

*University of Kentucky
Department of
Physical Medicine and
Rehabilitation*

14th Annual

*Research Day
June 7th, 2002*

*Cardinal Hill
Rehabilitation Hospital
Center for Learning*



Physical Medicine and Rehabilitation Research Day 2002

14th Annual Research Day Agenda Cardinal Hill Rehabilitation Hospital Center on Learning Rms. CL3 & CL4 June 7th, 2002

08:30 – 09:00 am Continental Breakfast
09:00 – 09:10 am Opening Remarks: Jimmy Abbas, Ph.D.

Resident Research Presentations

Plans

09:10 – 09:20 Melanie H. Ledford, MD
09:25 – 09:35 Fernando S. Branco, MD
09:40 – 09:50 Markus Niederwanger, MD
09:55 – 10:05 Herb Villaflores, MD

10:10 – 10:20 BREAK

10:20 – 10:30 George Bitting, MD
10:35 – 10:45 Paul Harries, MD
10:50 – 11:00 Scott R. Akers, MD
11:05 – 11:15 Melinda Hayes, MD

Projects

11:20 – 11:35 Fernando Branco, MD
11:40 – 11:55 Melanie Ledford, MD

Student Research Presentations Plans

12:00 – 12:10 Karen Summers
12:15 – 12:25 Joseph Finley

12:30 – 1:00pm LUNCH BUFFET
Sponsored by Ashley B. Gordon and Pope Beeler from
Sanofi-Synthelabo Pharmaceuticals

FEATURE SPEAKER

Neuromuscular Electrical Stimulation for Upper Limb Restoration in Hemiparesis

1:00 – 2:00 John Chae, MD, ME
Assistant Professor of Physical Medicine and Rehabilitation
Assistant Professor of Biomedical Engineering
at Case Western University, School of Medicine

Sponsored by Bryan Sackman from Novartis Pharmaceuticals

2:15 – 2:30 BREAK

2:30 – 3:15 pm Faculty Poster Presentations: Discussion

3:15 – 3:30 pm Awards and Closing Remarks: Jimmy Abbas, PhD
Gerald V. Klim, DO

Physical Medicine and Rehabilitation Research Day 2002

PM&R Resident Presentations (Plans)

Assessment of Caloric Needs in Amyotrophic Lateral Sclerosis (ALS)

Presenter: Melanie H. Ledford, MD

Collaborator: Edward J. Kasarskis, MD, PhD

Problem: Malnutrition due to caloric deficiency is very prevalent in ALS during the course of the disease. Profound weight loss, muscle weakness and muscle atrophy are prominent features, which produce progressive disability and early death. Since the precise cause(s) of malnutrition in ALS has not been adequately studied using modern technology, it is unknown whether caloric deficiency is due solely to inadequate intake, or could be due to increased expenditure of calories, or both of these mechanisms. Gastrostomy is frequently recommended but guidelines on the degree of caloric deficiency requiring it nor the amount of caloric replacement needed to correct the malnutrition are forthcoming. **Aim:** Our goal along with three other centers is to examine caloric requirements to identify caloric deficiency early in the course of the disease, plan for timely nutritional intervention, and predict the need for gastrostomy by objective nutritional criteria rather than simply by the presence of dysphagia. **Methods:** We will estimate daily caloric intake and expenditure in ALS patients and compare with those in age- and gender-matched healthy controls from our database (cross-sectional analysis), and measure daily caloric intake and expenditure in ALS patients periodically over 12 months to examine the effects of progressively increasing disease severity and changes in body composition and physical activity level on caloric requirements (longitudinal analysis). 56 patients (28 males and 28 females), 14 at each site age range 40-75 with ALS will be recruited. Techniques used will be resting metabolic rate (RMR), measurement of body composition with DEXA, forced vital capacity, ALS functional rating scale (ALSFRS), leisure time physical activity questionnaire, short-form-36 (SF-36) questionnaire, and caloric intake.

