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Correlation Between Isokinetic Plantarflexion versus Vertical Height Jump Power Index

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CORRELATION BETWEEN ISOKINETIC PLANTARFLEXION VERSUS VERTICAL HEIGHT JUMP POWER INDEX

by

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Bachelor of Aeronautical Studies
University of North Dakota, 1991
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University of North Dakota, 1996

An Independent Study

Submitted to the Graduate Faculty of the

Department of Physical Therapy

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1997

This Independent Study, submitted by Eric H. Anderson 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 — Correlation Between Isokinetic Plantarflexion Versus Vertical Height Jump Power Index

Department — Physical Therapy

Degree — Master of Physical Therapy

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Signature Eric A Anderson

Date 12/10/96

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I would like to thank the University of North Dakota Physical Therapy faculty, especially Mark Romanick, for their advising in the completion of this independent study. I would also like to thank my family for their never-ending love, support, and guidance through the years; whose belief in my ability has kept me going. Finally, a special thanks to Karla Glick, whose patience and help has been invaluable. I have enjoyed my experience at UND and wish the best to all of my classmates. Life is rich and we are wealthy souls.

ABSTRACT

Twenty-five male subjects between the ages of 20 and 41 were tested on the Kin-Com isokinetic dynamometer to obtain peak torque values for the bilateral ankle plantarflexor muscle groups at 60 degrees/second. The subjects were also tested for vertical height jump (VHJ) and body composition to determine corelation between isokinetic plantarflexion peak torque and vertical height jump capacity.. VHJ was multiplied by the participant's body weight to obtain the vertical height jump power index (VHJPI). The results indicate that there was no significant correlation between VHJPI and peak torque of bilateral plantarflexion using the parameter of isokinetic peak torque.

CHAPTER I

INTRODUCTION

In today's managed care environment, insurance companies are demanding functional outcomes for their patients. This places high demands on researching and practicing physical therapists to use the most reliable and valid protocols for assessing and treating a variety of injuries and other conditions. Several studies[1,2,3,4,5] indicate that isokinetic apparatuses are reliable instruments for muscle evaluation and rehabilitation and are effective for the purpose of obtaining torque values about various joints. It is especially convenient for the comparison of the uninvolved extremity to the involved extremity.

Functional rehabilitation of an injured extremity often incorporates isokinetics into the rehabilitation process. Isokinetic, isotonic, and isometric strengthening exercises are used to return the patient to a previous functional level, however, there is some debate as to whether isokinetic devices are more beneficial in producing functional strength gains than isotonic exercises.[6] The literature fails to identify whether the measurements of torque or percent strength gain accurately reflect an estimate of functional strength.[7,8] However, one study did report an increase in the two-legged vertical height jump (VHJ) of 5.4% following high velocity isokinetic strength training and an increase of 3.9% at low velocity isokinetic strength training.[8] The same study demonstrated only a minimal increase of 1.9% for the isotonic group.

In a study by Barber et al[9] the effectiveness of using one-legged hop distance, one-

legged vertical jump, one-legged timed hop, shuttle run with pivot, and shuttle run without pivot tests in determining lower extremity functional limitations in the anterior cruciate ligament (ACL) deficient knees was determined. The study demonstrated a statistically significant relationship between the 60 degrees/sec quadriceps percentage deficit scores (abnormal scores on quadriceps strength test) and abnormal symmetry scores in one-legged hop distance test ($p<.01$).

Noyes et al[10] examined alterations in lower limb function in ACL deficient knees by using four different types of one-legged hop tests. The study showed a statistically significant trend using low velocity isokinetic tests and the hop tests.

Another study that reviewed 13 different complications of ACL reconstruction surgery found the complications to be interrelated.[13] The three most common complications were flexion contracture, patellofemoral irritability, and quadriceps weakness. The Cybex (Division of Lumex Inc., Ronkonkoma, NY, 11779) was used for isokinetic strength testing at 60 degrees/sec. The quadriceps index was calculated using peak torque of the weaker leg divided by the peak torque of the stronger leg, multiplied by 100. This strength index was positively correlated with hop index ($p<.001$). The hop index is the lesser average distance divided by the greater average distance, multiplied by 100.

Others have reported no correlation between isokinetic test results and athletic performance such as sprinting, jumping, and agility drills.[12,13] All of those investigations chose to utilize peak torque parameters of isokinetic testing of the knee musculature in their projects.

One study demonstrated a positive correlation between concentric knee extension peak torque at 180 degrees/sec and the timed hop, the hop for distance, and the triple cross-over hop.[14] At speeds of 300 and 450 degrees/sec, a statistical trend was evident.

The correlation was positive, but it was less significant. This study also demonstrated a positive correlation between knee extensor peak torque at 180 degrees/sec and 300 degrees/sec and the patients' subjective knee assessment scores.

