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A Wrist and Cervical Screening of Grand Forks City Employees: A Pilot Study

William D. Jr. Kukuk
University of North Dakota

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A WRIST AND CERVICAL SCREENING OF
GRAND FORKS CITY EMPLOYEES:
A PILOT STUDY

by

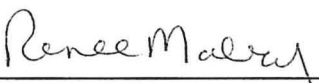
William Duane Kukuk, Jr.
Bachelor of Science in Physical Therapy
University of North Dakota, 1995



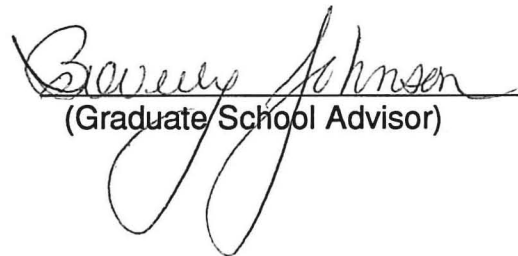
An Independent Study
Submitted to the Graduate Faculty of the
Department of Physical Therapy
School of Medicine
University of North Dakota
in partial fulfillment of the requirements
for the degree of
Master of Physical Therapy

Grand Forks, North Dakota
May
1996

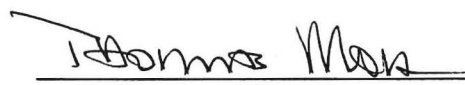
This Independent Study, submitted by William Duane Kukuk, Jr. in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.



(Faculty Preceptor)



(Graduate School Advisor)



(Chairperson, Physical Therapy)

PERMISSION

Title A Wrist and Cervical Screening of Grand Forks City Employees:
A Pilot Study

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 Department of Physical Therapy 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 work or, in her absence, by the Chairperson of the department. It is understood that any copying or publication or other use of this independent study 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 the University of North Dakota in any scholarly use which may be made of any material in my Independent Study Report.

Signature William D. Kurkuk Jr.

Date March 8, 1996

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ABSTRACT

Cumulative Trauma Disorders (CTDs) developed at work are caused by repetitive movements or sustained postures. Carpal Tunnel Syndrome (CTS) and Cervical Radiculopathy (CR) are both CTDs resulting from repetitive wrist movements and sustained cervical postures respectively. Although both conditions can present with similar symptoms in the exact same hand and finger location, there has been no research comparing the prevalence of CTS and CR symptoms in a given population.

The purpose of this study was to identify hand and finger symptoms and correlate the severity of the symptoms with objective measures. Thirty employees of the City of Grand Forks, ND, volunteered for this study. All subjects filled out a demographic survey, symptom severity questionnaire, and body diagram. They also performed the Phalen's test and the McKenzie repeated and sustained cervical flexion tests. Nineteen subjects reported pre-study symptoms of varying severity. The ratio of positive Phalen's tests to McKenzie tests was greater than 2:1. The correlation between pre-study symptom severity and Phalen's test result was significant. The correlation between pre-study symptom severity and McKenzie sustained flexion test result was also significant. The results of this study have implications for all health

professionals in occupational medicine and the City of Grand Forks in CTS and CR education and prevention programs.

CHAPTER I

INTRODUCTION

Cumulative trauma disorder (CTD) is synonymous with the terms “repetitive motion syndrome,’ ‘repetitive strain injury,’ and ‘overuse syndrome.’”^{1(p118)} These terms indicate that a particular body segment has been subjected to prolonged biomechanical stresses of vibration, excess force, extreme postures, and awkward motions.¹ These stresses cause microtrauma to the muscles, nerves, tendons, and/or tendon sheaths resulting in pain, muscle weakness, and/or sensory loss.²

The number of employees who are experiencing the symptoms of CTDs increases annually. This increase, according to Frederick,² stems from: 1) the heightened awareness and reporting on the part of industry and/or government and 2) the simplification of job tasks into repetitive movements to increase productivity. It is reasonable to assume that this trend will continue through the 1990s as industries continue to simplify job tasks and demand increased production.

Carpal Tunnel Syndrome (CTS), the most common CTD, is now a “buzz word” in many departments around the country. Secretaries and other job titles that require frequent or constant keyboarding are susceptible to CTS.

Employees in these positions are now more aware of CTS through employee education and prevention programs. The awareness of CTS has also increased substantially due to an increase in media attention and litigation. "At the start of this year, there were at least 18 product liability lawsuits nationwide involving nearly 90 plaintiffs blaming their injuries on keyboards."^{3(p24)} The media has kept the public informed as to the outcome of past cases and will undoubtedly report the outcome of the latest litigation. Besides media coverage, Robert Dietrich, managing editor of VDT News, a newsletter in New York, reports "The law firms pursuing these cases have been advertising in the newspapers for people with these injuries . . ."^{3(p24)} Law firms are actively seeking injured employees who desire monetary compensation. These examples demonstrate the growing awareness of CTS in the workplace and legal profession.

Many employees aware of CTS know very little if anything about cervical radiculopathy. Even though cervical radiculopathy is not typically classified as a CTD, it produces symptoms very similar to CTS. Each condition, however, involves different body regions and pathology of different structures. A review of the anatomy, pathology, and symptomology of CTS and cervical radiculopathy will therefore be presented in order to provide baseline information. The symptom similarities will then be addressed, followed by the research questions and purpose of the study.

Anatomy, Pathology, and Symptomology of CTS

The following three paragraphs review the basic anatomy, pathology, and symptomology of CTS. CTS, as its name implies, is a condition involving the carpal tunnel.

The carpal tunnel is located in the volar aspect of the wrist. The tunnel's deep border is formed by the carpal bones. The superficial border is formed by the transverse carpal ligament which spans between the trapezium and scaphoid tuberosity laterally and the hamate and pisiform medially. The following structures are found in the carpal tunnel: 1) four tendons of the flexor digitorum superficialis, 2) four tendons of the flexor digitorum profundus, 3) tendon of the flexor pollicis longus, and 4) median nerve. The median nerve is the affected structure of interest in CTS.

Repeated or sustained flexion or extension of the wrist (biomechanical stress) causes tendon irritation and swelling which increases intra-tunnel pressure. This increased pressure causes direct compression of the median nerve. Median nerve compression that produces carpal tunnel syndrome can display a varied clinical presentation depending on the duration and extent of compression.