Comparison of Oral Sildenafil and Penile Injections in the Treatment of Erectile Dysfunction in Patients with Spinal Cord Injury

Presenter: Fernando Branco, MD

Collaborators: David Gater, MD, PhD, Susan McDowell, MD, Michael Lynch, PhD

Problem: Sexual dysfunction is common among people with chronic illness and disability. It may occur in up to 75% of men after traumatic Spinal Cord Injury (SCI). Erectile Dysfunction (ED) is a common complication of SCI. Different therapeutic approaches have been used that included Sildenafil and Penile Injections. No study has been done with both methods and direct measurements. **Purpose:** To compare objectively oral Sildenafil (Viagra) with Penile Injections containing Alprostadil (Caverject). **Aim:** To determine which method has a better result for the treatment of ED in SCI patients. **Methods:** This will be a prospective study, controlled trial of 20 males age 18-65+ with ASIA A SCI, minimum of 6 months post SCI lesion, ED solely attributable to SCI. Patients will be their own controls. A history and physical exam will be performed by a physician prior to testing. If no contraindications are established patient will be tested with both methods in two different days. One day with Sildenafil orally up to 100 mg, or Alprostadil (Caverject). A direct measurement will be performed at pre-established times with a Mercury Gage Plethysmograph (Penile Tumescence Monitor). Patients will be tested in a hospital environment. **Relevance:** ED is very common with SCI patients, most studies results are based on subjective improvement of the sexual dysfunction. Sildenafil has been used widely on the SCI population but its superiority has not been established in comparison with the more traditional penile injections.

Key Words: Spinal Cord Injury, Erectile Dysfunction, Sildenafil, Viagra, Caverject, Alprostadil

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PM&R Resident Presentations (Plans)

The Effect of Physical Therapy on Venous Vascular Function in Spinal Cord Injury

Presenter: Markus Niederwanger, MD

Collaborators: Robert Taylor, MD, PhD and Herb Villaflores, MD

Abstract: Venous vascular function is controlled by neurohumeral and mechanical factors. Efferent sympathetic input of the autonomic nervous system causes contraction of smooth muscle of vessel walls and contributes together with the skeletal muscular pump to vascular compliance, venous return, and central venous pressure. Spinal cord injury (SCI) disrupts the vascular control by the autonomic nervous system, causes immobility and inactivity. These factors play critical roles in affecting peripheral vascular resistance (Levine 1993), and can induce orthostatic hypotension (Mathias et al. 1975). The effects of aggressive physical therapy on the peripheral vascular function in individuals with SCI have not yet been addressed. Venous occlusion plethysmography is a noninvasive method to determine total limb blood flow and can be used to determine venous vascular control (Barendsen et al. 1963, Forconi et al. 1979, Rueckert and Hanson 1995). Venous vascular function will be studied in patients with SCI admitted to the SCI Unit at Cardinal Hill Rehabilitation Hospital. Inclusion criteria are ability to participate in daily physical therapy. Venous capacitance, venous emptying rate, and total venous outflow will be measured using established methods (Wecht et al. 2000). Subjects will undergo serial testing, on admission, before discharge, and at clinic follow up. The subjects will have a daily physical therapy regime during the inpatient Rehab stay. Aim of the study is to analyze the effects of physical therapy on venous vascular function in subjects with SCI.

Key Words: Physical Therapy, Venous occlusion plethysmography, Spinal cord injury, venous vascular function

The Acute Inpatient Rehabilitation Stay and The Effect on Venous Compliance for Spinal Cord Injury and Stroke Patients

Presenter: Herbert B. Villaflores, MD

Collaborators: Robert Taylor, MD, PhD and Markus Neiderwanger, MD

Venous tone and compliance at the vessel level is mediated in large part by the sympathetic system. Another significant contributing factor are the skeletal muscles surrounding the vessels. The tone of a skeletal muscle helps in the ability for a vein to dilate and accommodate a larger volume of blood, or to maintain a decreased lumen so as to impede the capacity that vessel is allowed to hold or to have blood flow through. When central sympathetic outflow or skeletal muscle tone is disrupted acutely, the immediate affect on decreased venous tone and subsequent increased vessel compliance can be observed. This is not an uncommon observance in the acutely spinal cord injured patients. These patients are then volume controlled to prevent orthostasis by a number of measures ranging from physical means such as venous compression stockings and abdominal binders to chemical interventions with oral salt tablets. In time, these patients are able to volume and pressure regulate even without regaining any tone or measurable function in the affected limbs distal to the injured vertebral level. The design of the study is to determine if an acute rehabilitation program after an injury such as a spinal cord injury or stroke with hemiparesis has an immediate affect with venous compliance and tone.