Muscle contractions are defined in two ways, static (isometric) and dynamic (isotonic and isokinetic).[15] During isometric contractions, the length of a muscle remains constant. Isotonic, which literally means "same tension", is a confusing term since the tension is variable throughout the range of motion (ROM) due to the limb segment moving and leverage forces changing. Isotonic contraction produces shortening or lengthening throughout the ROM. When the muscle shortens, it is referred to as a concentric contraction, a contraction during which the tension of the shortened muscle may vary throughout the movement. When the muscle lengthens, an eccentric contraction has occurred, and the tension of the lengthened muscle may also vary throughout the movement.

Isokinetic contractions are dynamic in nature and can be concentric or eccentric.[16,17] This type of contraction lacks acceleration and speed is held constant. In order to achieve this outcome, it is vital to have an external means of keeping the speed of body movements at constant rates regardless of the amount of force applied by a body segment. The resistance encountered will vary with the force applied by the body segment. As a result of this characteristic of isokinetics, the tension developed by a muscle group exercising isokinetically can be maximized at all joint angles throughout the ROM. This variable resistance is sometimes referred to as accommodating resistance.

The concept of isokinetic exercise was described by Hislop and Perrine[18] in the late 1960's. They discussed principles of load, resistance, and speed and their relationship to isokinetic contractions. Load is not a conventional agent such as gravity or

friction. It comes from a mechanical process of energy absorption performed by the dynamometer of the isokinetic machine. The resistance of isokinetic exercises, with its accommodating design, can allow for maximal muscle capacity at end range of motion where the muscles have their least mechanical advantage, by offering less resistance while at a constant velocity. The speed of isokinetic exercises can be set close to the speed of a functional activity. It should be noted that there is a limit to the speed of this device. Currently, the maximum velocity commercially available is 500 degrees/sec.[19] There are many activities that occur outside the range of current isokinetic dynamometers.[18] One example of this is the velocity at the knee during a soccer kick, which was measured at 1200 degrees/sec.[19]

An isokinetic dynamometer is an electromechanical instrument containing a rate-limiting device that accelerates to a preset velocity when a force is applied. The loading mechanism accommodates automatically. The isokinetic dynamometer apparatus has the means to monitor the immediate level of generated force and relays this information to the appropriate recording apparatus. Isokinetic dynamometers come with a variety of software programs that allow for variable types of resistance, velocity limits, and differing load limits.

There are many advocates for isokinetic exercises.[16] The proponents of isokinetic exercises believe that neurophysiologic "patterning" can be produced for function in specific sports. Secondly, the exercise can be done at faster speeds and thus are more closely representative of functional activities. Thirdly, maximal resistance is provided throughout ROM regardless of the velocity of the dynamometer. Finally, the accommodating resistance produces maximal dynamic load throughout the ROM. In other words, the exercise can simulate the speed and motion of a particular movement of a sport.

The purpose of this paper was to address the question of functionality of isokinetic exercises, specifically in regard to isokinetic ankle plantarflexion torque and the VHJ. Isokinetic testing of plantarflexion in concentric/concentric protocol was compared to the vertical height jump power index (VHJPI), the product of weight and vertical height jump.

CHAPTER II

REVIEW OF LITERATURE

Many strength and conditioning programs use the VHJ test to measure the physiological adaptations that result from training.[20] The VHJ test is also used as a measure of lower extremity power or function. The muscle groups involved with VHJ include the extensors of the hip, knee, and ankle. Each muscle group contributes in varying proportions. The hip extensors are reported to contribute 40% of overall VHJ performance, the knee extensors provide 24.2%, and the ankle has the remainder of 35.8%.

One study using 48 students from Western Illinois University demonstrated that the performance of the VHJ can be improved through high speed (two m/sec) isokinetic training.[21] The training schedule was three times per week for six weeks utilizing two sets of 10 repetitions, two sets of 20 repetitions, and two sets of 30 repetitions.

Isokinetics are only one means to the end of improved VHJ. Anderson and Hedrick[20] concluded that resistive training of a heavy (powerlifting) or explosive (weightlifting) nature can increase vertical height jump effectuation. Plyometrics can also increase vertical height jump performance. In their study, it was shown that the resistive training and plyometrics employed in combination were the most effective and efficient performance enhancing activities for vertical jump.

Isokinetic evaluation uses various parameters of force and torque to record strength differences between extremities. One problem in isokinetics literature is that

strength of musculature is defined in a variety of ways making comparison difficult. Prentice[22] defines strength as "the ability of a muscle to generate force against some resistance." O'Sullivan[23] defines it as "the ability of a muscle to produce tension necessary for the initiation of movement, control of movement, or maintenance of postures." Heyward[24] defines it as "the ability of a muscle group to exert maximal contractile force against." Torque is a force which acts about an axis of rotation. Force times its perpendicular distance from the center of rotation equals torque, which has units of ft-lbs or N-m.