The clinical manifestations of CTS are motor weakness, sensory loss, tingling, numbness, and/or pain within the median nerve distribution at, and distal to, the tunnel. The median nerve's distribution (Figure 1)⁴ includes the volar aspect of the thumb, index and middle fingers, and the radial half of the

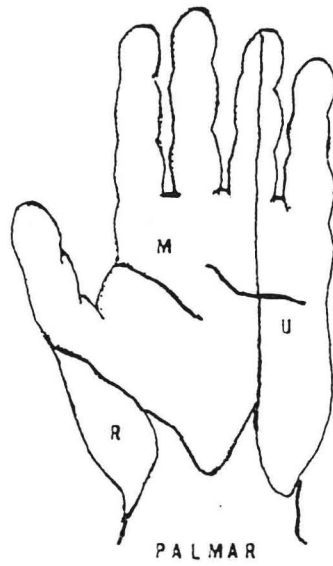
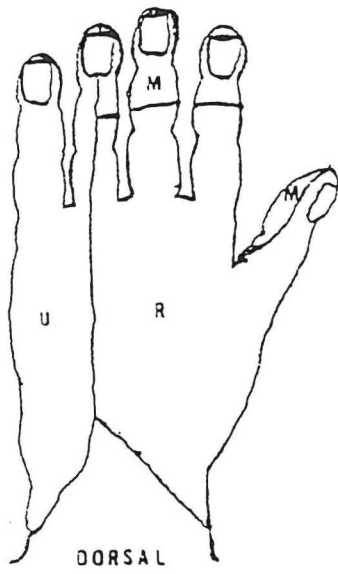


Fig 1.--Sensory mapping of the median nerve (M), radial nerve (R), and ulnar nerve (U) (from F. A. Davis Company)

ring finger. It also includes the most distal dorsal aspect of these same digits. The initial symptoms are numbness and/or tingling in the index and middle finger which frequently occurs at night. Thenar muscle weakness and atrophy develops as the condition progresses; hand pain may or may not be present. Referred pain in the elbow and shoulder is also possible in the advanced stages.⁵

Anatomy, Pathology, and Symptomology of Cervical Radiculopathy

The condition of cervical radiculopathy involves different structures and pathological processes than CTS, though symptoms may be similar. The following three paragraphs will briefly review the anatomy, pathology, and symptom picture of cervical radiculopathy before comparing this condition to CTS. Cervical radiculopathy, as its name implies, involves the cervical spine as the anatomic structure of interest.

The cervical spine consists of seven adjacent vertebrae that are connected via the facet joints posteriorly and the intervertebral disc anteriorly (below C₂ vertebral level). Each disc is composed of the gelatinous nucleus pulposus surrounded by the tough annulus fibrosis. The disc allows for movement between adjacent vertebrae and absorbs the forces transmitted through the spine. Bony projections at the posterior-superior margin of each of the lower five cervical vertebral bodies together with the adjacent vertebral body form the joints of von Luschka. These joints form a barrier to prevent the cervical disc from impinging the nerve root. The eight cervical nerve roots exit

the spine via the intervertebral foramen. The upper seven nerve roots exit the spine above their corresponding vertebral segments and the eighth nerve root exits below the C₇ vertebral level.

The nerve root is the structure most often implicated in cervical radiculopathy. The intervertebral discs, facet joints, and joints of von Luschka can all cause compression of the nerve root within the intervertebral foramen.⁶ Disc herniation, however, is the most frequent cause of compression and subsequent radiculopathy.⁷ Studies have distinguished between soft and hard disc herniations. Soft herniations involve a rupture of the nucleus pulposus. Hard herniations involve a hardened disc with subsequent bony ridge or a spur from the facet or von Luschka joint in the intervertebral foramen.⁸⁻¹⁰ Other causes of cervical radiculopathy besides disc herniation include trauma,¹¹ tumor,¹² and cerebral palsy.¹³

The upper extremity is divided into dermatomes (Figure 2),¹⁴ each supplied by a cervical nerve root. The C₆ dermatome covers the thumb and radial aspect of the forearm. The C₇ dermatome includes the middle three fingers and the middle one-third of the posterior forearm. The little finger and ulnar aspect of the wrist make up the C₈ dermatome. The sixth and seventh cervical nerve roots are the most frequently involved in cervical radiculopathy resulting from C₅₋₆ and C₆₋₇ disc herniations respectively.^{9,10,15} The symptoms of radiculopathy are dermatomal pain and/or paresthesia (numbness and tingling) and/or weakness in specific muscles.