Key Words: Venous Compliance, Venous tone, Spinal Cord Injury, Cerebrovascular Accident

Physical Medicine and Rehabilitation Research Day 2002

PM&R Resident Presentations (Plans)

Walking Status of Patients with Arthrogyposis Status Post Lower Extremity Surgery

Presenter: George Bitting, MD

The purpose of this study is to evaluate the long term outcome of children with Arthrogyposis following lower extremity surgery. The data base used is the Lexington Shriners Hospital patient list. This will be a retrospective study using the Hoffer and Bullocks grading system for ambulatory status. Information will include the number of surgeries, and current ambulatory status. Goals will be to evaluate outcomes of surgery and if surgery had any long term impact on ambulatory status.

The H Reflex and F Wave as Objective Measures of Spinal Cord Stimulation

Presenter: D. Paul Harries MD

Collaborators: R. Nickerson, MD, J. Holtman, MD, and W. Witt, MD.

Problem: Spinal cord stimulation (SCS) is increasingly being used to treat refractory neuropathic pain. SCS is felt to work in a multifactorial fashion with some descending and some ascending input on pain pathways. SCS requires impantation of a percutaneous spinal epidural lead with 4 electrodes at its tip and a subcutaneous pulse generator. Correct placement of a lead can take several hours while the area of stimulation is mapped. The patient is awake for the entire procedure and their concentration tends to fluctuate reducing the likelihood of optimal electrode placement. There is currently no neurophysiological measure of SCS to assist in lead placement. We aim to indirectly measure the descending activity in the spinal cord using the H-reflex and F-wave. Small studies performed in the 1970s and 1980s demonstrated that the H-reflex and F-wave are affected by SCS. These studies have not been repeated with more effective modern day SCS equipment. **Purpose:** To determine whether the H-reflex and F wave can be used as clinical measures of the effectiveness of SCS. **Methods:** Twenty consecutive patients due to undergo SCS implant for chronic neuropathic pain will have preoperative H-reflex and F wave studies performed. The studies will be repeated in the postoperative period with SCS turned on and off. Pain scores will be recorded prior to each study. The effect of SCS upon latency and amplitude will be calculated. **Relevance:** Development of a reliable neurophysiological measure of spinal cord stimulation may aid in SCS lead placement. Additional benefits may include assisting in the optimal selection of electrical stimulation parameters and obtaining a better understanding of how SCS works.

Key words: Spinal cord stimulation, H-reflex, F wave

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PM&R Resident Presentations (Plans)

Comparison of Functional Outcome of Synvisc® Versus Celestone® Injections in the Treatment of Patients With Osteoarthritis of the Knee: A Randomized Double Blinded Prospective Study

Presenter: Scott R. Akers, MD

Collaborators: E. J. Rayes, MD and Brad Ranta, PT

Aim: To compare functional outcomes in patients with severe osteoarthritis of the knee after treatment with intra-articular Celestone® versus intra-articular injection of Synvisc®. **Methods:** Randomized, double blinded, prospective study. Clinical observer and patient will be blinded to the treatment received. A course of treatment will consist of three intra-articular injections of Synvisc® or one injection of Celestone® followed by arthrocentesis at one-week intervals in the target knee. Outpatient University and VA musculoskeletal Physiatry patient's are to serve as target population. As yet undetermined number of adult patients to be included in the study. Patients must be ambulatory (assistive devices permitted), carry the diagnosis of OA of the target knee of at least three months duration according to the American College of Rheumatology (ACR) criteria, pain from OA requiring frequent use of analgesics or NSAIDS for at least 3 months before enrollment, and any acute disease or trauma leading to secondary OA of the target knee must have occurred at least five years before study entry. All patients must be capable of understanding, signing and dating an informed consent form. **Outcome Measures:** Measurement instruments to include Functional Independence Measure score as outlined by the Uniform Data System for Medical Rehabilitation, which will be assessed by a licensed physical therapist before entering the study and then again at twelve weeks. Patients will also be required to complete the SF-36 short form Health Survey prior to the first injection and again at their twelve week follow up.