Torque parameters found in the literature refer to either peak torque or average torque. Peak torque is the highest torque generated at one point in the ROM.[18,19] As the speed of contraction increases, the time to peak torque increases. Average torque reflects the mean torque production throughout the ROM.[25] Peak and average torque can be adjusted for body weight by some dynamometers.[19]

The isokinetic torque curve provides a continuous record of torque throughout the available ROM. A normal concentric isokinetic torque curve reflects the amount of force produced by the muscle on the vertical axis and ROM through which the joint was tested on the horizontal axis.[26] The curve always begins and ends at the baseline of zero, which differs from isometric contractions plotted at various joint angles. Isometric torque curves use torque on the vertical axis and a particular ROM on the horizontal axis. There is no movement with this type of contraction; therefore, the torque always has a positive value.[27] At slow speeds of 10 degrees/sec to 30 degrees/sec, maximum isokinetic torque values mirror isometric values. At faster speeds of 30 degrees/sec to 210 degrees/sec, the isokinetic curves are altered, with a decrease in the amount of torque produced at each point in the ROM.[28]

An accurate interpretation of an isokinetic evaluation requires a thorough understanding of the force-velocity curve. Concentric force is greatest at slow isokinetic velocities. When the excitation-contraction coupling mechanism is activated, myosin binds to actin as the inhibitory factors on the actin binding site are removed through the release of calcium.[26] Potential energy is transformed into mechanical energy after the attachment of the myosin head to the actin site has occurred. This produces tension in the muscle. As velocity of the concentric contraction increases, fewer cross bridges between the actin and myosin are formed. The net result is a decrease in the amount of force (energy) in this system.

Plantarflexion of the ankle is performed mainly by the triceps surae.[29] The triceps surae are the gastrocnemius, soleus, and plantaris muscles. These muscles have excellent leverage and a large cross-sectional area for plantarflexion. Accessory muscles that do not produce significant plantarflexion force are the peroneus longus, peroneus brevis, tibialis posterior, flexor hallucis longus, and flexor digitorum longus.

The gastrocnemius is a biarticular muscle and has an attachment of its two heads above the axis of the knee. This anatomical feature makes it a more effective plantarflexor when the knee is extended. The large angle of pull of approximately 90 degrees helps the gastrocnemius develop a great amount of force.[30] The equilibrium point hypothesis states that the force produced by each muscle is a function of the muscle's length and joint angle.[31] Therefore, both joint angles play a role in the length of biarticular muscles. With the knee extended, this joint position increases the length of the gastrocnemius which allows for greater muscular contraction potential. The functions of the gastrocnemius and soleus were investigated by Herman and Bragin.[31] Six normal subjects were tested in the prone position with the knee extended to examine electromyo-

graphy (EMG) activity and muscle tension. Gastrocnemius EMG activity was observed to be greatest when the ankle was plantarflexed, when contractions were maximal, and when tension developed rapidly. In running and jumping[28,29,32] the gastrocnemius is important because its muscle fibers have the ability to produce a rapid rise in tension. The soleus was most active in positions of ankle dorsiflexion and when contractions were minimal. This indicates that the soleus may be more active in maintaining balance during erect standing than the gastrocnemius.

CHAPTER III

METHODOLOGY

Subjects

Healthy male (n=25) college physical therapy, occupational therapy, and medical students at the University of North Dakota were recruited to take part in the study. The level of physical activity varied from recreational athletes to weightlifters. The Institutional Review Board at the University of North Dakota set standards for this human subjects study. The subjects were accepted on the basis of no current ankle sprain or ankle instability, no pathology of lower extremity that would limit ROM or strength. The subjects ranged in age from 20 to 41 years, with a mean of 26.56 (SD=6.23). All subjects were informed of procedures and testing protocol. Participants signed a statement of informed consent prior to participation in this research project.

Instrumentation

The Kin-Com AP with software version 5.16 (Chattanooga Corporation, Chattanooga, TN) uses a load cell mounted on the machine arm for the purpose of measuring force. Distance measurements from the load cell to the dynamometer arm axis must be made accurately in order to obtain valid torque calculations. Force, rather than torque, is measured by the apparatus. The device utilizes a load cell for force measurements. The lever arm length is entered into the computer, which allows torque calculations to be

made. It is important for the axis of rotation of a body segment and the axis of the dynamometer to be properly aligned in order to reduce errors in the torque calculations. As a consequence of improper alignment, the muscle performance will not be accurately portrayed.[33] In theory, isokinetic strength training permits activation of the greatest number of motor units and maximally overloads muscles at every point in the available ROM. This achieves the maximal muscle tension throughout ROM.

Various isokinetic strength test protocols are supported by manufacturers and literature.[19] As a function of peak torque, generally 30 degrees/sec to 60 degrees/sec has been used as a primary test speed for concentric isokinetic testing and 120 degrees/sec for eccentric isokinetic testing.

Procedure

The vertical height jump was tested with both feet together, and participants were allowed to use arm swing countermovement. The testing apparatus consisted of a 4 x 36 inch piece of plywood that is back by a 2 x 4 inch board which was attached to a hanging rack. A baseline measurement was taken by placing the subject's hand on the testing apparatus while one arm was extended overhead (See figure 1). Once a baseline reach score was found, the participant was allowed three trials. The best one of the three trials was used. The subject jumped as high as possible and reached as high as possible. Prior to each jump, the subject was asked to perform maximally.

