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With respect and gratitude, this issue of *Capabilities* is dedicated to the memory of Jan Little and her life spent breaking new ground, promoting assistive technology, and opening new horizons for people with disabilities.

Jan Little (1939-2003)

A Lifetime of Big Achievements

by
Dudley S. Childress, Ph.D.
and
R. J. Garrick, Ph.D.

Pioneer in Disability Movement

Jan Little was a pioneer in the disability movement; she was an insistent iconoclast who steadfastly refused to acquiesce to naysayers and discouragement. During her life she achieved an academic career; won six gold medals as one of the first wheelchair paralympic athletes; authored articles and her autobiography; articulately and effectively lobbied on behalf of people with disabilities; promoted assistive technology and cofounded the Rehabilitation Engineering Society of North America (RESNA). From 1995 and throughout her active retirement, she edited

Jan Little

Capabilities, the quarterly research publication for Northwestern University's Prosthetics Research Laboratory and Rehabilitation Engineering Research

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Program. Concurrently, she was Project Director of the Resource Unit for Information and Education Services.

At the age of thirteen she was paralyzed by polio. Performing activities of daily living while working on her parents' Janesville, Wisconsin farm introduced her to independent living and to the unassailable expectation that she would be a productive participant in her family and society. Jan continued her education at home, and later became a success story affiliated with Tim Nugent's Student Rehabilitation Center at the University of Illinois in Champaign-Urbana where she majored in Journalism (1961) and completed an M.S. in Communications Science (1965).

While at the University of Illinois, she became serious about two seemingly unrelated areas: athletic competition and assistive technology. Associating with other students at University of Illinois' Student Rehabilitation Center, Jan learned the value of creating and promoting assistive technology. One of her close associates was Gibb Fink, a talented technologist and occupational therapist who has contributed greatly to rehabilitation technology and engineering. Since that time, Jan made the promotion of assistive technology for persons with disability her *sine qua non*.

Gold Medalist

Jan became a serious athlete and was one of the first paralympians, winning six gold medals in swimming, silver medals in archery and competing as a paralympic javelin thrower. In 1962, 1963, 1964 and 1965, Jan represented the USA on five U.S. Wheelchair Teams to the Paralympics and competed in England, France, Spain, Japan and South Africa, where she taught and demonstrated wheelchair sports under USIA sponsorship. In 1985, she was inducted into the National Wheelchair Sports Hall of Fame.

Success in the Windy City

Jan loved the creative energy of Chicago, a focal point for communication, transportation and manufacturing. In 1966, Jan became a photojournalist for the National Sporting Goods Association, moved to Chicago and made the city her own. Within several years, she transferred her communication skills and managerial abilities to Medical Equipment Distributors (MED), Inc., a Chicago-based association of nationwide companies that fitted, delivered and provided services in

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assistive technology products for persons with disability.

Eventually becoming CEO of MED, she opened U.S. markets to under-used and innovative technical imports from Europe, such as a rather crude sip-and-puff powered wheelchair from England that was greatly modified in Chicago. This import marked a new era in mobility for persons with profound quadriplegia. Jan Little also pioneered early technologic transfer from research laboratories to the rehabilitation industry.

During this time, Jan became acquainted with the Rehabilitation Engineering Research Program, established in 1972 at Northwestern University. Through MED, she commercially promoted products developed at RERP such as wheelchair controllers, environmental control systems, reclining mechanisms, and computer interfaces.

In later years, she was Director of Marketing for Invacare Corporation in Cleveland, Ohio; Project Director of Technology at Cleveland Clinic Foundation; and subsequently became Project Director of Infinitec, where she developed programs and new physical facilities for the Assistive Technology Application Center of the United Cerebral Palsy Association of Greater Chicago.

Activist, Consultant and Founder

Jan's broad experience in rehabilitation and in technology for persons with disability made her a prominent consultant and lecturer in the field. She served on many advisory boards, including a Congressional subcommittee. She was active in many organizations such as the National Paraplegia Foundation and was a founding member of RESNA (Rehabilitation Engineering Society of North America).

At RESNA, Jan served on its Board of Directors and was its first treasurer. In 1981, the International Year of Disabled Persons, Jan Little and Dudley Childress, working with others, organized the Fourth Annual Conference on Rehabilitation Engineering in Washington, D.C. It was the first conference that RESNA supported on its own and it was a programmatic and financial success.

Due in great part to Jan's skills and hard work, RESNA evolved from a fledgling organization to an important, professional forum. In 1983 RESNA awarded Jan Little a Distinguished Service Award. In 1986, Jan was the E&J Distinguished Lecturer at the RESNA annual meeting; and in 1994, Jan became a RESNA Fellow.

Win Them Over

Throughout Jan's activities with rehabilitation technology, her self-professed maxim was, "If you can't beat them, win them over." And, so she did, making friends wherever she went. Her second maxim was a testament to her perseverance, "Do as you always do; take a different route."

The route Jan took was one to success in athletics, a career in writing, activism and business management. She made and kept many friends, was widely respected by her peers and associates for an acerbic wit, effective interaction and getting the job done. Throughout her life, she kept the big picture in focus: promote assistive technology and enable disabled people to achieve their potential. She did all that and more. Jan Little was big and we will miss her greatly.

Read Jan Little's autobiography to learn more about her life and how she advanced rights, opportunities and assistive devices for persons with disabilities. *If It Weren't for the Honor – I'd Rather Have Walked: Previously Untold Tales of the Journey to the ADA* (Brookline Books, 1996).

Jan Little: Friends Recall A Life Lived Large

Thirty Years of Memories

Dudley S. Childress, Ph.D., Director of RERP / PRL, reflected on Jan Little's 30 years of involvement with the lab. He recalled that Jan Little had served RESNA since its inception and was the organization's first treasurer. *"Of course, the actual work of the treasurer at that time was not that great because RESNA had no money! But no money meant there was a lot of worry associated with the job. Keeping the organization solvent without sufficient money was a major task — a task that Jan was up to.*

Business Manager

I remember in 1981, I was the Chairman of the 4th annual meeting, which was held in Washington, D.C. RESNA was preparing proceedings without assistance and everything was done on a shoestring budget. Jan was one of my chief assistants in organizing and managing the meeting. In fact, Jan herself, at no cost to the Society, did the artwork and illustrations for the cover of the ***Proceedings****. It was a 'do-it-yourself' event. We were scared stiff we might not come out even financially because we had no backup funds. We didn't actually know what would happen if the event lost money. On the last day of the meeting, I can still remember Jan wheeling up to where I was and asking if I wanted to know how we had done on the meeting. Of course, I did. Jan replied, 'Well,' and after a long pause, 'we made $40,000 dollars!' Jan and I were two happy people.*

Jan Little continued to be a staunch supporter of RESNA and she had a big voice in the disability movement. In later years, she lived in La Crosse, Wisconsin where she prepared and edited ***Capabilities****, our quarterly newsletter. She was a source of information to people around the globe. There was nothing 'little' about Jan Little! She is greatly missed."*

Ed Grahn, Associate Director of RERP/PRL recalls working with Jan. *"I'll always remember Jan as a person who was a joy to work with. She didn't see her disability as a handicap and always worked at full speed. I had known Jan for over thirty years in her various capacities, but worked most closely with her during her time as editor of* ***Capabilities****. She was meticulous about the accuracy of each issue and we would always resolve any difference of opinon over content or style amicably. She was a colleague and a friend that I miss."*

An Irresistible Force

Craig Heckathorne, Research Engineer, remembered Jan Little as *"a force that could not be resisted. She had objectives and worked toward them without letting up. She had a biting wit, but also a good sense of humor about things. The drive behind her force was her desire to create opportunities for people with disabilities, to ensure that they could get all that they required, whether it was better wheels, advocating for legislation or removing architectural barriers.*

Social Justice

She was concerned about how people are treated in society and she wanted to do something to improve it. She didn't try to transfer personal knowledge about living with a disability, but worked at a global level to effect change. Our laboratory was a tool for her to achieve what she wanted to for others.