Exploring Sleep Quality in People with Fibromyalgia: Review and Follow-up (Plan)

Presenter: Melinda Hayes, MD

Collaborators: John F. Wilson, PhD

Problem: Fibromyalgia is diagnosed by at least three months of widespread pain with reproducible tender points bilaterally above and below the waist. The chronic pain syndrome is characterized by morning stiffness, fatigue, and sleep disturbances, as well as variable other symptoms. Chronic pain initiates a vicious cycle resulting in difficulty initiating and maintaining sleep, and nonrestorative sleep in turn exacerbates chronic pain symptoms. The purpose of this study is to review an existing database of people with fibromyalgia, focusing on aspects of sleep, and to design and execute a follow-up study three years after the original collection of data. **Hypothesis:** On a three-year follow-up study, people with fibromyalgia who report fewer sleep disturbances will have stable or improved pain symptoms compared with people who endorse more sleep disturbances. **Aim:** To determine the correlation between sleep quality and pain quality in a group of people with fibromyalgia at baseline and at follow-up three years after the initial study. **Methods:** In 1999, data was collected from 50 people who met the diagnostic criteria for fibromyalgia. This database will be used as the baseline. The subjects will be re-contacted to repeat selected questions regarding sleep and pain symptoms as well as to answer questions to gauge sleep hygiene and techniques used to facilitate sleep. Data will be analyzed to determine associations and statistical significance. **Relevance:** Exploring the ways in which people with fibromyalgia achieve restorative sleep will give clinicians clues to helping people with chronic pain stabilize or improve their symptoms.

Key Words: *Fibromyalgia, Sleep, Chronic pain syndromes.*

Physical Medicine and Rehabilitation Research Day 2002

PM&R Resident Presentations (Projects)

Plantar Pressure Changes Before and After Treadmill Walking in Patients with Sensate and Insensate Feet

Presenter: Fernando Branco MD

Collaborators: Donna Oeffinger PT, Hank White PT, Christin Daniels MA, Dr. Chester Tylkowski
Department of Orthopedics at Shriners Hospital – Lexington/KY

Problem: Foot pressures have been studied to determine pressure distribution and its effect on skin ulceration. Patients with insensate feet cannot feel tissue trauma and don't change shoes or gait pattern. Plantar pressures are different in the insensate feet due to structural changes. **Purpose:** To compare the peak plantar pressure of insensate feet after prolonged ambulation in a treadmill. **Aim:** To determine if insensate feet respond differently from the healthy foot when stressed by prolonged ambulation. **Methods:** Ten patients with insensate feet will be selected with variable age (up to 21 years old) and compare to twenty-four previously tested subjects with intact feet. A self-selected pace will be chosen with the patient wearing PEDAR in-shoe pressure measurement insoles. Each subject will walk across an EMED platform to measure barefoot plantar pressure before and after treadmill walking. For the PEDAR measurements, the foot will be divided into eight regions to record pressure data in each region and pressure changes in the distribution across the eight regions. For the EMED measurements, the foot will be divided into 5 regions. We will compare the results with a previous study done at Shriners hospital with 24 subjects with intact sensory feet that established normative data for in-shoe plantar pressure measurements of mean peak pressures, maximum force and contact areas. **Relevance:** Individuals with insensate feet (Spinal Cord Injury, Diabetes, etc..) will benefit if a reliable method is established to determine areas at risk for pressure ulcers.

