript{9,10} However, no reported research has been conducted regarding the reliability of the cervical algorithm. The purpose of this study was to investigate the interexaminer reliability of the McKenzie Cervical Spine Algorithm.
CHAPTER II

METHODS

Subjects

Thirty-one subjects (25 females and 6 males) participated in this study. Their ages ranged from 20 to 77 with a mean age of 43 (SD = 14.2) and the duration of their symptoms varied from approximately 1 week to 40 years with a mean of 8 years (SD = 4.9). The subjects were recruited by offering a free cervical evaluation through media advertisement, flyers, and the university's newspaper. The subjects were included in the study if they currently experienced reported cervical pain. The recruitment process was in accordance with the policies set by the University of North Dakota's Institutional Review Board (Appendix A).

Instrumentation

The McKenzie lumbar algorithm was adapted for cervical impairment (Appendix B). To use the McKenzie Cervical Algorithm, the examiner starts with the first question located in the upper right hand corner of the figure. The question states, "Do any repeated movements decrease, abolish, or centralize the pain?" Since the use of repeated movements to determine pain behavior is one of the mainstays of the McKenzie assessment, this question is appropriate at the earliest point in the algorithm. A "yes" answer indicates a derangement.
If the respondent answers a "yes" to the second question, "Are the symptoms centralized, decreased, or abolished by repeated flexion?", the subject has an anterior derangement number 7. If the subject answered "no," the patient has one of six other possible posterior derangements. McKenzie differentiates between these six derangements by pain distribution and the presence or the absence of relevant spinal deformities.\(^7,8\)

If the pain is not centralized, decreased, or abolished with repeated movements, the follow-up question inquire about the existence of constant pain. A "yes" answer indicates that the therapist must reassess the subject condition after a period of 24 hours. Two possibilities arise from this situation. One, the patient's condition is too severe at this time to complete a full assessment and obtain a definite conclusion or, two, a more serious pathology is suspected. If the subject's response was "no" to the question of constant pain, then the next question asks, "Is there pain only at the end of the range?" A "yes" designates a dysfunction syndrome, especially if there is no referred pain. The only referred pain present in dysfunction is caused by a nerve root adherence. If this is suspected, the appropriate tests should be performed. If there is no pain at end ranges of movement, the next question asks, "Is there pain upon static loading?" A postural syndrome is determined if there is no referred pain and the patient complains of pain when adopting one position for a prolonged period of time.\(^9,10\)
Procedure

In an attempt to minimize treatment room occupancy and therapists' time commitment, two subjects were frequently scheduled for the same appointment date and time. Upon arrival, the subjects were randomly assigned between two physical therapists and assigned to separate evaluation rooms. The consent form and subjective/history portion of the McKenzie evaluation (Appendix C) was completed by an impartial judge.

The physical therapists who performed the cervical evaluations were trained in McKenzie techniques for evaluating, diagnosing, and treating of specific spinal pathologies. One therapist had completed through part C while the other had completed through part D.

The therapists conducted the individualized evaluations in a 30-minute time segment. At the end of their respective assessments, the therapists switched evaluation rooms and repeated the procedure. The subjects were instructed to not offer any results that occurred during the first assessment to the second therapist. An impartial judge remained in the evaluation room during both assessments to record any differences which may have invalidated the study. At the end of the evaluation, the subjects were provided with a free consultation on the results of the assessments. The subjects were also offered the opportunity to watch a video of McKenzie's principles and treatments and to return if they desired additional therapy.
The therapists assigned a single diagnostic category to 30 of the 31 subjects. One subject received a dual diagnosis of dysfunction and derangement number 3 from both therapists. The 9 diagnostic variables were dichotomized for each subject and were arranged in a correlation matrix between examiners. The data obtained were statistically analyzed using phi coefficients to determine interexaminer reliability. However, only five diagnostic categories contained enough cases to accurately examine reliability. Therefore, the coefficient alpha was selected to analyze the dependability of the measured diagnostic decisions. If there was a high degree of internal consistency between scores, then it would be reasonable to assume that comparable results would have been obtained had another set of similar questions been asked. No standard levels for correlation coefficients have been adopted when describing the reliability of measurements. This study used a previously reported scheme to define the amount of reliability based on our coefficient alpha values. Values between .90 to .99 indicated high reliability; values between .80 to .89 indicated good reliability; values between .70 to .79 indicated fair reliability; and values below .70 indicated poor reliability.