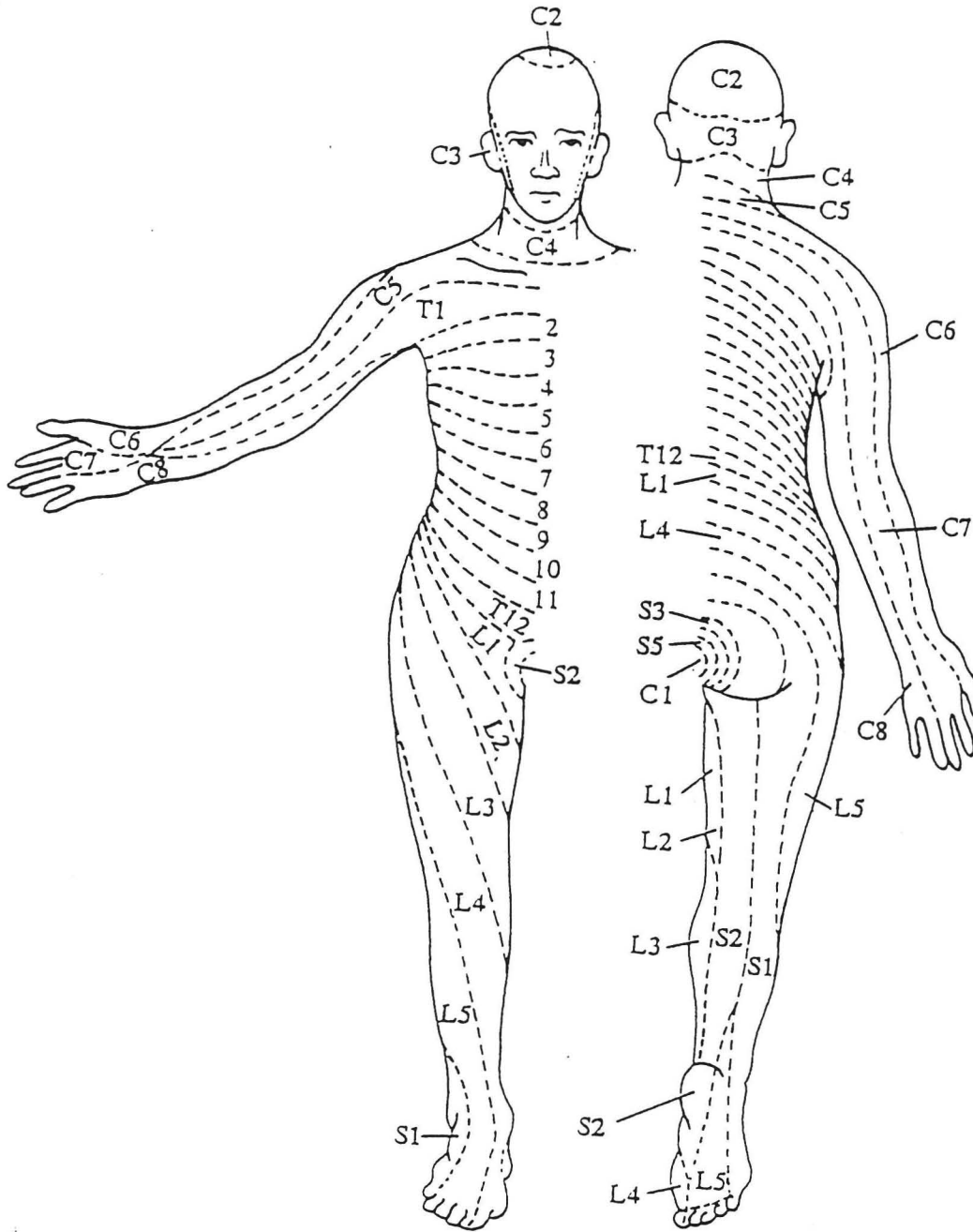


Fig 2.--Body dermatomes (from McGraw Hill)

Carpal Tunnel Syndrome Versus Cervical Radiculopathy

Carpal Tunnel Syndrome and Cervical Radiculopathy can both yield symptoms of pain, numbness, and/or tingling to the same aspect of the hand and fingers. This is possible because the median nerve distribution (Figure 1) is very similar to the C₆ and C₇ dermatomes (Figure 2) over the palm and fingers. The anatomy involved in each condition, however, is different. CTS involves the carpal tunnel, whereas cervical radiculopathy involves the cervical spine. The pathology of each is also different. CTS is caused by median nerve compression, whereas CR is caused by nerve root compression.

The clinician's treatment plan depends on the identified pathology. It is therefore of paramount importance that the clinician accurately identify the exact site of pathology when presented with hand and finger symptoms. Clinicians must be careful not to automatically assume CTS is present when another area may be at fault.

Even though similarities in symptomology exist between CTS and CR, the literature is devoid of studies that measure the presence and severity of hand and finger symptoms and then use objective tests to determine possible CTS and/or CR. The research questions of this study are: 1) What is the prevalence and severity of CTS symptoms in a given population for the two weeks before the screen? 2) What is the prevalence of positive objective tests for possible CTS and CR? and 3) Is there a correlation between wrist and cervical provocative test results and pre-screen symptom severity in the same

population? The purpose of the study is to both identify severity of symptoms and correlate symptom severity with objective measures.

Benefits of the Study

This study will benefit the employees of the city of Grand Forks, the city as an employer, physical therapists (especially those in occupational medicine), and other health professionals. The benefits to each entity will follow in the above order.

Each city employee who participates will benefit from knowing the City of Grand Forks as employer is concerned about his/her physical functioning on the job. Participation in screening programs such as this one will also benefit employees in early problem identification and timely treatment. Timely and appropriate treatment, however, depends on active employee participation in the screening or reporting process. If injured employees report symptoms, more can be done in the area of education and prevention when problem areas arise within an organization.

Employers can use screens for early identification and treatment purposes. Timely identification and treatment resulting in a faster return to work will decrease the employer's worker's compensation costs. Prevention strategies and educational programs can be properly designed and implemented with results from a screen. The City of Grand Forks will incorporate the results of this study into its risk management program, a program that is designed to benefit all employees through injury prevention and early problem identification.

Physical therapists must compare subjective and objective data before formulating an impression and making proper treatment plan decisions. This study will produce a correlation between objective test results and subjective symptom history that will benefit therapists in evaluating a patient with hand and finger symptoms and formulating an accurate impression. The provoked and pre-screen symptom prevalence results will remind therapists about the importance of clearing possible sites of pathology when presented with hand and wrist symptoms.

Physical therapists who work with organizations in work injury programs can use this study's methodology to facilitate early identification and treatment of CTS or cervical radiculopathy. Results from such a tool will assist the consulting therapist and organization in creating appropriate and effective prevention and education programs.

Doctors, nurses, and other health care professionals involved in occupational medicine will benefit from knowing the prevalence and correlation results as well. Physicians have the responsibility of making the initial patient diagnosis. Provoked symptom prevalence results from this study will provide information that physicians can use to augment their diagnosis of CTS. Nurses can use the results in patient education programs and injury prevention programs in the hospital, clinic, or industrial setting.

CHAPTER II

METHODS

In order to answer the three research questions presented in the previous chapter, a study was conducted with the employees of the City of Grand Forks. This chapter will present in order the study approval, subject profile, instrumentation, procedure, and data analysis.

Study Approval

The study was initially approved by the safety committee and the Mayor of the City of Grand Forks, ND (Appendix A). Following city approval, the Institutional Review Board (IRB) at the University of North Dakota reviewed and approved the study (Appendix B).

Subjects

Thirty subjects (25 male, 5 female), ages 24 to 58, without acute rheumatoid arthritis, fractures, or soft tissue injuries to the wrist or neck volunteered for this study. The subjects (Table 1) represented the Grand Forks City departments of sanitation, street maintenance, public transportation, wastewater, water treatment, engineering/inspections, finance, and assessing/planning. All of the subjects signed a statement of informed consent (Appendix B) prior to participation.