Key Words: plantar pressure, PEDAR, EMED, insensate feet

Valgus Femoral Osteotomy in Perthes Disease

Presenter: Melanie H. Ledford, MD

Collaborator: Brian Carney, MD

Purpose: A review of the literature with consideration of future implications. **Literature Review:** Bankes, M.J.K. et al study showed valgus extension osteotomy (VGEO) in the short term relieved pain and corrective deformity in "hinged abduction" in Perthes disease; as growth proceeds it may produce useful remodeling in this worst affected group. Quain, S. et al found that abduction extension osteotomy of the femur relieved pain, improved leg length, reduced limp and provided a better functional range of movement in Perthes disease. Schiltenswolf, M. et al followed up with 24 patients receiving subtrochanteric angulation osteotomies (mean 17 years) to evaluate long term results. 20 showed persistent gain of abduction, 14 improvement of gait, 18 less pain. Gotoh E. et al followed 31 patients, mean follow up of 15 years, treated with valgus-extension osteotomy. Mean pain score and function improved. Range of movement had decreased. Maistrelli, G.L. et al reviewed 277 intertrochanteric valgus-extension osteotomies – follow up varied from 11 to 15 years. 67% of the hips were good or excellent on the Merle D'Aubigne scale. Morita et al treated 31 hips with valgus-extension femoral osteotomy with mean follow-up of 12.7 years. 67% reported good or excellent outcome but not better than THA. VGEO determined to be valuable as 'holding procedure'. **Material and Methods:** HIM identified 33 children with Perthes who underwent femoral osteotomy. 8 of these were valgus approach and were performed between 1975 and 2000. Based on the literature we expect these patients had improvement in pain, leg length, limp, functional range of motion. Measures include preop pain and limp compared to postop pain and limp evaluated by chi square statistical analysis. Other measures are lateral extrusion and Mose circles pre and postop evaluated using t-test statistical analysis. Charts and radiographs will be reviewed retrospectively for pain, limp, surgical indications, casts, previous treatment, Herring lateral pillar classification, amount of lateral extrusion, Mose circles, arthrogram, scanogram, containment.

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Student Presentations (Plans)

The Relationship between allergies and Dysfunction in Sensory Integration in the Pediatric Population

Presenter: Karen Summers, OTR/L

Department Affiliations: Cardinal Hill Rehabilitation Preschool and Eastern Kentucky University

Abstract: Allergies are the most common chronic condition in the United States and the incidence of allergies is increasing worldwide. Occupational therapists have informally observed children with dysfunction in sensory integration frequently have allergies also. However, no formal documentation of their co-existence has been published. Children with dysfunction in sensory integration have difficulty organizing sensory input through their central nervous system. This impairs their ability to perform motor tasks, activities of daily living, their ability to attend and learn. By documenting the co-existence of allergies and dysfunction in sensory integration, this research will lead to increased understanding of these two conditions. The data will be collected from discharged pediatric charts who received occupational therapy at Cardinal Hill Rehabilitation Hospital. The Pediatric Developmental History in the medical record will be used to document if allergies exist. The Sensory Profile will be used to document dysfunction in sensory integration. The results will be analyzed using descriptive statistics.

Key Words: Allergies, dysfunction in sensory integration, motor tasks, activities of daily living, Sensory Profile, occupational therapy

Evaluation of Postural Variables for Feedback in FNS Standing

Presenter: Joseph Finley, BS

Collaborators: Jason C. Gillette, PhD, JoAnne Riess, MS and James J. Abbas, PhD
Center for Biomedical Engineering, Department of Physical Medicine & Rehabilitation,
and the Spinal Cord and Brain Injury Research Center, University of Kentucky

FNS (Functional Neuromuscular Stimulation) standing prostheses can assist individuals with SCI (spinal cord injury) in standing and making transfers. Improving reaching capability of FNS users could enhance the utility of these systems. A proposed method of improving reaching capability is to allow the FNS user to make postural adjustments by altering stimulation values in preparation for a reaching task. A variable that provides information about the postural adjustment must be measured and fed back for stimulation adjustment. Two variables, the position of the pelvis (PoP) and the center of pressure (CoP) are investigated in this study. In the experiment, subjects with SCI stand using FNS on force platforms to measure CoP, a position sensor is worn on a belt to measure PoP, and hand forces are monitored. While standing, the anterior-posterior and medial-lateral components of either the CoP or PoP are displayed as a cursor on a computer monitor at eye level. A circular target appears on the monitor and the subject adjusts posture to move the cursor inside the target area. After the cursor is held inside the target for two seconds, the target moves to a different position. Targets are located at a distance of 25% of the subject's limits of stability. Each research subject will participate in a series of trials in which CoP and PoP are displayed alternately for different trials. Performance using the CoP and PoP as feedback will be compared using a set of indices to quantify the subjects' ability to adjust posture.