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She Took the Long View

Funding was important to the success of RESNA. Jan had a lot of vitality. She had good business skills, a keen commercial sense, and she made RESNA financially solvent. She worked well with politicians on a national level and was a strong advocate in the development of the ADA.

Jan worked effectively both by example and by determined action. She made her own way in life. She was proactive, took the long view and lay the groundwork for the future."

Bonnie Collard, Department Assistant and Jan's close friend for many years, reflected on their long association and enduring rapport. As native Wisconsinites, Bonnie and Jan discovered common ground. Their friendship grew during years of collaborative, professional work and meetings. Working in tandem at an early meeting of RESNA, Jan and Bonnie solved a major organizational challenge and established RESNA's financial success and independence. This shared experience firmly cemented their friendship. Bonnie reflected, *"Jan and I knew each other well due to years of interaction and close communication."*

Bonnie continued, recalling Jan's ready wit and penchant for direct talk, *"Jan was never one to gloss over something unpleasant; she always spoke in a direct, straightforward way."* She emphasized Jan's use of humor and repartee as an effective approach to life's challenges, large and small. Adeptly applying a humorous twist, Jan succeeded in transforming difficulties into manageable events.

Bonnie revealed that in 1995, she was instrumental in bringing Jan to the Department to edit ***Capabilities***. During those years, they often spoke by phone. Bonnie admitted, *"On the telephone, we only had to hear the other's voice and we began to laugh! When I heard 'Hey-dair' in Wisconsin dialect, I knew it would be Jan. I couldn't help but laugh and reply 'Hey-dair.' Most of all, I remember that whenever we spoke or met, we laughed a lot!"*

In 1996, Jan gave Bonnie a copy of her autobiography, *If It Weren't for the Honor - I'd Rather Have Walked*. Jan had inscribed, "Bonnie, Thanks for changing my life." Referring to that inscription, Bonnie reflected on her years of friendship with Jan Little, *"The feeling is mutual."*

A Good Sense of Humor

Elizabeth Schreiber, Program Assistant, remembers meeting Jan at the Center's State of the Science Meeting in 2002. Although they met seldom, they spoke about once a week. *"Jan was very good and careful about keeping contact with authors and she communicated well with them. She had excellent communication skills and a good rapport with people. I think she was a 'people person' and her enthusiasm for lab work really came across strongly. She genuinely enjoyed working with the people here. It was always good to hear her voice. She had a very dynamic personality on the phone and in person. She had a good sense of humor and she made me laugh."*

Robert M. Baum, Prosthetic Program Manager at the Veterans Affairs Central Office in Washington, D. C., voiced a similar reflection, stating simply, *"Jan was great to work with."*

Brian Ruhe, doctoral student, remembered that Jan's voice was his first direct contact with the Department. In 1997, still an undergraduate at Wright State University, Ohio, he telephoned and explained his interest in the engineering program. *"She kept trying to transfer my call to the main campus. I refused to let her transfer me. I was persistent and kept asking questions. I think she enjoyed my persistence. I got to know her better after I arrived at Northwestern. She was a great lady. It was fun to talk with her. She had spunk."*

AFO Study Draws to a Close: An Investigation of the Effect on Gait of Ankle Alignment and Foot-plate Length

By Stefania Fatone, Ph.D.

Introduction

Stroke/Cerebral Vascular Accident (CVA) is the leading cause of serious long-term disability in the United States with a reported 4.5 million stroke survivors alive today of whom 15-30% are permanently disabled (American Heart Association, 2000). The prevalence of stroke increases with age, hence the aging population faces an increased risk of pathologies such as stroke that lead to impairments in limb function. Stroke often results in impairment of one side of the body, known as hemiplegia.

Initially following a stroke (the acute phase), the hemiplegic side of the body experiences flaccid paralysis, in which muscles are very weak or paralyzed. Later, in the chronic stage, this often progresses into spastic paralysis, a condition that is characterized by over activity of muscles. Function of the lower limb is compromised, with extensor synergy (patterned activation of the extensor muscles) the most common problem. People with hemiplegia have difficulty raising their foot (ankle dorsiflexion) and bending their knee (knee flexion). For a smaller number of people, flaccid paralysis persists, resulting in a condition referred to as foot-drop, which also results in an inability to raise the foot (ankle dorsiflexion).

Both spastic and flaccid paralysis impede the ability to dynamically shorten the lower limb during the swing phase of walking, requiring compensatory actions, such as circumduction and hip hiking, to assist with foot clearance of the ground. Circumduction refers to the outward swing of the leg during the swing phase of walking, while hip hiking refers to increased elevation of the pelvis occurring on the side of the swing leg. These compensatory actions increase the effort required to walk. Depending on the type of paralysis present, people with hemiplegia may develop a hyperextension deformity at the knee due to extensor synergy or may have issues with insufficient stability. Where the knee is unstable, additional gait strategies, such as bending the trunk forward, may be utilized to ensure the knee remains extended during weight bearing. Over time, these compensatory actions may lead to a hyperextension deformity at the knee.

The research project

Over 4 million Americans use orthoses, with Ankle Foot Orthoses (AFOs) being the most widely used type in the USA today (Russell, *et al.*, 1997; Whiteside, *et al.* 2000). AFOs are lower limb orthoses designed to provide control of ankle motion in the presence of foot and ankle pathologies and are typically prescribed to assist with walking. Although AFOs can be made of metal or plastic, plastic or polymer AFOs are most commonly used in the USA today (Simons, *et al.*, 1967). It is believed that AFOs offer the least cumbersome and most effective method of addressing abnormalities at the foot and ankle, as well as at the knee. An AFO is used to improve ankle-foot position during the swing phase of walking, typically holding the ankle in a neutral (90°) position during swing. In previous studies performed on able-bodied subjects, it was suggested that AFOs may act indirectly at the knee by either increasing the tendency for the knee to be stable or decreasing the tendency for the knee to hyperextend (Cook and Cozzens, 1976; Lehmann, *et al*, 1982 and 1985). This occurs due to alterations in the position of the Vertical Ground Reaction Force (VGRF) with respect to the knee joint.