Table 1.—Subject Characteristics

VARIABLE	MEAN	STANDARD DEVIATION
Age	39.50	7.40
Years in Position	7.70	6.57
Job Hours/Week	39.90	2.11

Instrumentation

A five-item survey (Appendix C) allowed for demographic data collection. An 11-item symptom severity questionnaire¹⁶ (Appendix C) measured the severity of the subjects' hand and wrist symptoms prior to participation. Each subject's overall symptom severity score (individual mean score) was determined by adding the circled numbers and dividing the sum by 11. An associated body diagram (Appendix C) allowed subjects to localize areas of upper extremity symptom presentation prior to participation. The Phalen's test and McKenzie repeated and sustained cervical flexion tests were used to provoke symptoms of Carpal Tunnel Syndrome and Cervical Radiculopathy respectively. Each subject maintained both wrists in maximal flexion up to 60 seconds for the Phalen's CTS test. Numbness and/or tingling within the median nerve distribution indicated a positive result. The McKenzie repeated and sustained cervical flexion tests required the subjects to maximally flex the cervical spine up to 10 repetitions and hold a maximally flexed position for up to one minute respectively. These two tests were positive if numbness, tingling, and/or pain was reported in the upper extremity. Although no research in the literature addresses the reliability of these flexion tests, they are generally accepted by the physical therapy profession.

Procedure

After reading and signing the informed consent form, each subject was cleared for participation by absence of a current acute wrist or cervical condition

requiring medical care. Each subject then filled out the demographic survey, symptom severity questionnaire, and body diagram. Each subject was given a visual demonstration of and completed the Phalen's test, McKenzie repeated cervical flexion test, and McKenzie sustained cervical flexion test. A sufficient rest period was given for symptom dissipation following a positive test before progressing to the next test. Results of the tests (Appendix C) were immediately recorded below the demographic survey questions. Completion of the objective tests marked the end of subject participation in the study.

Data Analysis

Statistical analysis was performed using the Microsoft Excel software package. Descriptive statistical tools of frequency distribution, mean, and standard deviation were calculated on the demographic data. Prevalence of CTS and CR symptomology within this sample of employees from the City of Grand Forks was determined. A point-biserial statistic was calculated to determine the correlation between objective test results and symptom severity (individual mean) scores for all three provocative tests. The alpha level for correlation significance was set a priori at .05 and two-tailed (non-directional) tests for significance were used.

CHAPTER III

RESULTS

This brief chapter will report the results of the pre-screen symptom severity questionnaire, objective testing, and correlations. These results will answer the research questions presented previously.

Pre-Screen Symptom Questionnaire

Eleven subjects scored 1.0 on a scale of 1.0 to 5.0 with 1.0 being a complete lack of symptoms and 5.0 being the most severe symptoms (Appendix C). The scores of the 19 symptomatic subjects ranged from 1.27 to 3.09 with a mean of 2.03. Eighty-four percent (16/19) of the symptomatic subjects localized symptoms to their dominant hand.

Objective Tests

Forty-seven percent (14/30) had no positive tests and 53 percent (16/30) had at least one positive test (Table 2). A positive Phalen's test was by far the most common among the three tests. The ratio of positive Phalen's to positive sustained flexion was greater than 2:1.

Correlations

The correlation ($r = .752$) between Phalen's test results and symptom severity scores was significant ($df = 28, p < .01$). The correlation ($r = .418$)

Table 2.—Prevalence of CTS and CR Symptomology from Provocation Testing

POSITIVE TEST	FREQUENCY	PERCENT (%)
Phalen's only	10	33
Repeated Flexion only	0	0
Sustained Flexion only	2	6.7
Both Repeated and Sustained Flexion	1	3.3
Phalen's and Sustained Flexion	2	6.7
All Three	1	3.3
TOTAL	16	53

between sustained flexion test results and symptom severity scores was also significant ($df = 28, p = .022$). The correlation ($r = .312$) between repeated flexion test results and symptom severity scores was not significant ($df = 28, p = .094$).

CHAPTER IV

DISCUSSION

This chapter will present a discussion of the results of the symptom severity questionnaire, objective tests, and correlations. The chapter will conclude with the limitations of the study.

Symptom History

Approximately two-thirds of the subjects reported recent hand and finger symptoms. As they did not have an acute condition requiring medical intervention, the affected subjects were able to carry out the essential functions of their jobs in spite of their symptoms. An overall mean severity score of 2.03 (with 1.0 being asymptomatic and 5.0 being the most severe) for all symptomatic subjects signifies the severity on average was minimal. However, the fact that 63 percent were symptomatic with an overwhelming majority affected in their dominant hand provides ample justification for CTS and CR education and prevention programs.

Objective Tests

CTS symptoms were more prevalent than CR symptoms upon provocation. That is not surprising as the current overall prevalence of Carpal Tunnel Syndrome in the workplace makes it the most common cumulative

trauma disorder. Although this study did not compare the prevalence of diagnosed CTS and cervical radiculopathy, it did compare the prevalence of symptomology indicative of both conditions. A few subjects reported symptoms of both CTS and CR upon provocation. This phenomena was not anticipated prior to the study. It is possible but unusual for two pathological processes presenting with similar hand and finger symptoms to exist simultaneously.

Correlations

This study found a significant correlation between Phalen's test results and recent symptom severity. A positive Phalen's test was associated with nocturnal presentation and an increase in symptom duration, intensity, progression, and frequency as reported on the symptom severity questionnaire. A negative Phalen's result was associated with no symptoms or symptoms of limited severity. The Phalen's test was designed to assist in implicating CTS, and the questionnaire was created to measure the severity of CTS symptoms following a diagnosis. A significant correlation between Phalen's results and symptom severity scores, therefore, was highly likely given the purpose of both measures. The significant correlation between McKenzie sustained flexion test results and symptom severity scores demonstrate that the questionnaire could also be used to screen for CR. Although the symptom severity questionnaire was originally formed to measure the severity of symptoms in patients with diagnosed CTS, it may also implicate pathology originating from other

structures. Additional evaluation of these structures and appropriate therapeutic intervention based on the results would then be indicated.

Limitations of the Study

Margolis and Kraus¹⁷ reported a CTS symptom prevalence of 62.5% in a survey of female supermarket checkers. Their study focused on a specific job title with an increased risk for CTS problems. With only a limited number of employees from each Grand Forks City department, comparing symptom history across departments was not viable. This study also did not assess the subjects' job requirements in terms of physical demand and movement repetition. Much of the literature in cumulative trauma disorders focuses on theory, economic impact of CTDs, and the identification and elimination of potential or actual hazards (prevention). This study did not address any of these issues.