Key Words: FNS, posture control, standing function, center of pressure

Physical Medicine and Rehabilitation Research Day 2002

Posters

The Influence of the Upper Limb Tension Test on Nerve Conduction Velocity in Healthy Adults

Presenter: Nancy E. Quick, MA, PT

Collaborators: Diane Lash, PT, Nathan Reffitt, PT, Art Francis, PT, Arthur Nitz, PhD, PT
Division of Physical Therapy, University of Kentucky, Lexington, KY

PURPOSE: The upper limb tension test (ULTT) is used to evaluate the response of neural tissue to stretch in patients with nerve injuries. The purpose of this study was to determine if the amount of stretch that occurs during the ULTT affects the physiological response of the nerve. Motor nerve conduction velocity (MNCV), which measures the electrical conductivity of a nerve, was used to measure physiological response. **METHODS:** 20 healthy adults (10 males and 10 females), ages 23 to 42, participated in this study. MNCV measurements for the median nerve were obtained while the subject's arm was in anatomical neutral and in the end-range ULTT position. Both extremities were tested and were randomized using a coin toss. **RESULTS:** A Univariate ANOVA ($p < .05$) was used to determine statistical dependency of MNCV on the ULTT. Significant slowing in MNCV was noted between neutral and the ULTT ($p < .0001$) for both extremities. The mean MNCV for the left extremity was 52.9 m/s (± 5.8) during neutral and 46.12 m/s (± 6.7) during the ULTT. For the right extremity, the mean MNCV for neutral was 54.6 m/s (± 5.8) and 49.1 m/s (± 6.9) for the ULTT. **CONCLUSION:** These results indicate impairment in MNCV occurs during the ULTT. A change in the nerve diameter as a result of stretching may be responsible for these findings. Until further studies can elucidate the mechanism responsible for this finding, caution should be used when using the ULTT, especially in patients with nerve injuries.

Key Words: Upper Limb Tension Test, Median nerve injury, Neural provocation tests, Physical therapy

Quantitative Assessment of FNS Assisted Standing with Alternative Foot Placements

Presenter: Jason C. Gillette, PhD

Collaborators: Nancy E. Quick, MS, PT Joseph L. Finley, BS, and James J. Abbas, PhD
Center for Biomedical Engineering, Dept. of Kinesiology & Health Promotion, Dept. of Physical Medicine & Rehabilitation, Spinal Cord & Brain Injury Research Center

Problem: When using functional neuromuscular stimulation (FNS) for standing, altering foot placement may result in postural benefits. Our long-term goal is to enhance an FNS user's ability to perform activities of daily living by providing sufficient standing stability. **Aim:** The goals of this study were: a) to identify quantitative measures for the assessment of standing, b) to compare able-bodied and FNS standing, and c) to compare standing performance with alternative foot placements. **Methods:** Two subjects with thoracic-level spinal cord injury (ASIA-A) that stand with FNS and five able-bodied subjects stood quietly using three different foot placements. The subjects stood on force platforms that measured centers of pressure (COP) and wore reflective video markers that were tracked to determine joint angles. **Results:** With one exception, vertical ground reactions (a measure of hand support) were not dependent upon foot placement for FNS users. Reduced hand support was coincident with mean anterior/posterior (A/P) COP values that were further posterior in the base of support. M/L COP excursions, maximum A/P COP velocities, and maximum M/L COP velocities were all significantly greater for FNS users than for able-bodied standers. The modified tandem stance allowed one of the FNS users to more effectively compensate for weakness in his right quadriceps musculature. **Conclusion:** The capability to stand quietly was not appreciably affected by altering foot placement for the two FNS users tested. COP and joint angle measures were useful for assessing postural adjustments in an effort to reduce reliance on upper extremity support while maintaining stable balance.

Key Words: Balance, functional neuromuscular stimulation, spinal cord injury, standing

Physical Medicine and Rehabilitation Research Day 2002

Posters

The Effect of Cryotherapy on Foot-Leg Kinematics during a Sidestep Cutting Maneuver

Presenter: Beth L. Wells, BS

Collaborators: Jean L. McCrory, PhD
Department of Kinesiology and Health Promotion, University of Kentucky