Despite their popularity and clinical utility, many of the theories underlying AFO prescription are unsubstantiated. Given the widespread use of AFOs, there is a need for better scientific rationale for AFO design and for increased understanding about their effect on walking. We recently completed work on a VA-funded project to investigate how

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ankle-foot alignment and foot-plate length in AFOs affect the gait of people with hemiplegia following stroke. The purpose of this research project was to increase our understanding of AFO-assisted walking and determine if ankle-foot alignment and foot-plate length significantly affect AFO performance during walking in subjects with hemiplegia.

Figure 1: *Effect of shoe heel height on shank angle in an AFO with the ankle angle set at neutral (90° foot-shank angle). This figure illustrates how the vertical alignment or inclination of the shank is altered when the AFO is placed in a shoe with a heel. Changes in the angular attitude of the shank may alter the moments occurring at the knee.*

Many AFOs are aligned without a clear understanding of the effect of ankle and shank angle on gait. Figure 1 illustrates this concept using the heel height of a shoe to alter the inclination of the shank while the ankle angle remains constant. Lack of consideration of AFO alignment is surprising given the importance placed on ankle alignment for successful ambulation in other gait pathologies such as lower limb amputation and ankle arthrodesis (Mazur, *et al.*, 1979; Hannah, *et al.*, 1984; Buck, *et al.*, 1987; Zahedi, *et al.*, 1988; Hansen, 1998). There is also no clearly defined rationale in the orthotic literature for AFO foot-plate length, nor has the effect on gait been investigated. There are basically two choices of AFO foot-plate length: either three-quarter or full-length (Figure 2). Both ankle-alignment and foot-plate length may influence forward progression

(a) *(b)*

Figure 2: *Typical AFO foot-plate lengths: (a) full length and (b) ¾ length.*

during walking and the effect that the orthosis exerts at the knee (i.e. the external moments acting at the knee). We believe that quantitative gait analysis can be applied to help us better understand the biomechanics of orthotic-aided gait. A gait analysis is a non-invasive, experimental procedure that utilizes reflective markers taped to the skin (Figure 3), cameras, and a computer to record data about the way someone walks.

Twenty-two people with hemiplegia following stroke were enrolled in this study. However, for various reasons, only sixteen people completed the study (6 females and 10 males with a mean age of 53 ± 7 years; 6 with right-sided hemiplegia and 10 with left-sided involvement; mean time since the stroke was 7 ± 4 years). Participants for the study were recruited with the assistance of Dr. Richard Harvey, Stroke Chair at the Rehabilitation Institute of Chicago. Participants were required to be functional ambulators between 40 and 60 years of age with a minimum of two years post-stroke and appropriate candidates for wearing the test AFO. The Northwestern University Institutional Review Board approved this study, and informed consent was obtained from each individual prior to his or her participation. Twelve healthy, age-matched, able-bodied subjects were also

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Figure 3: *The Helen Hayes marker set used during the gait analysis. Reflective markers were taped to the skin over both Anterior Superior Iliac Spines (ASIS), femoral condyles, malleoli, dorsum (top) of the feet, laterally on the thighs and shanks (wand markers), and the sacrum and heel (not shown in photo). Data from markers placed on the trunk and upper limbs were not used in this study. Where the AFO obscured the landmarks required for identification of the ankle joint axis, markers were screwed into the mechanical ankle joint. Medial markers are used in the calculation of joint centers of rotation and were removed after collection of a single static trial. Surface electrodes, with the exception of the ground electrode on the tibial plateau, were taped down and the leads were connected to a telemetry pack worn on a backpack-style harness.*

recruited to participate in this study (4 females and 8 males with a mean age of 57 ± 8 years). These subjects provided normative, control data for comparison to the subjects with hemiplegia.

For the subjects with hemiplegia, the project involved five visits over the course of eight weeks. Initially, each participant was provided with a custom-fabricated AFO and a pair of orthopedic shoes. It was important that shoe heel height be the same for all subjects, hence all participants were provided with PW Minor orthopedic shoes. Using a single 'test' AFO, three different AFO conditions were tested with two weeks of accommodation (wearing) time allowed between testing of each condition. The test AFO was an articulated (Tamarak joints), polymer (polypropylene) AFO with a plantarflexion stop (rigid polypropylene stop) and unrestricted dorsiflexion. Gait analyses were performed with subjects walking under four conditions: baseline (no AFO), conventionally aligned AFO (CAFO), heel-height compensated AFO (HHCAFO) and three-quarter length AFO (3/4 AFO). Condition 1 (CAFO) was tested during the first gait analysis. In this condition, the ankle-foot angle was set at 90° with a full-length foot-plate. Condition 2 (HHCAFO) was tested during the second gait analysis. In this condition, the ankle-foot angle was adjusted by removing material from the plantarflexion stop so that the shank was vertical in the shoe. Foot-plate length was unaltered. Condition 3 (¾ AFO) was tested during the third

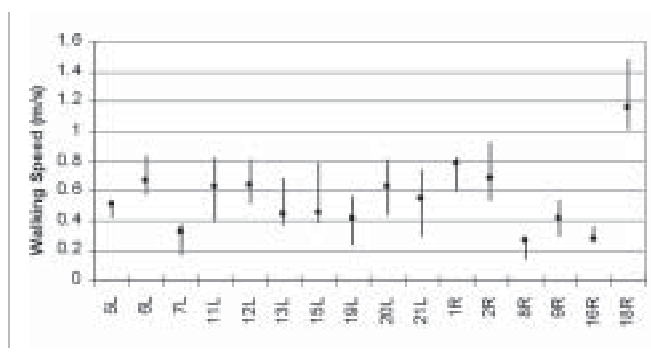

Figure 4: *Range of walking speeds demonstrated by study participants when asked to walk at their 'normal' speed, as fast as possible and as slow as possible. Black square indicates mean self-selected 'normal' walking speed while the line indicates the range of walking speeds from 'slow as possible' to 'fast as possible'. Subject 18R was capable of walking speeds that were comparable to the 'normal' self-selected walking speed of age-matched, able-bodied subjects (1.19 ± 0.15 m/s).*

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gait analysis. In this condition, ankle alignment was unaltered and the foot-plate trimmed to a three-quarter length. A baseline, shoe-only condition was also recorded.

Our findings at the ankle and knee

People with hemiplegia walked with a much slower 'normal' self-select walking speed than able-bodied people of a similar age. There was substantial variability in walking speed and range of walking speeds among the sixteen participants (Figure 4).