A 20% volunteer rate (30/150) was encouraging, but does not eliminate the possibility that the subjects constituted a biased sample of employees. Many subjects voluntarily expressed the desire to participate based on a previous medical history of hand and wrist symptoms. The only way to assure unbiased results in this study would have been to screen every city employee. Mandatory employee participation was not, however, an enforceable option in this situation. The consent form was also worded in such a way as to include all city employees, not just those with a history of wrist, hand, finger, and/or neck symptomology.

The prevalence rates and correlations in this study were not based on clinical evidence, but relied on self-reported symptoms in both the questionnaire and provocative testing. As with any form of self-reporting, the assumption of truthfulness in answering was made. This assumption must be made so as to preclude the presence of a confounding variable. Subjects were frequently encouraged to ask questions to ensure that lack of understanding would not confound the overall results.

CHAPTER V

CONCLUSIONS

A significant number of subjects from this sample of city employees reported hand and finger symptoms of varying severity. The presence of symptoms in the dominant hand within two weeks of the study has implications for Carpal Tunnel Syndrome and Cervical Radiculopathy education, prevention, and early identification components as part of the city's risk management program. There was a higher prevalence of positive Phalen's tests than the two McKenzie cervical flexion tests combined. This justifies a specific focus on CTS education and prevention within all city departments. Phalen's and McKenzie sustained cervical flexion test results were significantly correlated with recent symptom severity. These correlations can assist the physical therapist in clinical decision-making with a patient presenting with hand and finger symptoms. It can also serve as a guide to other physical therapists and students doing future research in occupational medicine.

Future studies with a larger sample size could compare hand and finger symptoms across job titles with various and unique physical requirements. Studies could also be done with a larger sample to determine the correlation between years employed in a current position and the severity of hand and

finger symptoms. This research was an initial pilot study, thereby creating ideas for future research in the area of occupational hand and finger symptom presentation.

APPENDIX A



City of Grand Forks

255 North Fourth Street • P.O. Box 5200 • Grand Forks, ND 58206-5200

(701) 746-2665

FAX# (701) 772-0266

MEMO

To: Physical Therapy Department, UND
From: Dan Gordon, Director
Date: Friday, September 29, 1995
Subject: Thesis Study, Duane Kukuk

This letter is to verify that the City of Grand Forks supports the study to be conducted by Duane Kukuk in his efforts to complete his thesis.

All participants to this study have volunteered their time. The assessment to be completed by Duane is a valuable tool for the City's Safety Program, as well as a personal benefit to the individual employees involved.

Please call 746-2667 if you have any questions.

APPENDIX B

EXPEDITED REVIEW REQUESTED UNDER ITEM 7 (NUMBER] OF HHS REGULATIONS
 EXEMPT REVIEW REQUESTED UNDER ITEM _____ (NUMBER] OF HHS REGULATIONS

UNIVERSITY OF NORTH DAKOTA
HUMAN SUBJECTS REVIEW FORM
FOR NEW PROJECTS OR PROCEDURAL REVISIONS TO APPROVED
PROJECTS INVOLVING HUMAN SUBJECTS

PRINCIPAL INVESTIGATOR: William D. Kukuk Jr TELEPHONE: 795-9849 DATE: 10-2-95

ADDRESS TO WHICH NOTICE OF APPROVAL SHOULD BE SENT: 113 Northwestern Drive, G. Forks, ND, 58203

SCHOOL/COLLEGE: Medical School DEPARTMENT: Physical Therapy PROPOSED PROJECT DATES: Sept, 1995 - Feb, 1996

PROJECT TITLE: A wrist and cervical screening of Grand Forks City Employees: A Pilot Study.

FUNDING AGENCIES (IF APPLICABLE): N/A

TYPE OF PROJECT: _____ NEW PROJECT _____ CONTINUATION _____ RENEWAL DISSERTATION OR THESIS RESEARCH _____ STUDENT RESEARCH PROJECT
_____ CHANGE IN PROCEDURE FOR A PREVIOUSLY APPROVED PROJECT

DISSERTATION/THESIS ADVISER, OR STUDENT ADVISER: Renee Mabey

PROPOSED PROJECT: _____ INVOLVES NEW DRUGS (IND) _____ INVOLVES NON-APPROVED USE OF DRUG _____ INVOLVES A COOPERATING INSTITUTION

IF ANY OF YOUR SUBJECTS FALL IN ANY OF THE FOLLOWING CLASSIFICATIONS, PLEASE INDICATE THE CLASSIFICATION(S):

MINORS (<18 YEARS) PREGNANT WOMEN MENTALLY DISABLED FETUSES MENTALLY RETARDED
 PRISONERS ABORTUSES UND STUDENTS (>18 YEARS)

IF YOUR PROJECT INVOLVES ANY HUMAN TISSUE, BODY FLUIDS, PATHOLOGICAL SPECIMENS, DONATED ORGANS, FETAL MATERIAL, OR PLACENTAL MATERIALS, CHECK HERE _____

1. ABSTRACT: (LIMIT TO 200 WORDS OR LESS AND INCLUDE JUSTIFICATION OR NECESSITY FOR USING HUMAN SUBJECTS.

Cumulative Trauma Disorders (CTDs) developed at work are caused by repetitive movements or sustained postures. Carpal Tunnel Syndrome (CTS) and cervical radiculopathy are both CTDs resulting from repetitive wrist movements and sustained neck postures respectively. Both conditions may produce hand and finger weakness, tingling, numbness, sensory loss, and/or pain. The Phalen's test and McKenzie cervical flexion tests are used to check for CTS and cervical radiculopathy respectively. The literature is void of studies correlating results of these tests with patient symptomology mentioned above. The research questions are: 1) What is the relative prevalence of CTS and Cervical Radiculopathy in a given population?; and 2) Is there a strong correlation between wrist and cervical test results and pre-screen symptom severity in the same population?
To answer these questions, Grand Forks' city employees will be screened using three provocative tests, a demographic survey, and a symptom questionnaire. The Safety Committee of the City of Grand Forks will incorporate the results into its risk management program. The results will benefit physical therapists in clinical decision-making and working with companies in risk management. As this screening necessitates appropriate feedback to the tests and surveys, the use of humans is necessary.