Cryotherapy is a popular treatment method for both acute and chronic athletic injuries because of its ability to reduce pain, swelling, and muscle spasm. However, limb cooling has been shown to decrease nerve and muscle function, sensation, and slow or inhibit normal reflexes. **Purpose:** to determine the effects of a 10 minute icing treatment on the dynamic ankle stability of an athlete performing a sidestep cutting maneuver. **Methods:** Twenty-five healthy, active subjects (21.6 ± 1.5 yrs, 169.9 ± 7.9 cm, 69.7 ± 12.1 kg) participated in the study. Retroreflective markers were placed on the following landmarks on the subject's dominant extremity: medial and lateral knee, anterior, lateral, and posterior tibia, medial and lateral malleoli, superior foot, and medial and lateral calcaneus. A 6-camera motion analysis system was used to collect 3D kinematic data (120 Hz). Subjects were instructed to perform a 45 degree medial cut maneuver on the laboratory runway. After 7 good trials were collected, subjects received a 10 minute icing treatment on the lateral side of their dominant ankle. Immediately following this treatment, 7 additional medial cut trials were collected. **Results:** No differences ($p = 0.05$) were found between pre and post treatment (Table 1). **Conclusion:** These results suggest that cryotherapy is a safe treatment option for athletes.

Table 1: Kinematic Results (degrees \pm SD)

	DF	PF	Inversion	Eversion	Med. Rot	Lat. Rot
Pre	7.2 ± 11.2	13.6 ± 9.1	16.1 ± 17.9	10.0 ± 9.4	6.8 ± 2.5	3.8 ± 3.6
Post	9.7 ± 10.7	13.3 ± 8.9	14.1 ± 17.6	8.0 ± 9.6	6.1 ± 2.6	4.3 ± 3.5

Key Words: *cryotherapy, biomechanics, ankle, sidestep cutting, movement analysis*

Posters

Effects Of A Dynamic Knee Orthosis On Subject Kinematics During The Lateral Step Up Exercise

Presenter: Jean L. McCrory, PhD

Collaborators: Nancy E. Quick, MA, PT, Bryon T. Ballantyne, MS, PT, Irene S. McClay-Davis, PhD, PT
Department of Kinesiology and Health Promotion, University of Kentucky, Lexington, KY,
Joyner Sportsmedicine, Newark, DE

The Protonics knee orthosis was developed from the theory that patellofemoral pain is a result of an imbalance between the hip flexor and extensor musculature. In this theory, overactive hip flexors and an anteriorly rotated pelvis, due to insufficient hamstring activation, lead to an internally rotated, and thus malaligned, femur. **Purpose:** to determine if a single treatment session with the orthosis resulted improved lower extremity alignment. **Methods:** Nineteen females (23.4 ± 3.1 yr, 1.66 ± 0.05 m, 65.3 ± 20.4 kg) with a history of chronic PFP performed a lateral-step up in three conditions: pre-treatment (PRE), a placebo condition in which the orthosis was set at zero resistance (PLAC), and post-treatment (POST). Treatment consisted of having the subject perform the rehabilitation exercises with the orthosis set at the resistance level in which knee pain was alleviated. 3D kinematic data were collected in each of the three conditions. **Results:** After treatment, the hip displayed a greater ROM (PRE $39.2\pm 8.8^\circ$, PLAC $40.4\pm 8.9^\circ$, POST $49.2\pm 10.4^\circ$), although no differences were noted between the maximum flexion values (PRE $47.5\pm 10.4^\circ$, PLAC $48.6\pm 10.3^\circ$, POST $45.3\pm 11.4^\circ$). Internal femoral rotation was not affected (PRE $5.4\pm 7.7^\circ$, PLAC $5.5\pm 9.4^\circ$, POST $6.3\pm 9.3^\circ$). There was less frontal plane pelvic movement in the PLAC and POST conditions than the PRE condition (PRE $5.6\pm 5.3^\circ$, PLAC $2.7\pm 5.3^\circ$, POST $3.0\pm 5.1^\circ$). No differences were seen in anterior pelvic tilt (PRE $21.4\pm 6.6^\circ$, PLAC $20.7\pm 6.6^\circ$, POST $21.3\pm 6.5^\circ$), nor were differences were noted at the trunk, knee, or ankle. **Conclusions:** After a single treatment with the knee orthosis, the hypothesized movements did not occur. However, there appeared to be greater frontal plane pelvis stability.

Key Words: *Patellofemoral pain, lateral step up, biomechanics, kinematics, malalignment*

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