All AFO conditions improved the angular orientation of the ankle during walking compared

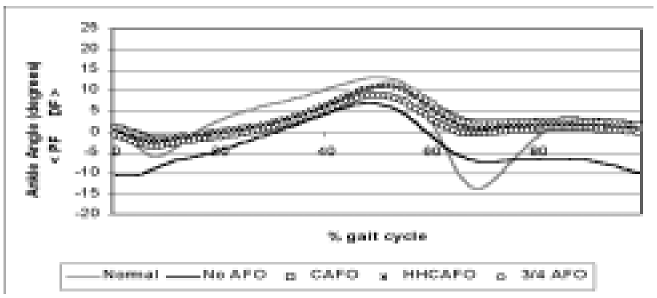

Fig 5a:

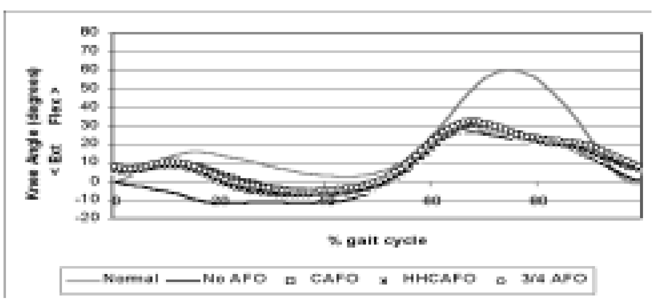

Fig 5b:

Figure 5: *Mean sagittal plane ankle and knee kinematics of the involved limb.*

to walking without an AFO (Figure 5a). The effect of the AFO on knee moments was most pronounced for subjects who demonstrated dynamic knee hyperextension during stance (Figure 5b). In these subjects, all AFO conditions delayed the onset of hyperextension, decreased the magnitude of hyperextension, and altered the internal knee moment from flexor to extensor.

Use of a walking aid, such as a cane by 9 of the 16 subjects, reduced the differences that existed between AFO conditions (Figure 6). For the subjects who walked with a cane, there were no changes in walking speed and VGRF between AFO conditions. For the subjects who walked without a cane, walking speed increased slightly in the ¾ AFO (Condition 3) and there were differences in the VGRF during the loading response phase of walking. Although subjects were asked to ambulate without a cane

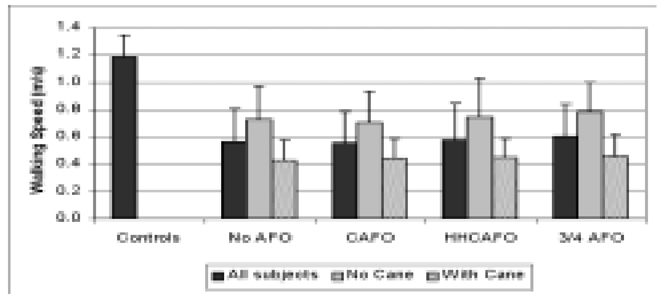

Fig 6a:

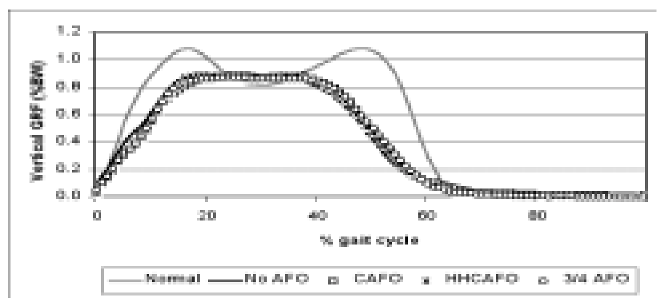

Fig 6b:

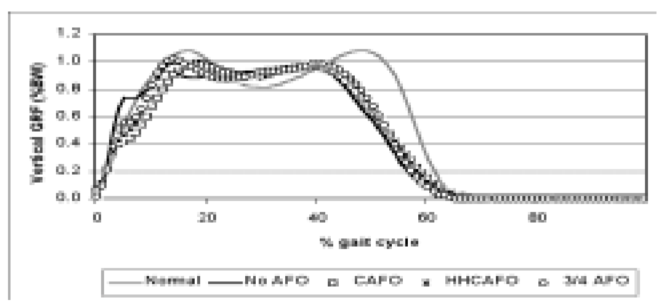

Fig 6c:

Figure 6: *Effect of cane on mean walking speed (a) and VGRF (b and c). VGRF data are shown for the involved limb in all conditions at self-selected 'normal' walking speed for (b) subjects who used a cane (n=9), and (c) subjects who didn't use a cane (n=7).*

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during testing, subjects were not forced to do so if they did not feel comfortable. During stance on the involved limb, the VGRF never reached body weight when a cane was used and the moments acting at the knee were reduced compared to the subjects who walked without a cane (Figure 7).

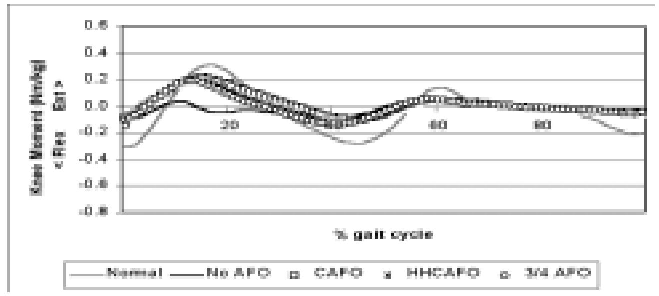

Fig 7a:

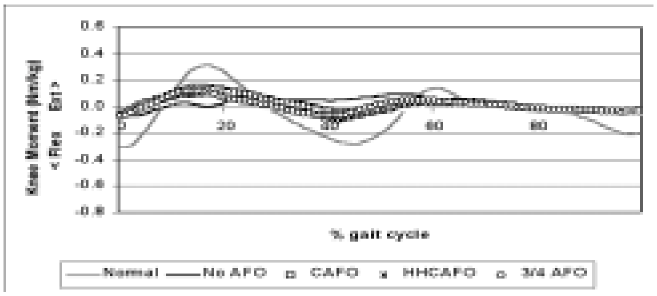

Fig 7b:

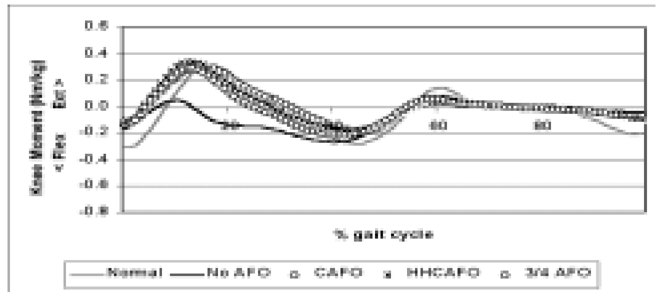

Fig 7c:

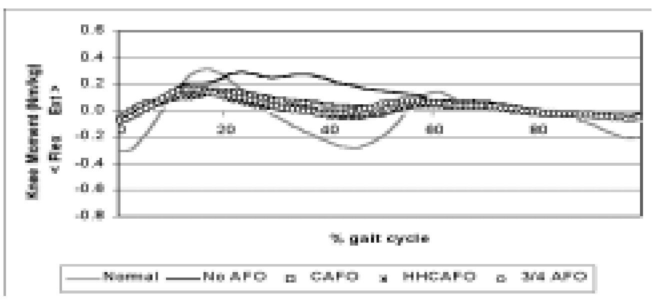

Fig 7d:

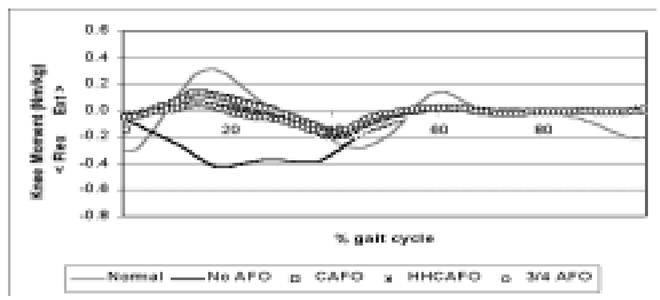

Fig 7e:

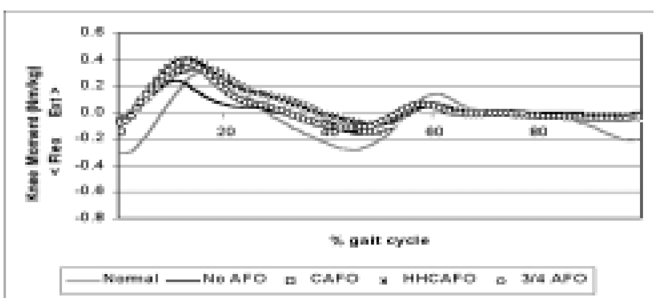

Fig 7f:

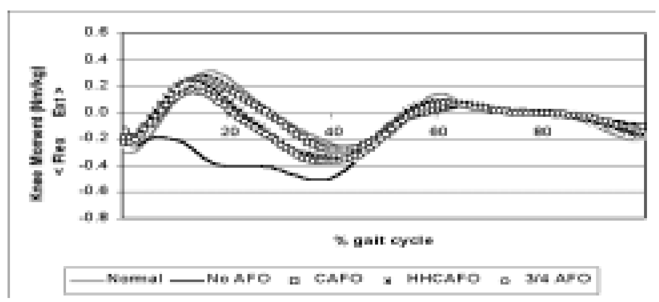

Fig 7g:

Figure 7: *Mean sagittal plane knee moments for the involved limb of: (a) all subjects (n=16); (b) subjects who used a cane (n=9); (c) subjects who didn't use a cane (n=7); (d) subjects who used a cane and didn't have dynamic knee hyperextension; (e) subjects who used a cane and had dynamic knee hyperextension; (f) subjects who didn't use a cane and did not have dynamic knee hyperextension; (g) subjects who didn't use a cane and did have dynamic knee hyperextension.*

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What does it all mean?

For this study, changes made to the ankle alignment of the AFO were relatively small (5-7°), but of a clinically relevant magnitude. However, we only found differences in knee kinetics (moments) between alignment conditions in the three subjects who demonstrated knee hyperextension and walked without a cane (Fig 7g). It is possible that the changes made to the AFO alignment were not substantial enough to have an impact on people with the degree of pathology present in this subject population. There is a great deal of variability in the gait of people with hemiplegia, especially with respect to walking speed, ability to walk without a cane, and knee alignment (i.e. the presence of hyperextension or not). All of these factors increase the difficulty of data analysis and interpretation, and serve to decrease the sample size available for analysis if subjects are separated into sub-groups. Many of the subjects with hemiplegia in this study walked with a halting, shuffling gait that was not very dynamic. It may be that if a subject requires the use of a cane and walks very slowly, changes in alignment and foot-plate length will have less impact on their gait. However, the potential long-term effects have not been investigated.

We have more data to analyze for this project, including examining center of pressure progression, plantar pressures and EMG (muscle activity) data. The difficulties we have encountered in analyzing our data, in particular the large variability, serves to illustrate the challenges inherent in conducting orthotic research in a population with similar pathology but variable presentation. Such an observation helps to explain why research on orthotic-aided ambulation has been less popular in the past than research on prosthetic-aided ambulation.

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Acknowledgements

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News from RERP, PRL and NUPOC

Childress Invited as Presidential Guest Speaker at ACPOC

Dudley S. Childress, Ph.D., was invited to be the Presidential Guest Speaker at the Association of Children's Prosthetic-Orthotic Clinics (ACPOC) held March 24 through 27, 2004 in Banff, Alberta, Canada. Dr. Childress' address was entitled "Finding Their Own Way." Previously, Dr. Childress presented the 5th Hector Kay Memorial Lecture when the ACPOC meeting was held in Chicago on June 8, 1989.

Dudley S. Childress, Ph.D. Receives RESNA Mentor Award

Dudley S. Childress, Ph.D., received the Mentor Award from the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) at their annual meeting, June 19 through 22, 2004. The Mentor Award is an honor given to a RESNA member who has been nominated by at least three nominators who have submitted essays describing how the nominee has influenced and nurtured others in the field of Rehabilitation Engineering or Assistive Technology.

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News from RERP, PRL and NUPOC

Andrew Hansen, Ph.D. Awarded Best Paper at ISPO 2004

Andrew H. Hansen, Ph.D., was awarded Best Paper in the Technology Innovation Category for his presentation entitled "Effects of Prosthetic Foot Roll-over Shape Arc Length on Gait of Trans-Tibial Prosthesis Users" at the 11th Annual World Congress of the International Society of Prosthetics and Orthotics (ISPO), Hong Kong, August 1 through 6, 2004.

Andrew Hansen, Ph.D., accepting award for Best Paper at ISPO 2004

Lissette Ruberte CAHSEE Fellow and Recognition for Leadership

Lissette Ruberte, M.S., was invited to be a Fellow at the Center for the Advancement of Hispanics in Science and Engineering Education (CAHSEE) in Washington, D.C. from June 12 through August 7, 2004. CAHSEE's Young Educators Program prepares Latino college students for success in their academic and professional careers. Ms. Ruberte took seminars on leadership, educational and professional development and public policy; participated in a five-week field assignment in Science, Technology, Engineering and Mathematics at George Washington University, and wrote reports about her educational experience.

Earlier in 2004, the Office of Minority Affairs at The Graduate School of Northwestern University publicly recognized Ms. Ruberte for her efforts to diversify new applicants to The Graduate School. Ms. Ruberte, a founding member and Vice President of the Graduate Student Association for Latino and Spanish Activities (G-SALSA), actively works to recruit and assist minority students in their selection of and application process to Northwestern University's graduate programs.

Regina J. Konz Wins Red Ribbon for Poster

Regina J. Konz, M.S., was awarded a Red ribbon for her poster "Development of an Advanced Bio-mechanical Spine Model to Assess the Effect of Surgical Stabilization and Alignment on Gait" at the 2003 Congress of Neurological Surgeons Annual Meeting.

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NEWS FROM THE DEPARTMENT OF VETERANS AFFAIRS

"What Are My VA Benefits?"

by
Robert M. Baum
Prosthetic Program Manager
Prosthetic and Sensory Aids Program
(113)
VA Central Office, Washington, D. C.

What are my benefits? What an important and powerful question. Working for the Federal Government, I ask myself this question every year when it comes time for federal employees to decide to keep their current health benefits or choose another provider. This question is just as important for anyone changing jobs, purchasing insurance, or just looking to join a new club. The answer is just as important since it will be the means by which one decides their future. This question is also popular among our Nation's veterans. There is no question that serving our country has its benefits. Those who have fought for us have given contributions and sacrifices to our country. They deserve not only recognition and gratitude, but they also deserve the best in healthcare, education and assistance in returning to society. As Secretary of Veterans Affairs Anthony J. Principi stated, "One of the ways the nation shows its gratitude is by ensuring veterans receive the benefits they deserve." The Department of Veterans Affairs (VA) prides itself on doing just that.