Percentage agreement was also calculated to allow direct comparison with Kilby et al. This measured how often the therapist agreed upon the diagnosis assigned to each subject. The coefficient of agreement was computed as follows:
Po = number of exact agreements/number of possible agreements = \( \Sigma f_o/N \times 100 \)

where Po is the total proportion of observations, \( \Sigma f_o \) is the sum of the frequencies of observed agreements, and N is the number of pairs of scores that were obtained.\(^{26}\) An adjusted N was calculated for each syndrome by counting the total number of occurrences within a diagnostic category and then dividing this number in half.
CHAPTER III

RESULTS

Since one patient received a dual diagnosis from both therapists, each examiner recorded a total of 32 cases. The postural syndrome and derangement number 6 had zero cases for both therapists, while derangement numbers 2 and 5 had zero cases for one of the examiners (Table 2). Therefore, correlations could only be computed for the remaining diagnostic categories.

The phi coefficient values for dysfunction and derangement numbers 1, 3, 4, and 7 were statistically significant at the alpha .05 level (Table 3). Internal consistency (coefficient alpha) for the measurement of these five diagnostic categories indicated fair to excellent reliability (.74 to 1.0) with the exception of derangement number 4 which had a coefficient alpha of .547 (Table 4).

Table 5 shows the level of agreement for each diagnosis. The overall percentage agreement was 76.4 percent and ranged from 44 percent in derangement number 4 to 100 percent in derangement number 7. When derangement numbers 3 and 4 were collapsed to accommodate for problems detecting a wry neck or torticollis, 16 out of the 18 possible cases were in agreement. This amalgamated category had a percentage agreement of 89 percent.
Table 2.--Frequency Distribution of Diagnostic Syndromes Between Therapists

<table>
<thead>
<tr>
<th>Diagnostic Syndrome</th>
<th>Therapist A</th>
<th>Therapist B</th>
<th>No. of Cases in Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postural</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dysfunction</td>
<td>10</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Derangement 1</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Derangement 2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Derangement 3</td>
<td>11</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Derangement 4</td>
<td>6</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Derangement 5</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Derangement 6</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Derangement 7</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>32</td>
<td>32</td>
<td>23</td>
</tr>
</tbody>
</table>
Table 3.--Phi Coefficient Values Associated with the Diagnostic Syndromes Between Therapists

<table>
<thead>
<tr>
<th>Diagnostic Syndromes</th>
<th>Phi Coefficient</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posture</td>
<td>NA*</td>
<td>NA</td>
</tr>
<tr>
<td>Dysfunction</td>
<td>0.7748</td>
<td>$p &lt; .001^*$</td>
</tr>
<tr>
<td>Derangement 1</td>
<td>0.8023</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Derangement 2</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Derangement 3</td>
<td>0.5832</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Derangement 4</td>
<td>0.3920</td>
<td>$p &lt; .015$</td>
</tr>
<tr>
<td>Derangement 5</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Derangement 6</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Derangement 7</td>
<td>1.0</td>
<td>$p &lt; .001$</td>
</tr>
</tbody>
</table>

*NA = Not Applicable

$^*$Significance level = .05 alpha level
Table 4.—Coefficient Alpha Values Associated with Diagnostic Syndromes Between Therapists

<table>
<thead>
<tr>
<th>Diagnostic Syndrome</th>
<th>Coefficient Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysfunction</td>
<td>.873</td>
</tr>
<tr>
<td>Derangement 1</td>
<td>.882</td>
</tr>
<tr>
<td>Derangement 3</td>
<td>.736</td>
</tr>
<tr>
<td>Derangement 4</td>
<td>.547</td>
</tr>
<tr>
<td>Derangement 7</td>
<td>1.000</td>
</tr>
</tbody>
</table>
Table 5.--Percentage Agreement Values Associated with the Diagnostic Syndromes Between Therapists