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

This study will include Grand Forks city employees from the departments of streets, sanitation, water treatment, bus services, finance, planning, and administration. Their voluntary participation will follow the reading and signing of the enclosed consent form.

Procedure

Each subject will read and sign the consent form. If the subject does not have any current acute condition that would contraindicate participation, he/she will then fill out the enclosed 5 item demographic survey, complete the 11 item symptom severity scale, and shade in the body diagrams in that order. The body diagrams and symptom severity scale will indicate the presence, location, and severity of symptoms within the previous two weeks. The last part of the screen will involve the use of the Phalen's test and the McKenzie repeated and sustained cervical flexion tests. The Phalen's test will require the subject to put the backs of the hands together in front of the body for up to sixty seconds. Numbness and/or tingling in the hand and/or fingers will indicate a positive test result. The test result will be recorded on the enclosed data form. The repeated cervical flexion test will require the subject to bend the neck as far forward as possible and then back up to ten times. A positive result will be indicated by pain, numbness, and/or tingling between the shoulder and the fingers. The sustained cervical flexion test will require the subject to bend the neck as far forward as possible and hold that position for up to sixty seconds. A positive test result is the same as the repeated flexion test. The conclusion of the sustained test marks the end of the subject's participation in the study.

Data Collection

All Data will be collected at the Grand Forks City Human Resource Department. The screening tool attached to this form will serve as the data collection instrument. All information pertinent to this study will be taken from the tool.

Data Analysis

The data in aggregate will first be analyzed using the descriptive statistical method of frequency distribution. Correlative inferential statistics will also be run on the entire data set to determine relationship between objective and subjective results.

Data Sharing

The overall results of the study will be given to the City of Grand Forks upon completion for incorporation into the City's risk management program.

3. BENEFITS: (Describe the benefits to the individual or society.)

Employees in a wide variety of occupations experience upper extremity pain, tingling, and numbness during the course of a typical work day. Though the setting and job tasks may vary, the self-reported symptomology may be similar in location, frequency, duration, and intensity. This study will use a simple screening tool that the City of Grand Forks may wish to incorporate as part of their risk management program.

The City of Grand Forks will benefit from the results of this study and the use of this early intervention screen and questionnaire by; 1)potentially reducing the number of work days missed, 2)limiting the premiums paid to the workman's compensation bureau, and 3)increasing employee morale and overall productivity. The City and its human resource department will also benefit in knowing it is an active participant in the overall safety and welfare of the employees.

The employees will benefit from knowing that their employer is concerned about their overall physically functioning on the job. Knowing that this study will play a role in the City's risk management program will benefit the employees. The risk management program is ultimately for their benefit.

Physical therapists in the clinical decision-making process must compare the subjective and objective data before making proper treatment plan decisions. This study will produce a correlation between the objective test results and the self-reported symptom history that will benefit therapists in evaluating a patient with hand and finger symptoms. Physical therapists that work with organizations in work injury programs can use this simple screening tool in early identification of possible cumulative trauma disorders.

Society will also benefit if more employers were to use this study tool and results in the implementation of an early screening/identification program for affected employees. Upper extremity symptomology on the job is a growing public issue in the work place, not a private problem.

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 psycho-logical, 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 Phalen's test and Mckenzie's repeated and sustained cervical flexion tests are both tools at the disposal of the therapist during the course of evaluation and treatment. They are standardized tests that are generally recognized by the physical therapy community at large. The employees in this screening may or may not experience symptoms. If they do, the severity of the symptoms should not exceed that typically experienced in the work setting. All subjects will be instructed prior to the actual screening to stop during either test if symptoms become excessive. Subjects that are currently experiencing an acute bout of rheumatoid arthritis or are recovering from a wrist, forearm, or cervical pathology or fracture will be asked to forego participation. Each subject will perform the provocative tests alone behind a portable divider to prevent embarrassment

The principal investigator will collect all research data and encode it to ensure confidentiality. The principal investigator and his advisor will have sole access to this information stored via computer disk. The data will in no way be used to identify any subject in the study and will not jeopardize the participant's employment status.

- 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.

The consent forms will be kept in a locked file in the UND PT department for seven years after which they will be properly destroyed. A copy of the informed consent form is attached to this form.

- 6. For FULL IRB REVIEW forward a signed original and thirteen (13) copies of this completed form, and where applicable, thirteen (13) 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.

The 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.

SIGNATURES:

William D. Kurkuk J.
 Principal Investigator

DATE: October 2, 1995

Renee Malvey
 Project Director or Student Adviser

DATE: 10-2-95

Training or Center Grant Director

DATE: _____

INFORMATION AND CONSENT FORM

Title: A Wrist and Cervical Screening of Grand Forks City Employees: A Pilot Study

You are invited to participate in a study conducted by Duane Kukuk, a Graduate Student in the Physical Therapy Department at the University of North Dakota. The purpose of this study is to compare neck and wrists movements with symptoms, if any, over the past two weeks. I want to see if there are any strong relationships between the movements and the symptoms or lack thereof. You will help physical therapists make better patient care decisions with an understanding of these relationships.

You will be asked to do four things in the following order: 1) fill out a 5 item survey; 2) complete the 11 item questionnaire; 3) shade in areas where symptoms occurred over the past two weeks; and 4) participate in the three tests. On the survey you will indicate your age, gender, dominant hand (left/right), duration of employment in present position, and hours worked per week. You will then complete the 11 item questionnaire and shade in areas where you have experienced symptoms, if any, over the last two weeks. Your participation in the study will conclude after performing three tests. Test #1 will require you to put the backs of your hands together in front of you for up to 60 seconds. Test #2 will require you to bend your neck as far forward as you can and then back up to ten times. Test #3 will require you to bend your neck as far forward as you can and then hold that position for up to 60 seconds. All tests will be demonstrated by the investigator prior to the actual trial. Please ask questions if any part of the screening is unclear.

Each test will be terminated early if you feel you cannot continue due to discomfort. The investigator does not anticipate discomfort greater than that experienced by you at work. Your name will not be used in any reports of the results of this study. All information obtained in this study will remain confidential. The data will in no way be used to identify you in the study and will not jeopardize your employment status. If you decide to participate, you are free to discontinue participation at any time without prejudice. You will not receive any compensation for your participation. This study will take approximately 10-15 minutes of your time. If you have any questions concerning this study, you may call Dr. Renee Mabey at 777-2831.