In an effort to reach out to all veterans and also those veterans of combat in Iraq and Afghanistan, this piece is written for you so you can become more familiar with various VA benefits that may be of interest to you. First of all, the VA healthcare system is unique in that it has many specialty services and special emphasis programs that you will not see in the private sector. One of those specialty programs is the Prosthetic and Sensory Aids Service. This service is an integrated delivery system designed to provide medically prescribed prosthetic, orthotic, sensory aids, medical supplies, equipment and devices, assistive aids, repairs and services to eligible disabled individuals to facilitate the treatment of their medical condition. Examples of prescribed prosthetic items include aids for the visually impaired, artificial limbs, hearing aids, eyeglasses, speech and communication devices, home dialysis supplies, orthopedic braces and supports, orthopedic footwear, ocular prostheses, cosmetic restorations, wheelchairs, hospital beds, and other aids of daily living. Other services provided and managed by this department include, but are not limited to: in-house orthotic and prosthetic laboratories that fabricate and provide state-of-the-art prosthetics; home improvements or structural alterations; automobile adaptive equipment; and clothing allowance. Let me briefly explain their importance.

The Home Improvement and Structural Alteration (HISA) program helps pay for home improvements necessary to ensure continuation of medical treatment or provide access to the home and essential lavatory and sanitary facilities. VA will pay a lifetime benefit up to $4,100.00 for home alterations for a veteran being treated for a service-connected disability; and a lifetime benefit up to $2,100.00 may be paid for other veterans. Some alterations chargeable to the veterans cost limitations include, but are not limited to: roll-in showers, permanent ramping, widening of doorways, lowering of

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bathroom and kitchen counters and cabinets, improving entrance paths and driveways in immediate area of the home to facilitate access to the home. This program should not be confused with the Specially Adaptive Home grant in which veterans may be entitled to a grant from the VA for a home specially adapted to their needs. In this benefit, VA may approve a grant of not more than 50 percent of the cost of building, buying or remodeling adapted homes or paying indebtedness on those homes already acquired, up to a maximum of $50,000.00.

Maintaining independence is important and in order to help you do that, VA assists in getting disabled veterans back on the road again. The VA has established over 40 driver rehabilitation centers nationwide. Eligible veterans or active duty personnel are provided a clinical program of primary services that include: driving assessments; patient and family education; behind the wheel instruction; vehicle and equipment evaluation. In conjunction with this program, certain veterans and service-members qualify for the automobile adaptive equipment benefit if they have service-connected loss of, or permanent loss of use of, one or both hands or feet, or permanent impairment of vision of both eyes. Veterans entitled to compensation for ankylosis (immobility) of one or both knees, or one or both hips, also qualify for an automobile grant. There is a one-time payment by VA of not more than $11,000 toward the purchase of an automobile or other conveyance. VA will pay for adaptive equipment, and for repair, replacement, or reinstallation required because of disability, and for the safe operation of the vehicle purchased with VA assistance. Other items, such as van lifts, raised doors, raised roofs, wheelchair tie-downs for passenger use, may be furnished as part of medical services for all veterans as a follow-up to VA care, provided the equipment is medically necessary for the care and treatment of the veteran.

Just as many of you receive yearly compensation from your employer for laundry or dry-cleaning of uniforms or work-clothes, VA provides an annual monetary clothing allowance disbursement to any veteran who is entitled to receive compensation for a service-connected disability for which he or she uses a prosthetic or orthopedic appliance, which tends to wear out or tear the clothing of such veteran. The allowance is also available to any veteran whose service-connected skin condition requires prescribed medication that damages the veteran's outer garments. This benefit could be approved on a yearly basis, or as a lifetime benefit dependent on the disability and appliance causing damage to clothing. The clothing allowance for this past year was $588.00.

Enrollment in VA also allows access to comprehensive inpatient and outpatient services such as preventive services (immunizations), screenings, health education, primary health care, surgery, mental health, spinal cord injury care, physical medicine and rehabilitation, services for the blind, outpatient pharmacy services, home health, emergency services, drugs and pharmaceuticals. Additional benefits and programs include home loans, life insurance, readjustment counseling, and other popular benefits like Vocational Rehabilitation. In this program, VA provides employment and independent living services to service-connected veterans – vocational counseling to service-members and veterans who have recently separated from active duty, and vocational counseling or special rehabilitation services to dependants of veterans who meet certain program eligibility requirements.

While the VA mails brochures to all service-members separating from the military to notify them of VA benefits, VA has a website that contains more details about these and many other available benefits. You can apply for many of the benefits on line at www.va.gov or by visiting your closest VA Medical or Regional Office. Another good source of information is a pamphlet you can get at any of these locations titled Federal Benefits for Veterans and Dependants, which is updated and published yearly.

VA has brochures, websites, and staff ready and waiting to assist you in answering any and all of your benefit questions. The next step is yours.

ISPO Conference 2004 in Hong Kong

Eleven members of the Northwestern University Rehabilitation Engineering Research Center in Prosthetics and Orthotics attended the 11th World Congress of the International Society for Prosthetics and Orthotics in Hong Kong from August 1 through 6, 2004. ISPO 2004 featured two particular highlights for REPOC when Dudley S. Childress, Ph.D. presented a Keynote Speech; and Andrew Hansen, Ph.D., won a Best Paper Prize.

Presentations

As a non-commercial exhibitor at ISPO, the PRL/RERP booth displayed various prosthetic and orthotic components such as a small compression molding device to create small-scale Shape&Roll feet, Squirt Shape sockets and monolithic limb, all currently under development or evaluation by our laboratory. We also displayed posters that represent the variety and depth of our work. The titles, authors and findings of some of our presentations at ISPO are summarized below.

"The Effect of Prosthetic Shock Absorbing Pylons (SAPs) on the Gaits of Persons with Trans-tibial Amputations" by Steven A. Gard, Ph.D. and Regina J. Konz, M.S. It may be beneficial to fit trans-tibial amputees with SAPs, provided that users routinely walk at speeds greater than about 1.3m/sec. For some subjects, the SAPs decreased transient forces applied to the residual limb during the loading response phase of gait by up to 60% body weight. Subjective data show that SAPs increase comfort and enable users to walk at higher speeds, over greater distances and for longer periods of time.

"The Shape and Roll (SR) Prosthetic Foot: Design and Development of Appropriate Technology for Low-Income Countries (1)" by Margrit R. Meier, Ph.D., CPO, Michel Sam, M.S., Andrew H. Hansen, Ph.D., Dudley S. Childress, Ph.D., and Hector R. Casanova. This testing took place in Chicago and the subjects' current feet were mostly expensive "high-end" feet. The results of the questionnaire revealed no significant differences between participants' performance while wearing the SR foot compared to the current prosthetic foot (CF). Analysis of the gait data will show if this result is also valid for the quantitative walking measurements.