This was followed by the Jackson-Pollock body composition testing.[34] According to their study, the sum of three skinfolds (triceps, chest and subscapula) for men provides an accurate estimate of hydrostatically measured body density. They also outline detailed instructions for securing accurate measurements of body composition.

A Lange Caliper (Cambridge Scientific Industries, Cambridge, Maryland) was

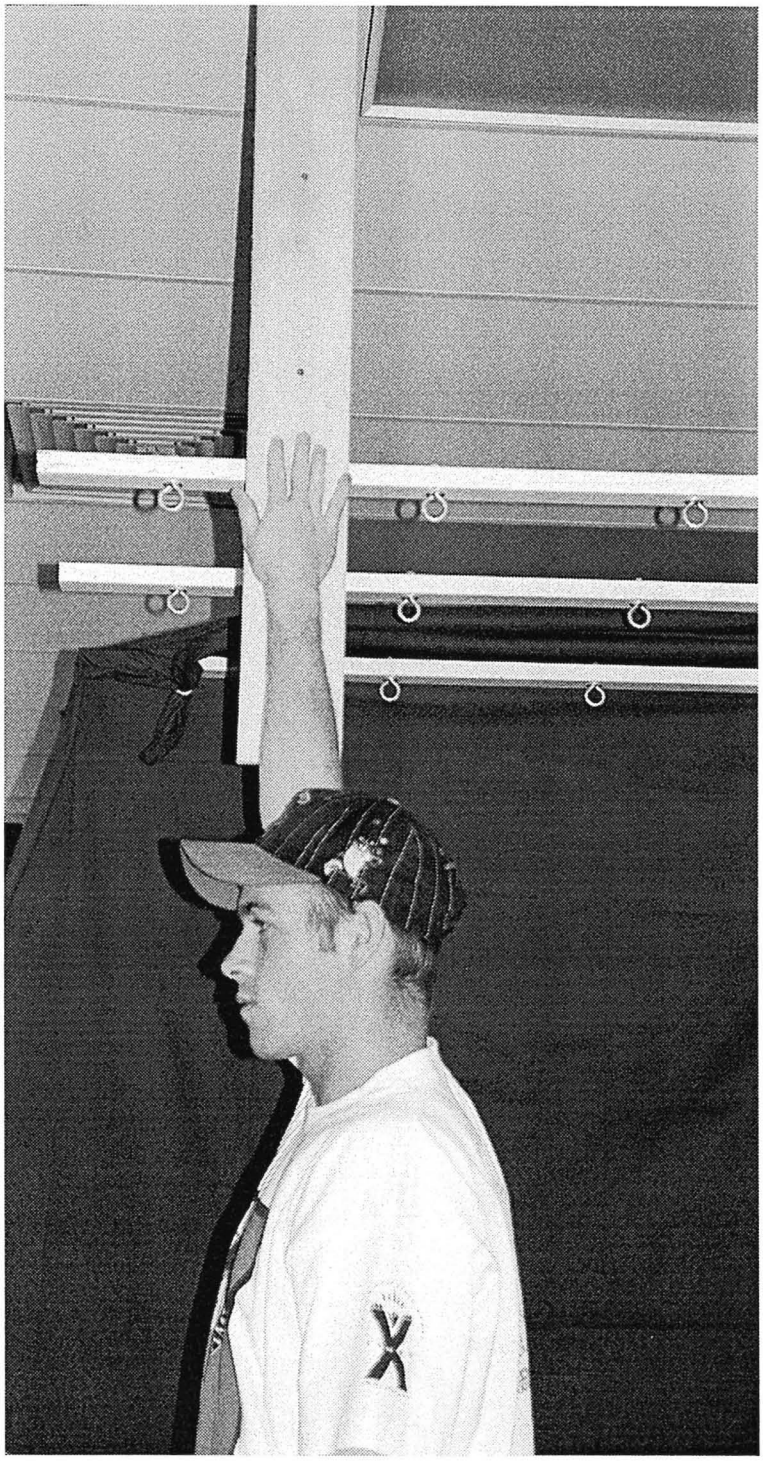

Figure 1. Position for baseline measurement of vertical height jump (VHJ).

used to obtain the three caliper readings.[34] This caliper will give the most accurate estimate of true body density with the generalized equations. Tables for body composition were created using computer generated regression equations from these skinfold measurements. Body density was transformed into percent body fat using the Siri formula. Subjects were then weighed using the standard medical style scale. Each participant was weighed in light clothing and shoes were worn during the vertical height jump.

Subject positioning for testing of lower extremity plantarflexion consisted of modifying existing preset right plantarflexion positioning. The appropriate modification was made to the foot plate to allow for testing of bilateral plantarflexion (See figure 2). The patient's trunk was flexed to 65-75 degrees and stabilized using a lap belt and shoulder harness. The knee was flexed to 30 degrees so as not to limit the desired movement if marginal hamstring tightness was present. The ROM for testing was from 5 degrees dorsiflexion to 40 degrees plantarflexion.