ALL OF MY QUESTIONS HAVE BEEN ANSWERED AND I AM ENCOURAGED TO ASK ANY QUESTIONS THAT I MAY HAVE CONCERNING THIS STUDY IN THE FUTURE. MY SIGNATURE INDICATES THAT, HAVING READ THE ABOVE INFORMATION, I HAVE DECIDED TO PARTICIPATE .

I have read all of the above and willingly agree to participate in this study explained to me by _____.

Participant's Signature

Date

Signature of Witness

Date

32
UNIVERSITY OF NORTH DAKOTA'S
INSTITUTIONAL REVIEW BOARD

DATE: October 2, 1995 PROJECT NUMBER IRB-9510-038
NAME: William D. Kukuk, Jr. DEPARTMENT/COLLEGE Physical Therapy
PROJECT TITLE: A Wrist and Cervical Screening of Grand Forks City Employees: A
Pilot Study

The above referenced project was reviewed by a designated member for the University's Institutional Review Board on October 4, 1995 and the following action was taken:

- Project approved. EXPEDITED REVIEW NO. 7.
Next scheduled review is on October 1996.
- Project approved. EXEMPT CATEGORY NO. . No periodic review scheduled unless so stated in REMARKS SECTION.
- Project approved PENDING receipt of corrections/additions in ORPD and approval by the IRB. This study may NOT be started UNTIL IRB approval has been received. (See REMARKS SECTION for further information.)
- Project approval deferred. This study may not be started until IRB approval has been received. (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.

cc: Dean, Medical School
R. Mabey, Adviser

Jim Corley ml
Signature of ~~Chairperson~~ or designated IRB Member
UND's Institutional Review Board

10/4/95
Date

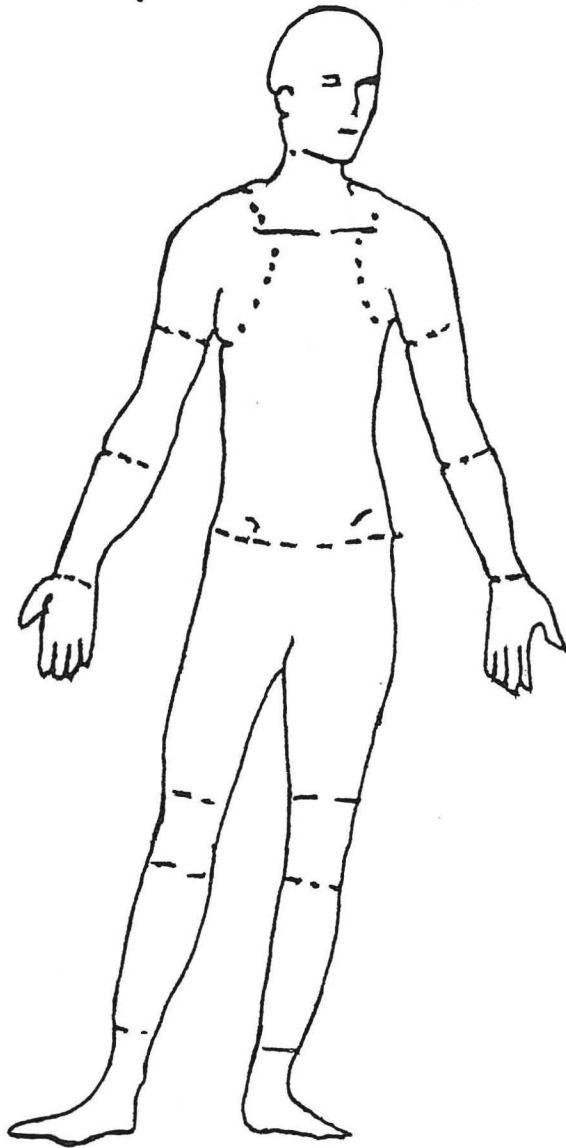
If the proposed project (clinical medical) is to be part of a research activity funded by a Federal Agency, a special assurance statement or a completed 596 Form may be required. Contact ORPD to obtain the required documents. (7/93)

APPENDIX C

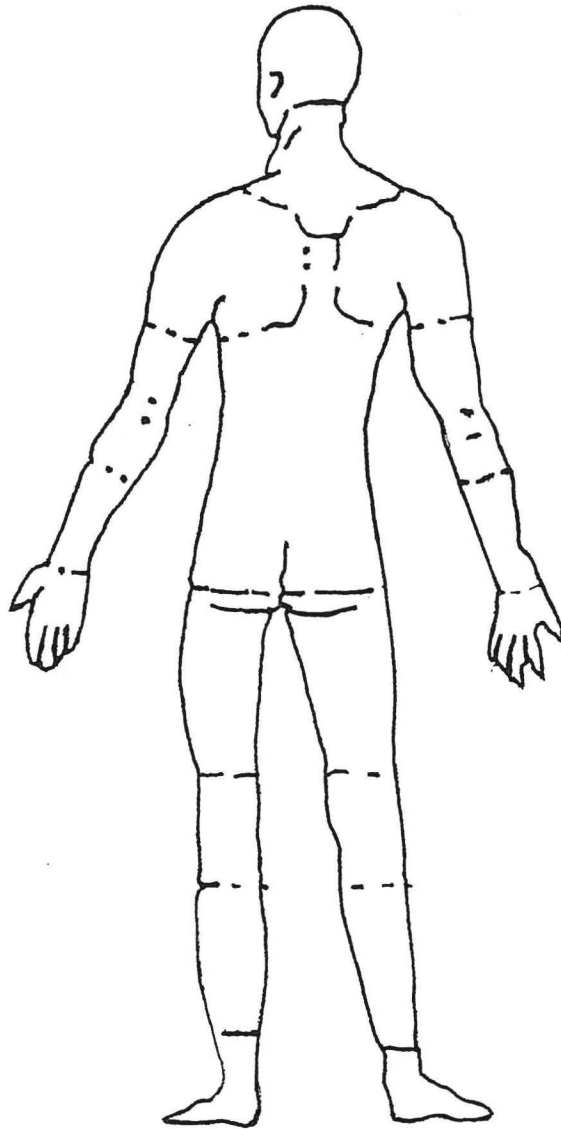
ID # _____

- 1. Age _____
- 2. Gender M F
- 3. Dominant Hand R L
- 4. How long have you worked in your present position in years and months? Years _____
Months _____
- 5. How many hours a week do you work in your present position on average? _____
- 6. Phalen's: pos neg Sustained: pos neg Repeated: pos neg
L R L R L R

If you have experienced any symptoms within the last two weeks, please carefully shade in the area of the drawing which bothers you the MOST.