<table>
<thead>
<tr>
<th>Diagnostic Syndrome</th>
<th>N</th>
<th>Σfo</th>
<th>Percent Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postural</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Dysfunction</td>
<td>9.5</td>
<td>8</td>
<td>84%</td>
</tr>
<tr>
<td>Derangement 1</td>
<td>2.5</td>
<td>2</td>
<td>80%</td>
</tr>
<tr>
<td>Derangement 2</td>
<td>.5</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Derangement 3</td>
<td>13.5</td>
<td>10</td>
<td>74%</td>
</tr>
<tr>
<td>Derangement 4</td>
<td>4.5</td>
<td>2</td>
<td>44%</td>
</tr>
<tr>
<td>Derangement 5</td>
<td>.5</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Derangement 6</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Derangement 7</td>
<td>1</td>
<td>1</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>32</td>
<td>23</td>
<td>76.4%</td>
</tr>
</tbody>
</table>
CHAPTER IV
DISCUSSION

Phi coefficient values calculated on dysfunction and derangement numbers 1, 3, 4, and 7 indicated that a significant positive correlation existed between therapists. However, only five diagnostic categories contained enough data to allow computation of reliability coefficients. Therefore, the coefficient alpha was selected to analyze internal consistency between scores.

Coefficient alpha values indicated that the McKenzie algorithm had fair to excellent reliability for all of the diagnostic categories with the exception of derangement number 4. The internal consistency for this category may have been affected by the differentiation between derangement number 3 and derangement number 4 which requires the identification of wry neck and/or torticollis to separate the categories. In 4 of the 17 cases, the first therapist observed a spinal deformity while the second therapist did not. The use of repeated extension in the first examiner's assessment technique may have eradicated the deformity thus eliminating its presence for assessment by the second therapist. McKenzie advocates that repeated movements will rapidly alter spinal deformities and these do not usually recur.9

The overall percentage agreement by diagnosis (76.4%) and the overall percentage of agreement for derangements (74.5%) were higher than that of
Kilby et al (58.0% and 57.0% respectively). The percentage of agreement for the amalgamation of derangements 3 and 4 (89.0%) was also found to be higher than that of Kilby et al (61.5%).

This study's evaluative procedure differed from that of Kilby et al because the subjects were evaluated twice by two different therapists. Two major aspects justified the decision to perform the evaluations in this manner.

First, Kilby believed that when performing a McKenzie evaluation, each subject should be assessed only once because a derangement can change during the examination procedure. However, the author decided that an effective McKenzie evaluation required each therapist to perform a "hands on" examination to accurately assess movement quality. The "hands on" approach also allowed the detection and the discrimination of overpressures and end-feel by each examiner. The refinement that movement quality, overpressures, and end-feel add to the clinical impression would not be perceived by an independent observer.

To control for the possibility of changing a derangement category between the two examiners, the author made sure that the first examiner stopped the evaluation as soon as a clear diagnosis appeared. This was done even if the therapist did not complete the required 50 repetitions for each motion. As mentioned above, this study did have instances where the examiner carried the evaluation too far and eradicated the deformity, thereby changing the derangement classification. As in Kilby et al, amalgamation of
derangements 3 and 4 produced a higher percentage agreement (89%) between therapists. Since detection of the spinal deformities was difficult in this study, as well as Kilby et al, it seems that interexaminer reliability would be enhanced if derangements 3 and 4 and 5 and 6 were collapsed.

No subjects suffered ill effects from being evaluated twice. In one instance, a subject reported the presence of a headache upon completion of the examination. However, the other 30 subjects all reported reduced symptoms after the evaluation.