Prior to testing, one submaximal practice trial of 5 to 10 repetitions was given. This allowed the subject to become familiar with the equipment. The practice trial was immediately followed by the test itself: ten maximal contractions in concentric plantarflexion with passive return to the starting position of five degrees of dorsiflexion with each repetition. Following plantarflexion, the subject completely stopped, allowed the examiner to passively dorsiflex the ankle, paused one second at the five degrees dorsiflexed position, then began the next repetition.

When isokinetic dynamometers are used to obtain peak torque values or any other measurements, some caution must be used. The isokinetic dynamometer needs to be calibrated prior to each test to assure accurate measurements. According to the Kin-Com manual, this machine has a self-calibrating system.[35] If the machine is not properly

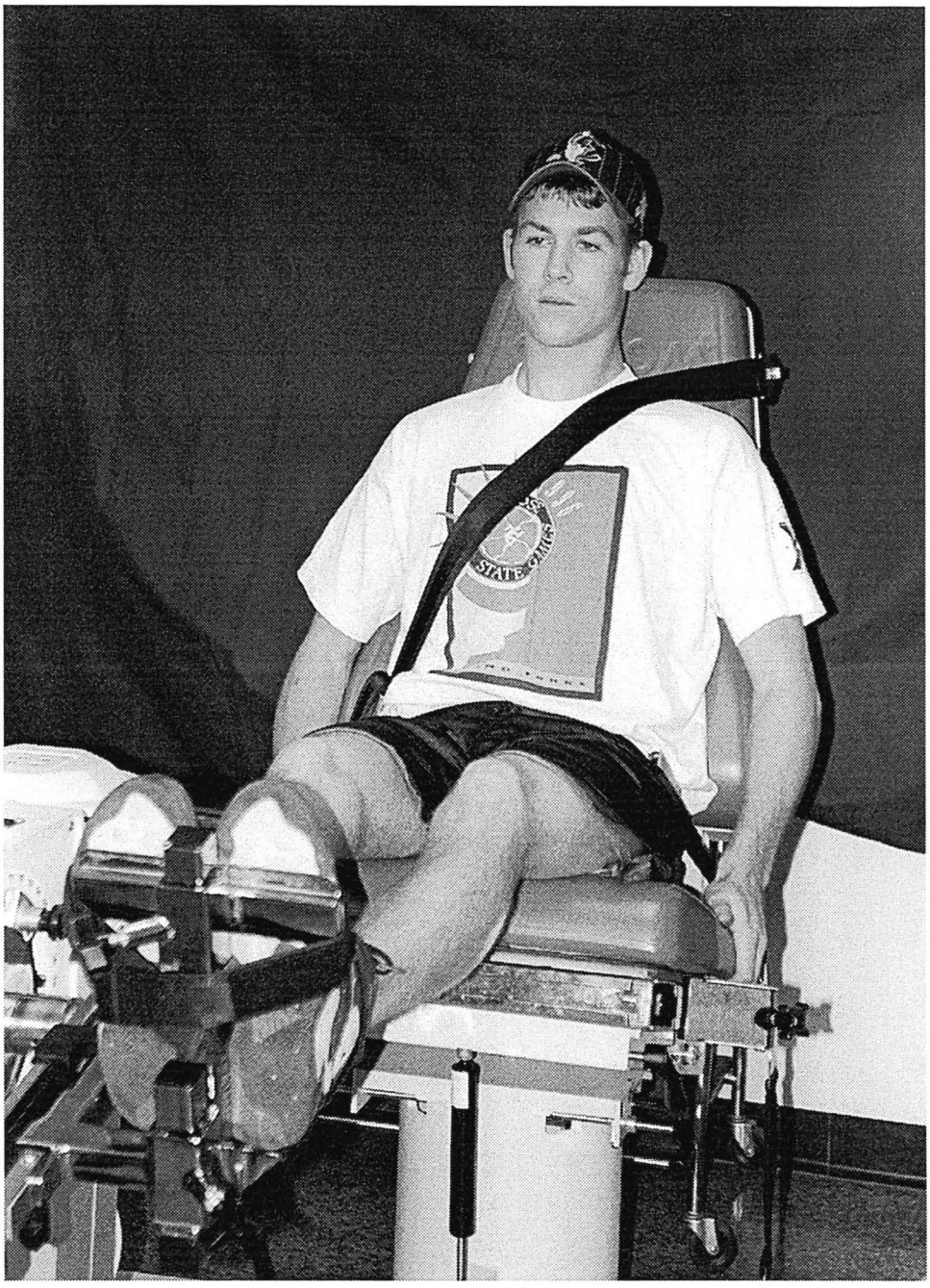

Figure 2. Position for bilateral plantarflexion on Kin-Com Dynamometer.

calibrated, there will be an error message on the screen.