"The Shape and Roll (SR) Prosthetic Foot: Design and Development of Appropriate Technology for Low-Income Countries (2)" by Margrit R. Meier, Ph.D., CPO, Michel Sam, M.S., Andrew H. Hansen, Ph.D., Dudley S. Childress, Ph.D., and Hector R. Casanova. Field testing of the Shape and Roll foot was conducted during three weeks in San Salvador on twelve unilateral transtibial amputees. Data analysis of a questionnaire revealed that, compared with their own prostheses, participants were able to walk significantly longer distances and achieved fast-walking abilities while wearing the Shape and Roll foot.

"Stance-Phase Knee Flexion In Persons With Unilateral Transfemoral Amputations Walking on an Otto Bock 3R60 EBS Knee: A Preliminary Report" by S.R. Koehler, M.S., S. A. Gard, Ph.D., M.R. Meier, Ph.D., CPO, M. Cassar, CPO, and R. Lipschutz, CP. Although the 3R60 knee unit is capable of providing up to 15º of stance flexion, subjects were observed to walk with only a small amount of stance flexion on their prosthetic knee. The average amplitude of stance flexion during freely-selected walking speeds measured approximately 3.4 $\pm$ 2.1º on the prosthetic side, compared to an average of 18.4 $\pm$ 7.9º on the sound side. This difference may be due to a conservative alignment that provides too much knee stability, or it may be due to gait habits developed while walking with prosthetic knee designs that do not incorporate a stance flexion feature.

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"The Effects of Thoraco-Lumbo-Sacral Orthoses (TLSO) on Gait" by Regina Konz, M.S., Stefania Fatone, Ph.D., and Steven Gard, Ph.D. One of the functions of TLSOs is to restrict spinal and pelvic motion, while walking, to achieve stability. Restriction of spinal motion limits pelvic obliquity, possibly lessening the ability of the body to absorb shock during walking. Spinal restriction resulted in a slight increase in stance phase knee flexion, indicating that individuals may compensate for the loss in pelvic obliquity with increased knee flexion during stance. Pelvic rotation also diminished with spinal restriction. To walk at faster speeds with a restricted spine, subjects shortened their step length and increased cadence.

"The Roll-Over Shape Alignment (ROSA™) System for Trans-Tibial Alignment" by Andrew H. Hansen, Ph.D., Michel Sam, M.S., Margrit R. Meier, Ph.D., CPO, Dudley S. Childress, Ph.D., and Mark L. Edwards, CP. The results of a double-blind experiment support the ROSA™ hypothesis (Hansen *et al.*, 2003). Similar to the ROSA™ System, experienced prosthetists seemed to align the roll-over shapes of four different prosthetic feet toward one common shape.

"The Shape&Roll Prosthetic Foot: Design and Development of Appropriate Technology for Low-Income Countries" by Michel Sam, M.S., Andrew H. Hansen, Ph.D., Dudley S. Childress, Ph.D., Margrit R. Meier, Ph.D., CPO, Steven Steer, M.S. and Sophie Lambla, M.S. Developed from empirical data and scientific theories of walking, the Shape&Roll foot was designed to mimic the roll-over characteristics of the biologic ankle-foot system during walking. Highly durable and fabricated using simple tools and locally available materials, the Shape&Roll foot is targeted for use in low-income countries. The prosthetic foot's core of polypropylene (co-polymer) is fabricated in a compression mold. The plastic blank from the compression mold is cut into the shape of a foot and cuts are made in the forefoot region of the foot. The location, thickness and number of cuts determine the roll-over shape of the foot, while the thickness of the sole plate determines the foot's stiffness. When the cuts close, the prosthetic foot approximates the physiologic ankle-foot roll-over shape.

"The Behavior of the Knee-Ankle-Foot (KAF) System during Gait Initiation, Steady-State Walking and Gait Termination" by Steve C. Miff, M.S., Dudley S. Childress, PhD., Andrew H. Hansen, Ph.D., Steven A. Gard, Ph.D., and Margrit Meier, Ph.D., CPO. The KAF roll-over shape appears to change in orientation during gait initiation and termination. For the first phase of gait initiation, overall dorsiflexion at the ankle moves the center of pressure (COP) backward, creating an imbalance that starts the forward falling movement of the body. The increase in dorsiflexion with higher walking speeds indicates a larger backward shift in the COP resulting in a larger and faster forward fall of the body during the first step. During gait termination, the plantarflexed appearance of the KAF roll-over shape indicates a forward progression of the COP resulting in a braking COP-BCOM (body center of mass) vector.

"An Investigation of Foot Alignment and Support in Ankle Foot Orthoses (AFOs)" by Stefania Fatone, Ph.D., Steven A. Gard, Ph.D., Dudley S. Childress, Ph.D., Andrew H. Hansen, Ph.D. and Bryan S. Malas, MHPE, CO. Authors report that twice as many Americans use orthoses compared to prostheses. Many AFOs are aligned without considering the effect that heel height and foot-plate length have on gait. After examining the effect of ankle-foot alignment and foot support in AFOs, authors report that foot-plate length have the greatest effect on those people with hemiplegia who walk at speeds above 0.6m/s. Ankle-foot alignment will have the greatest effect on hemiplegics who hyperextend at the knee. AFO alignment must consider the patient's shoe heel height because small changes in ankle-foot alignment and foot-plate length affect moments at the ankle and knee by altering the location of the COP.

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"New Cable-Actuated Locking Humeral Rotator" by Lissette M. Ruberte, M.S.and Craig W. Heckathorne, M.S. The authors developed a new cable-actuated positive-locking humeral rotator suitable for persons with a bilateral or unilateral amputation at the trans-humeral level or higher. The design offers several advantages over current commercially available rotator units, including an increased number of locking positions, provision of a large central opening for passage of electrical wiring, and an overload safety mechanism. The operation of the lock does not require the cable tension to be maintained. This mechanism offers potentially improved functional outcome for persons with high-level and bilateral arm amputations.

"Roll-over Shapes of Prosthetic Feet from Low Income Countries" by Michel Sam, M.S., Andrew H. Hansen, Ph.D. and Dudley S. Childress, Ph.D. Prosthetic feet from low-income countries were tested and found to have roll-over shapes similar to SACH feet, characterized by a flat region followed by a lack of toe support (Sam, *et al*., 2004). The lack of toe support generally begins at the distal end of the rigid keel. One exception to this pattern is the Jaipur foot, where the roll-over shape is smooth and gradually curves upward, but with a small radius compared to that of the physiologic ankle-foot system.

"The C-leg ® and the 3R60 Prosthetic Knee Joint: A Comparison Between a Microprocessor-Controlled and Passive Prosthetic Knee Joint" by Margrit R. Meier, Ph.D., CPO, Steven A. Gard, Ph.D., Andrew H. Hansen, Ph.D., and Dudley S. Childress, Ph.D. Results from three participants are presented. The C-leg tends to facilitate fast level walking speed, especially under a mental loading task. However, the 3R60's effect on energy efficiency, as estimated by the Total Heart Beat Index (THBI), is generally more favorable than that for the C-leg.