The author's second justification for allowing both therapists to conduct the assessments focused on differences found in examiner styles and techniques. Therapists vary in their approach to a patient and in their confidence for using manual skills. These differences usually emerge as a product of higher education but may be intensified through continuing education opportunities. In this study, there was a noticeable difference in manual skills between the two therapists. One therapist used more handling while the other used less. However, the algorithm still proved to be reliable. The results indicated that while individual differences existed within the McKenzie framework, the overall outcome produced a consistent and reliable diagnosis to drive the correct treatment choices. Therefore, the McKenzie approach formally addresses these variations by presenting a uniform method of evaluation which accommodates for individuality.
This study collected only enough data to analyze the reliability of five diagnostic categories. Further research should focus on continuing reliability studies which would incorporate enough subjects so that all the diagnostic categories can be investigated.

Inter-rater reliability ensures that measurements and clinical decisions will be consistent between therapists. However, it does not guarantee that the findings of the evaluation tool are valid. As Miller stated, "Therapists are coming to understand that if the validity of their instrumentation is questioned, so too will be the validity of their intervention." The McKenzie algorithm must be investigated for construct validity to see if the assessment procedures can differentiate between normal subjects and subjects with spinal pathology.
CHAPTER V
CONCLUSION

All tests and measures used in Physical Therapy should be examined for reliability and validity issues. This study investigated the interexaminer reliability of the McKenzie algorithm. Only five of the nine possible diagnostic categories contained enough data to be statistically analyzed. Interexaminer reliability was fair to excellent for all categories with the exception of derangement number 4. Poor reliability in this category may be attributed to difficulty in detecting spinal deformities. In four out of 17 cases, the first therapist observed a torticollis while the second therapist did not. The use of repeated extension in the first examiner’s assessment technique may have eradicated the deformity. An amalgamation of derangement 3 and 4 produced a higher percentage agreement (89%) between the therapists. With the exception of detecting spinal deformities, the McKenzie algorithm appears reliable when performed by McKenzie-trained therapists.
The above referenced project was reviewed by a designated member for the University's Institutional Review Board on October 27, 1992 and the following action was taken:

☐ Project approved. EXPEEDITED REVIEW NO. 7
Next scheduled review is on October 1993.

☐ Project approved. EXEMPT CATEGORY NO. ____ No periodic review scheduled unless so stated in REMARKS SECTION.

☐ Project approval deferred.
(See REMARKS SECTION for further information.)

☐ Project denied.
(See REMARKS SECTION for further information.)

REMARKS: Any changes in protocol or adverse occurrences in the course of the research project must be reported immediately to the IRB Chairman or ORPD.
In the field of physical therapy, there is a need for a reliable and objective method of performing cervical evaluations. This is particularly important because a concise and objective cervical evaluation is required for proper implementation of treatment procedures. The answer to this need may be through the use of Robin McKenzie's evaluation and diagnostic techniques. McKenzie's evaluation utilizes an algorithm and careful observations of the mechanisms of pain. Kilby et al. demonstrated adequate interexaminer reliability with the algorithm for the lumbar spine, however reliability has not been investigated for the cervical spine. Therefore, the purpose of this study will be to investigate the interexaminer reliability of the McKenzie cervical spine algorithm. Forty subjects will be evaluated separately by two McKenzie trained physical therapists and classified into one of McKenzie's three syndromes. An impartial judge will be present to record any differences between the evaluative procedures. Evaluation results will be analyzed using correlation coefficients to determine interexaminer reliability between the therapists. The use of human subjects will be required because clinically based results are directly applicable to patient treatment.
PLEASE NOTE: Only information pertinent to your request to utilize human subjects in your project or activity should be included on this form. Where appropriate attach sections from your proposal (if seeking outside funding).

2. PROTOCOL: (Describe procedures to which humans will be subjected. Use additional pages if necessary.)

SUBJECTS:

Thirty to forty patients, ages 18 to 49, with reported cervical pain will be utilized in this study. The subjects will be voluntarily recruited from local physician offices, the University of North Dakota campus, and a local physical therapy clinic. The subjects will be required to sign a consent form for participation in this study.