Data Analysis

Statistical analysis included inferential and descriptive statistics. Specifically, Pearson Correlation Coefficient (r_{xy})were performed to examine the relationship between isokinetic test data (y) and VHJPI (x).[36] Additionally, the means and standard deviations of the subjects' ages, isokinetic peak torques, and VHJPI were calculated (Table 1). SPSS-X™ statistical program for Windows was implemented to perform calculations on the data.[37]

CHAPTER III

RESULTS

The correlation and relationship between bilateral plantarflexion and VHJPI were analyzed. Table 1 illustrates that there is no significant relationship between bilateral plantarflexion at 60 degrees/sec and VHJPI (n=25, p=.099, and r=.3372) by using the two-tailed significance of $p<.05$. When the subjects were placed by body composition into two groups, one group of body fat = <15% and the other of body fat >15%. The group of body fat >15% demonstrated a positive correlation (n=7, p=.007, and r=.8927). There was, however, no correlation in the group of body fat =<15% (n=18, p=.857, and r=.0458). Table 2 illustrates the various body composition groupings and the correlation between the groups' VHJPI and the peak torque. Figure 3 is a graphical representation of the comparison of the VHJPI of body composition groups and the peak torque.

Table 1. Descriptive Statistics of Subjects by Age, Peak Torque and VHJPI*.				
Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Age (yrs)	26.56	6.23	20.84	41.71
Peak Torque (ft-lb)	251.93	42.69	150.00	309.00
VHJPI (ft-lb)	318.96	64.10	178.06	476.90
* Vertical Height Jump Power Index				

Table 2. Inferential Statistics: Pearson Correlation Coefficient (r_{xy}).			
Number of Subjects	**% Body Fat**	**p value**	**r value**
n=7	>15	.007	.8927
n=18	=<15	.857	.0458
n=25	5-30	.099	.3372

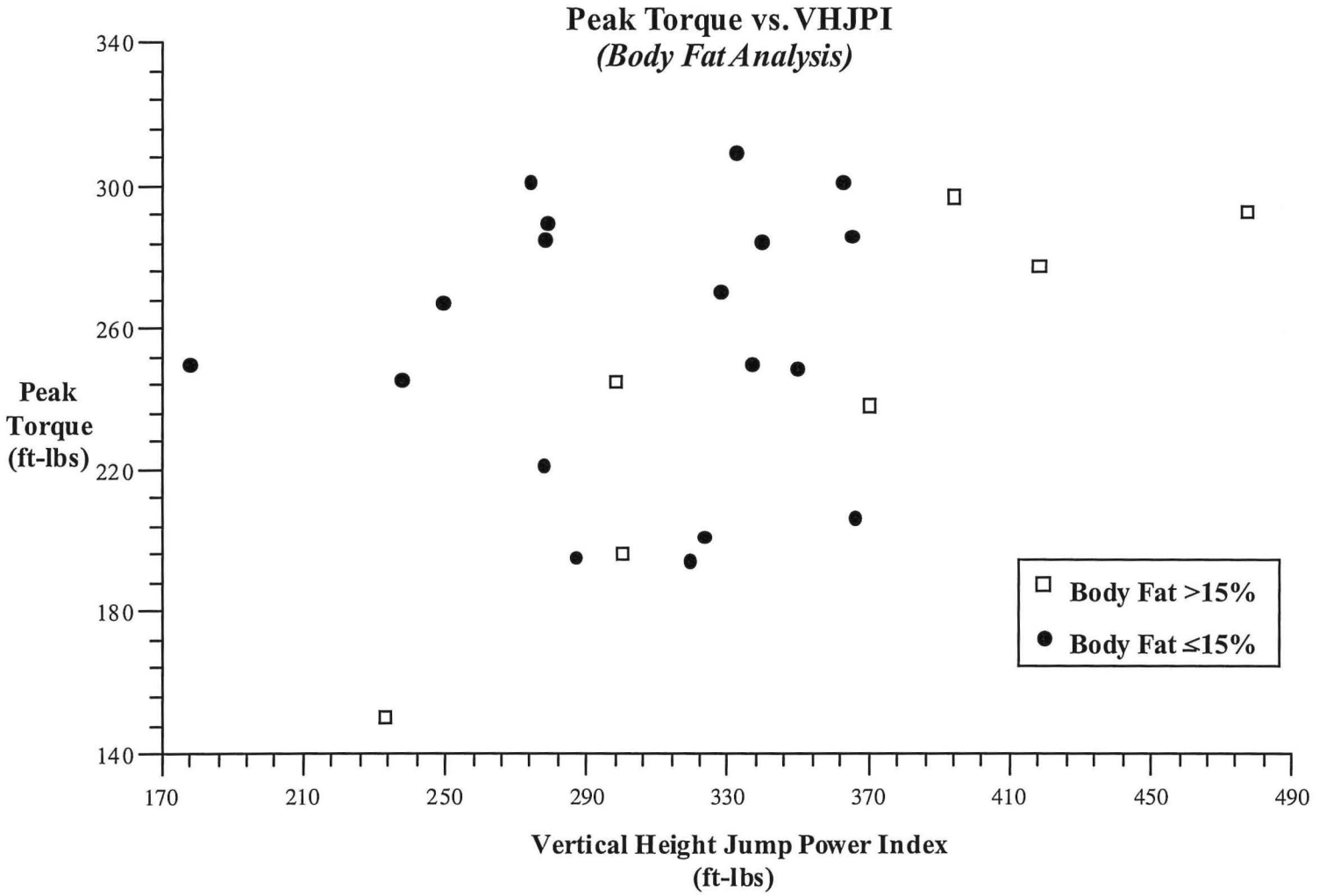

Figure 3. Peak torque correlation with VHJPI in various body composition groups.