Front



Back

_____ Please check here if you have not experienced any symptoms within the last two weeks.

The following questions refer to your symptoms for a typical twenty-four hour period during the past two weeks (circle one answer to each question).

1. How severe is the hand or wrist pain that you have at night?
 - 1 I do not have hand or wrist pain at night
 - 2 Mild pain
 - 3 Moderate pain
 - 4 Severe pain
 - 5 Very severe pain

2. How often did hand or wrist pain wake you up during a typical night in the past two weeks?
 - 1 Never
 - 2 Once
 - 3 Two or three times
 - 4 Four or five times
 - 5 More than five times

3. Do you typically have pain in your hand or wrist during the daytime?
 - 1 I never have pain during the day
 - 2 I have mild pain during the day
 - 3 I have moderate pain during the day
 - 4 I have severe pain during the day
 - 5 I have very severe pain during the day

4. How often do you have hand or wrist pain during the daytime?
 - 1 Never
 - 2 Once or twice a day
 - 3 Three to five times a day
 - 4 More than five times a day
 - 5 The pain is constant

5. How long, on average, does an episode of pain last during the daytime?
 - 1 I never get pain during the day
 - 2 Less than 10 minutes
 - 3 10 to 60 minutes
 - 4 Greater than 60 minutes
 - 5 The pain is constant throughout the day

6. Do you have numbness (loss of sensation) in your hand?
- 1 No
 - 2 I have mild numbness
 - 3 I have moderate numbness
 - 4 I have severe numbness
 - 5 I have very severe numbness
7. Do you have weakness in your hand or wrist?
- 1 No weakness
 - 2 Mild weakness
 - 3 Moderate weakness
 - 4 Severe weakness
 - 5 Very severe weakness
8. Do you have tingling sensations in your hand?
- 1 No tingling
 - 2 Mild tingling
 - 3 Moderate tingling
 - 4 Severe tingling
 - 5 Very severe tingling
9. How severe is numbness (loss of sensation) or tingling at night?
- 1 I have no numbness or tingling at night
 - 2 Mild
 - 3 Moderate
 - 4 Severe
 - 5 Very Severe
10. How often did hand numbness or tingling wake you up during a typical night during the past two weeks?
- 1 Never
 - 2 Once
 - 3 Two or three times
 - 4 Four or five times
 - 5 More than five times
11. Do you have difficulty with the grasping and use of small objects such as keys or pencils?
- 1 No difficulty
 - 2 Mild difficulty
 - 3 Moderate difficulty
 - 4 Severe difficulty
 - 5 Very severe difficulty

APPENDIX D

Duane Kukuk
113 Northwestern Drive
Grand Forks, ND, 58203

October 25, 1995

Mr. Jean-Francois Vilain
F.A. Davis Company
1915 Arch Street
Philadelphia, PA 19103

Dear Mr. Vilain:

I am writing to request permission to photocopy or reproduce a specific figure in the book Hand Pain and Impairment, third edition, by Rene Cailliet, M.D. The figure listed below would be used in my Independent Study Report as part of the requirements for the master of Physical Therapy degree at the Univ. of North Dakota in Grand Forks, ND. This figure will appear in 5 hard bound copies of the finished Study Report.

Reprint request:

Hand Pain and Impairment, third edition
Cailliet, 1982

Page 85: Figure 83. Sensory mapping of the peripheral nerves.

The copies would be used only for a scholarly purpose in which due recognition shall be given to F.A. Davis Company.

Sincerely,

Duane Kukuk

Duane Kukuk, B.S.P.T.
Student

Approval is given to Duane Kukuk for copying of the above figure for scholarly purposes as outlined above.

R. Cailliet, Publisher
Jean-Francois Vilain
F.A. Davis Company
1915 Arch Street
Philadelphia, PA 19103

10 30 95

Duane Kukuk
113 Northwestern Drive
Grand Forks, ND, 58203

September 14, 1995

Steve Tilton
The Journal of Bone and Joint Surgery, Inc.
20 Pickering Street
Needham, MA 02192

Dear Mr. Tilton:

I am writing to request permission to photocopy or reproduce a specific table in The Journal of Bone and Joint Surgery. The table listed below would be used in my Independent Study Report as part of the requirements for the master of Physical Therapy degree at the Univ. of North Dakota in Grand Forks, ND.

Reprint request:

The Journal of Bone and Joint Surgery
Volume 75-A, Number 11, November 1993
From the investigation performed at the Brigham and Women's Hospital, Harvard Medical School,
Boston, Massachusetts

Table 1 page 1586: Symptom Severity Scale

The copies would be used only for a scholarly purpose in which due recognition shall be given to The Journal of Bone and Joint Surgery.

Sincerely,

Duane Kukuk

Duane Kukuk, B.S.P.T.
Student

Approval is given to Duane Kukuk for copying of the above table for scholarly purposes as outlined above.

Stephen Tilton

Steve Tilton
The Journal of Bone and Joint Surgery, Inc.
20 Pickering Street
Needham, MA 02192



TO: Duane Kukuk, B.S. P. T.
113 Northwestern Drive
Grand Forks, ND 58203

Date: December 21, 1995

Invoice Number: 19556

Fee: \$0.00

The McGraw-Hill Companies material requested:

Title: REVIEW OF NEUROSCIENCE, 2E(1988)

Author(s): Pansky, A

Specific material: Figure.: Dermatomes of Body on page 73 only.

For inclusion in:

Title: A WRIST AND CERVICAL SCREENING OF GRAND FORKS CITY EMPLOYEES

Author(s): Duane Kukuk, B. S. P. T.


Publisher: Univ. of North Dakota

Publication Date: 1996

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By:


Ann Irons

Permissions Department

Agreed and accepted by:

Name and title: William Duane Kukuk Jr, B.S. P.T

Publisher: University of North Dakota

Authorized Signature: William D. Kukuk Jr. Date: January 1, 1996

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