METHOD:

Instrument:

The McKenzie Evaluation/Algorithm uses repeated neck movements and a series of questions to determine if these movements increase or decrease reported pain (Appendix A). The results of the assessment classifies the patient into one of three possible syndromes: postural, dysfunction, or derangement. The postural syndrome assumes that reported pain emanates from habitually maintaining poor body alignment. The dysfunction syndrome is characterized by a shortening of spinal tissues, and the stretching of these tissues produces pain. Pain in the derangement syndrome originates from involvement in the intervertebral disk (3). Procedures to classify these syndromes are assisted by the use of an algorithm (Appendix B).

Procedure:

The subjects will be issued specific appointment dates and times, at their convenience, to report to the clinic. Upon arrival, the subjects will be randomly assigned between the two therapists. Two separate rooms will be set up with the necessary equipment to perform the evaluations. The 2 therapists who will be performing the cervical evaluations are trained in McKenzie's techniques for evaluating, diagnosing, and treating of certain spinal pathologies (3). Each therapist will evaluate one subject in a separate room within a 30 minute time segment. At the end of their respective evaluations, the therapists will switch evaluation rooms and repeat the procedure. An impartial judge will remain in the evaluation room, during both evaluations, to record any differences which may invalidate the study. The data obtained will be statistically analyzed with correlation coefficients to determine reliability between the therapists.
3. BENEFITS: (Describe the benefits to the individual or society.)

The results of this study will benefit clinicians (physical therapists) by providing current research data indicating the reliability of the McKenzie cervical spine algorithm. There is a need for a reliable, accurate, and objective method of evaluating the cervical spine to maintain and validate proper treatment procedures for cervical spine pathologies.

4. RISKS: (Describe the risks to the subject and precautions that will be taken to minimize them. The concept of risk goes beyond physical risk and includes risks to the subject's dignity and self-respect, as well as psychological, emotional or behavioral risk. If data are collected which could prove harmful or embarrassing to the subject if associated with him or her, then describe the methods to be used to insure the confidentiality of data obtained, including plans for final disposition or destruction, debriefing procedures, etc.)

The risks to the subjects in this study will be minimal. McKenzie's cervical evaluations are common non-invasive procedures routinely utilized in clinical practice. The procedures involve repeated cervical range of motion movements which are normal for the cervical region. The subjects may experience slight muscle fatigue from the testing procedures which require muscle contractions. Data will be collected in a confidential manner. The subjects will be coded numerically and their names withheld to maintain strict confidentiality.
5. CONSENT FORM: A copy of the CONSENT FORM to be signed by the subject (if applicable) and/or any statement to be read to the subject should be attached to this form. If no CONSENT FORM is to be used, document the procedures to be used to assure that infringement upon the subject's rights will not occur.

Describe where signed consent forms will be kept and for what period of time.

Please see Attachment A for consent form.

For FULL IRB REVIEW forward a signed original and twelve (12) copies of this completed form, and where applicable, twelve (12) copies of the proposed consent form, questionnaires, etc. and any supporting documentation to:

Office of Research & Program Development
University of North Dakota
Box 8138, University Station
Grand Forks, North Dakota 58202

On campus, mail to: Office of Research & Program Development, Box 134, or drop it off at Room 101 Twamley Hall.

For EXEMPT or EXPEDITED REVIEW forward a signed original and a copy of the consent form, questionnaires, etc. and any supporting documentation to one of the addresses above.

...policies and procedures on Use of Human Subjects of the University of North Dakota apply to all activities involving use of human subjects performed by personnel conducting such activities under the auspices of the University. No activities are to be initiated without prior review and approval as prescribed by the University's policies and procedures governing the use of human subjects.

SIGNED:

[Signature]
DATE: 10/16/92

[Signature]
DATE: 10/16/92

[Signature]
DATE: 10/16/92

(Revised 7/1990)
INFORMATION AND CONSENT FORM

Interexaminer Reliability of the McKenzie Algorithm for the Evaluation of Cervical Pain

You are being invited to participate in a study conducted by Eric R. Sakamoto, physical therapist and graduate student from the University of North Dakota School of Physical Therapy. The purpose of this study is to determine the consistency of neck evaluations between therapists. The information obtained from this study will benefit physical therapists by providing current research data regarding the reliability of neck assessments.