CHAPTER IV

DISCUSSION

The results of this research project show that when subjects were grouped into categories of body composition (body fat >15%), isokinetic bilateral plantarflexion was significantly related to vertical height jump power index. The positive correlation (r=.8927) was found. The coefficient of determination (r^2) value showed that 80% of this group's vertical height jump power index can be related to bilateral plantarflexion peak torque.

The results of the other body composition group (body fat =<15%) was not significantly related to VHJPI. The Pearson Correlation Coefficient was r=.0458; and thus the coefficient of determination (r^2) value showed that less than one percent of the VHJPI scores can be accounted for by bilateral plantarflexion peak torque data.

The results of both groups combined also demonstrated no significant correlation. The possible factors that resulted in these outcomes may be related to the design of the project, such as sample characteristics (age, subject groupings or the type and level of activity of participants) or test methods (subject position setup, subject stabilization, interrater reliability or intrarater reliability).

The factor of age should not have had a negative effect on the design of the project. Although the range was approximately 20 years of age, the standard deviation was small (SD=6.23). The age range of 20 to 41 was reasonable. A study that included isokinetic plantarflexion demonstrated that between the ages of 20 to 49, strength did not decline as a function of age.[38]

A kinesiological analysis of the vertical height jump produces action by muscle groups that may not be related to plantarflexion, therefore, making a correlation more difficult. In a study by Semenick and Adams[39], the kinesiological analysis showed that during the take off stage of the jump the explosive power of plantarflexion was combined with concentric contractions of the knee, hip, and lumbar-thoracic spine extensors. The motion occurs in concert with the spine starting, and hips leading knees slightly, while ankle plantarflexors enter late in the sequence. This is supplemented by the upper body arm swing. Timing of these events is crucial for the highest potential VHJ to be obtained.

Earlier in this research paper, various amounts of the VHJ performance were assigned a certain percentage to the total VHJ performance. They were based upon averages and therefore, may not be representative to my sample. The study[20] also did not attribute any VHJ performance to upper arm swing. Harman et al[40] found that 5 percent of VHJ performance was attributed to the arms. In other words, the subject may be able to jump 5 percent higher with the use of arm swing. This may have confounded the correlation between VHJPI and peak torque for ankle plantarflexion.

Another area to investigate as a possible cause for the poor correlation of this research project is in the area of countermovement. Countermovement can be described as the quick knee bend at which time the body's center of mass is lowered somewhat before being propelled upward. The countermovement uses the stretch shortening cycle, which causes eccentrically loaded muscle to store elastic energy. This stored elastic energy (preload) is released during the subsequent concentric muscle contraction. This was reported to have a 12% advantage over a non countermovement group.[40] This preload was not available to the subjects during their isokinetic bilateral plantarflexion testing.

CONCLUSION

The intent of this study was to correlate a functional activity with a clinical test. A successful clinical test should be representative of the capability to perform functional tasks. Isokinetic apparatuses are clinical tools that give objective output, but this objective output may not be representative of the ability to perform functional tasks. The vertical height jump is a functional maneuver incorporated in many strenuous activities as a predictor of vertical height jump. Anderson et al[41] found that neither quadriceps nor hamstring forces measured isokinetically were predictive of vertical height jump at a significance level of $p<.05$. Whether one leg or a combination of forces were measured, there was no statistical significance. This study examined the correlation of bilateral plantarflexion peak torque and vertical height jump. No significant relationship was found between the peak torque and VHJPI. This indicated that clinical isokinetic testing may not be a fair predictor of functional capability in VHJ. However, limitations of this study may have influenced the statistical outcome. Further research in this area is needed.

APPENDIX

__x__ EXPEDITED REVIEW REQUESTED UNDER ITEM __3__ (NUMBER[S]) OF HHS REGULATIONS
___EXEMPT REVIEW REQUESTED UNDER ITEM ____ (NUMBER[S]) 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: Eric Anderson **TELEPHONE:** (701)772-1851 **DATE:** 5/7/96

ADDRESS TO WHICH NOTICE OF APPROVAL SHOULD BE SENT: 1120 N 5 AVE Grand Forks, ND 58203

SCHOOL/COLLEGE: University of North Dakota **DEPARTMENT:** Physical Therapy **PROPOSED PROJECT DATES:** 8/15/96-1/15/97

PROJECT TITLE: Correlation between isokinetic plantarflexion Vs vertical height jump power index

FUNDING AGENCIES (IF APPLICABLE): N/A

TYPE OF PROJECT:

___ NEW PROJECT ___ CONTINUATION ___ RENEWAL ___ THESIS RESEARCH (DISSERTATION OR) _X_ STUDENT RESEARCH PROJECT

___ CHANGE IN PROCEDURE FOR A PREVIOUSLY APPROVED PROJECT

DISSERTATION/THESIS ADVISER, OR STUDENT ADVISER: Mark Romanick

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 _x_ 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.

"Twenty-five male subjects that are students at the University of N. Dakota will be tested on the Kin-Com isokinetic dynamometer to obtain normative strength values for ankle plantar flexor muscle group. An isokinetic dynamometer is a device used to measure torque while moving a variable load at a constant velocity. The subjects will do both concentric at 60^0/sec and eccentric at 120^0/sec. These normative strength values will be compared with their respective vertical height jump power index (VHJ Index).

The vertical height jump power index is the vertical height jump score in centimeters multiplied by lean muscle mass (total body weight - % body fat multiplied by total body weight). The results will indicate whether there is a correlation between VHJ index and isokinetic plantarflexion strength.

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

The sample consists of twenty-five students of University of N. Dakota. Each student is given a consent form. Weight, and % body fat will be collected. Subjects will be eliminated that have % body fat that does not fall between 10% and 30%.

PROCEDURES

Each subject will be assigned a number for the study. The subjects will have one trial session of ten repetitions on the Kin-Com for plantar flexion in a gravity eliminated position. The next time will be recorded using peak torque data for the ten reps.

The subjects will do a vertical height jump. It will consist of three trials. Each trial will require double foot take-off stance and a best of the three scores will be recorded. Next a % body fat test will be performed using a three point test. The Jackson-Pollock method uses the sum of three skinfolds (triceps, chest, subscapula for men).

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

This Study aims to benefit the knowledge of isokinetics and how they relate to functional activities. Vertical height jump is a good indication of lower extremity functioning. Therefore, if there is good correlation between vertical height jump index and isokinetic plantarflexion average torque, then the isokinetics could be a good predictor of functioning in rehab candidates.

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.)

"As with any physical activity, there is always a chance of muscle strains and ligamentous strains. The speeds to be used on the Kin-Com should limit the chance of these occurring. The subject will be well instructed on the procedures and tests performed.

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.

The concent forms will be kept at the UND Physical Therapy department for a period of three years. They will be coded to ensure subject confidentiality.

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:

Eric H Anderson — **DATE:** 5-8-96
Principal Investigator

Mark Peterson — **DATE:** 5-8-96
Project Director or Student Adviser

_____ **DATE:**
Training or Center Grant Director

(Revised 8/1992)

Attn: Shirley Griffin
IRB

This correspondence is in response to our phone conversation. I am a candidate for masters of physical therapy. I would like to change the eccentric 120 degrees per second to a concentric 60 degrees per second. The eccentric portion does not play a role in my study. The removal of the portion makes the testing procedure less taxing on the subjects. This translates into a safer study and less chance of injury.

One other change is the ten percent body fat changed to five percent body fat. This allows for more conditioned subjects to be included into my research design. I have enclosed a copy of the consent form with the change of ten percent to five percent body fat.

Respectfully,

Eric H. Anderson

Informed Consent Form

You are invited to participate in a research project conducted by Eric Anderson, B.S. PT, a student from the University of North Dakota Physical Therapy Graduate Program. The study is intended to demonstrate a correlation between isokinetic plantar flexion torque and power index taken from vertical height jump multiplied by lean body mass.

Participants will be selected for this study based upon their representation of the average male college student with a percent body fat between 5 and 30 percent. Body fat testing will be conducted early in the study and those not meeting the criteria will be excused from the study.

As a participant, you will be tested on the Kin-Com, a device that measures torque or force while keeping a constant velocity for isokinetic (same speed) plantar flexion. It will measure both directions; one where your foot and toes move downward, and the other where your foot and toes move toward your head. You will also be tested on vertical height jump and percent body fat using the Jackson-Pollock test.

The potential benefits of this study are to determine if the isokinetic plantar flexion is a good indication of the functioning of the participant's lower extremities.

Participation in the study is completely voluntary and information collected will be kept confidential. You may withdraw at any time without prejudice. If you have any concerns or questions about the study, they can be answered by Eric Anderson at (701) 772-1851 (home) or 701-777-2831 (school).

I have read all of the above information and willingly agree to participate in the study. All of my questions have been answered.

_____ _____

Signature Date

November 12, 1996

Mr. Ross Argent
540 Carleton Ct. #106
Grand Forks, ND 58203

Dear Ross,

I am requesting permission to include a copy of the enclosed photographs in my independent study project. Please sign below to authorize the use of these photographs and return this letter in the enclosed envelope. Thank you for your cooperation.

Sincerely,

Eric Anderson

Eric Anderson

I, Ross Argent, hereby authorize Eric Anderson the use of the enclosed photographs in his independent study project.

Ross Argent
Signature

11-15-96
Date

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