The study will require you to be evaluated by two physical therapists. The procedures involve repeated neck(cervical) movements which are normal for the cervical region. You will be asked about discomfort that you may or may not experience from the repeated movements. The entire study will take approximately 1 hour to complete.

The process of physical performance testing always involves some degree of risk however, your risk's in this study will be minimal. Neck evaluations are common non-invasive procedures that are routinely used in clinical practice. You may experience slight muscle fatigue from the testing procedures which do require muscle contractions.

Your name will not be printed in any reports that will be generated in this study. All the data will be kept strictly confidential and will be identified as a number known only to the principal investigator. Consent forms and evaluation results will be secured in Erin Simunds' Office, Room 146, Medical Sciences North, for a period of 2 years.

Upon participation, you are free to withdraw from this study at any time without prejudice. Please contact me if you have any questions pertaining to this study. I can be reached at the University of North Dakota Physical Therapy Graduate Office at (701) 777-2831.

In the event that a physical injury is incurred during this study, medical treatment will be available as it is to any member of the general public. Payment for treatment required must be paid for by you or by your third party payor.

I have read all of the above and willingly agree to participate in this study. All of my questions have been answered in regards to this study and I have been encouraged to ask questions that arise in the future. Information has been explained to me by Eric R. Sakamoto.

_________________________  __________________________
Signature                     Date

I have discussed the above points with the subject, and it is my opinion that he/she understands the risks, benefits, and obligations involved in participation in this study.

_________________________  __________________________
Signature                     Date
REFERENCES

Appendix B: Cervical Spine Assessment/Algorithm

- flat or flexed cervical spine below the elbow
- wry neck or torticollis

Derangement Syndrome
- N: symptoms centralized decreased or abolished by repeated flexion?
- Y: is the pain constant?
  - N: refered pain
  - Y: referred pain
- Y: is there pain on static loading?
  - N: Diagnosis uncertain or problem resolved
  - Y: two day trial of provocative exercises
- N: is there pain only at end range?
- N: diagnosis uncertain or problem resolved
- Y: Review test for adherent nerve root
THE McKenzie INSTITUTE
CERVICAL SPINE ASSESSMENT

Date ..............................................................
Name ............................................................
Address ..........................................................
Telephone ......................................................
Date of birth ..................................................
Occupation ....................................................
Postures/stresses ...........................................
Doctor ..........................................................

HISTORY

Symptoms now ..................................................

Present for ....................................................

At onset .......................................................

Improving/unchanged/worsening .........................

Commenced as a result of .................................

☐ Commenced for no apparent reason

Symptoms constant .........................................

Intermittent ...................................................

WORSE

sitting    prolonged bending    turning    lying/rising
a.m./as day progresses/p.m.    stationary/on the move
other .......................................................

Better

sitting    prolonged bending    turning    lying/rising
a.m./as day progresses/p.m.    stationary/on the move
other .......................................................

Disturbed sleep .............................................

Pillows .......................................................

Sleeping postures .........................................

prone/supine/side ...........................................

Surface ......................................................

firm/soft/sagging/waterbed ..............................

Cough/sneeze/strain ........................................

+ve/-ve ......................................................

Gait ...........................................................

Dizziness/tinnitus/nausea ................................

Motion sickness ...........................................

Previous history ...........................................

Previous treatment ........................................

X-rays .........................................................

General health .............................................

Weight loss ................................................

Meds ..........................................................

Steroids ......................................................

Recent surgery .............................................

Accidents .....................................................

BY PERMISSION OF THE McKENZIE INSTITUTE INTERNATIONAL
ORTHOPEDIC PHYSICAL THERAPY PRODUCTS D O Box 4290 Minneapolis, MN 55440 (612) 877-8447 © 1990 OPUT a division of Postex, Inc.
REFERENCES


19. Ponte DJ, Jensen GJ, Kent BE. A preliminary report on the use of the