"Prosthetic Arm Design and Simulation System (PADSS)" by Craig W. Heckathorne, M.S. and P. Hungspreugs. PADSS is a computer based modeling program intended to help prosthetists choose components for upper limb prostheses. It is being designed to meet several goals, including assessment and comparison of different prosthetic configurations with less time, cost, and effort than traditional methods; use of visual representations of prothesis designs to assist in communication between client and prothetists; and simulation of new or hypothetical prothesis designs and configurations.

"Roll-over Shapes of Able-bodied Locomotor Systems (II): Effects of Surface Inclination – Ramp Walking Study" by Andrew H. Hansen, Ph.D., Dudley S. Childress, Ph.D., and Steve C. Miff, M.S. The *ankle-foot system* adapts its roll-over characteristics when going uphill but does not change appreciably when going downhill. The *knee-ankle-foot system* changes its orientation with all levels of surface inclination, perhaps to help the body maintain an upright posture on ramps.

Childress Invited to Join U.S. Engineering Delegation to Viet Nam

Dudley S. Childress, Ph.D., participated as an invited member of a delegation composed of seven American university professors, scientists and experts who actively are involved in Biomedical Engineering. From January 2 until January 15, 2004, the delegation visited Biomedical Engineering Departments at Hanoi University of Technology, Ho Chi Minh City of Technology and Can Tho University.

Other members of the delegation included Robert Jaeger, Ph.D., Executive Secretary of the interagency Committee on Disability Research (ICDR), the National Institute on Disability and Rehabilitation Research (NIDRR), Department of Education, Washington, D.C.; David Kaplan, Ph.D., Director of the Tufts University Bioengineering Center and Chairman of the Biomedical Engineering Department, Department of Chemical & Biological Engineering, Medford, MA; Murray H. Loew, Ph.D., Co-Director of the Institute for Medical Imaging and Image Analysis, George Washington University, Department of Electrical and Computer Engineering, Washington, D.C.; and Gordana Vunjak-Novakovic, Ph.D., Principal Research Scientist at Harvard - MIT Division of Health Sciences and Technology, Cambridge, MA. and Professor at Belgrade University (the former Yugoslavia).

By meeting with Vietnamese faculty, researchers and government officials in Hanoi, Ho Chi Minh City and Can Tho, the U.S. delegation conducted a needs assessment and explored prospective collaborative partnerships in Bioengineering. In its report, the delegation enumerated Viet Nam's current status of bioengineering, assessed its short and long term needs, proposed plausible solutions for future development, and recommended the next steps for an effective implementation of the delegation's findings. The National Science Foundations (NSF) supported the delegation and their work.

International Trade Show and World Congress for Prosthetics, Orthotics, and Rehabilitation Technology

Dudley S. Childress, Ph.D., gave a paper at the World Congress Orthopädie + Reha-Technik International Meeting (The International Trade Show and World Congress for Prosthetics, Orthotics, and Rehabilitation Technology) held in Leipzig, Germany from May 19 through 22, 2004. The title of his lecture, based on research conducted together with Andrew H. Hansen, Ph.D., was "Design, Evaluation and Alignment of Prosthetic Feet Using the Roll-over Shape."

Abstract of Childress' Address to The International Trade Show and World Congress for Prosthetics, Orthotics, and Rehabilitation Technology

Our research shows that in normal walking the human foot/ankle system creates roll-over shapes that are relatively invariant with respect to walking speed, added weight, and high-heeled shoes.[1-3] Roll-over shapes are determined by transforming the center of pressure of the ground reaction force in the direction of forward progression into the sagittal plane shank-based coordinate system. The human ankle/foot roll-over shapes are nearly circular during the period of heel contact to opposite heel contact.

We have evidence that prostheses that have roll-over shapes that are similar to those of normal physiological systems; that is, have similar curvature, similar length, similar orientation and location, and similar energy storage/release, will have many of the performance features that are seen in typical human foot/ankle systems. Hence, the roll-over shape of the normal foot/ankle system provides a guide for how prostheses should be designed. In like manner, prostheses can be evaluated on the basis of how closely their roll-over shape corresponds to that of the normal human foot/ankle complex. Our results also show that roll-over shape can be used to align prostheses by lining up the foot so that its roll-over shape is fitted as closely as possible to the roll-over shape of the normal foot/ankle system.[4-5]

Shapes are with respect to the attachment point of the foot. A biomimetic design is one in which a foot shape matches the shape of the physiological ankle/ foot complex. For example, roll-over shape length is an important evaluation tool for performance. The effective foot length (EFL) is defined as the length from the heel to the end of the roll-over shape. The foot length (FL) is the length from the heel to the toe of the foot. The EFL Ratio is defined as EFL/FL. A normal foot/ankle system has an EFL Ratio of about 0.8. The typical SACH foot has an EFL Ratio of about 0.6. A high ratio is thought to provide for longer stepping length and lower peak forces on the opposite limb.[6]

The height of the foot from the floor to its attachment point on the foot is readily visible in the roll-over shape. Consequently, one can readily see how tall an artificial foot is with respect to other feet merely by plotting the roll-over shapes of the feet on the same graph. In fact, one of the most positive aspects of roll-over shape data is that it is very visual and provides one with a graphical display that allows many characteristics of a prosthetic foot to be quickly evaluated with respect to other prosthetic feet and with respect to normal human roll-over shape. Examples of comparisons will be illustrated.

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[2] Hansen, A., Childress, D., Knox, E. Roll-over Shapes of Human Locomotor Systems: Effects of Walking Speed. *Clinical Biomechanics*, in press.

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NURERC Attends RESNA and Hosts Exhibit

Dudley S. Childress, Ph.D., Steven A. Gard, Ph.D., Stefania Fatone, Ph.D., and Craig Heckathorne, M.S., represented the Northwestern University Rehabilitation Engineering Research Center in Prosthetics and Orthotics at the 27th International Conference of Rehabilitation Engineering and Assistive Technology Society of North America (RESNA), June 18 through 22, 2004 in Orlando, Florida. RESNA is an interdisciplinary association dedicated to improving the potential of people with disabilities through the exchange of information about assistive technology.

Consonant with the RESNA conference theme, "Technology & Disability: Research, Design, Practice and Policy," NURERC hosted an exhibit booth that displayed our Mission Statement:

The Northwestern University Rehabilitation Engineering Research Center in Prosthetics and Orthotics is dedicated to the improvement of prosthetics and orthotics, to improved fitting and manufacturing processes for prosthetic and orthotic systems, and to the improved basic understanding of human interaction with these systems. This research, applied and technical in nature, is conducted in a medical environment that fosters direct clinical interaction and applications. We are dedicated to develop and provide - through science, engineering, prosthetics and orthotics and other related disciplines - limb replacements (prostheses) and structural and movement aids (orthoses) that help humans affirm their lives with enthusiasm, wholeness and hope.

Posters introduced conference attendees to the laboratory's current research sponsored by the Department of Education and the Department of Veterans Affairs. Some of the featured posters included: "The Behavior of the Knee-Ankle-Foot System During Gait Initiation, Steady-State Walking and Gait Termination" by Steve C. Miff, M.S., Dudley S. Childress, Ph.D., Andrew H. Hansen, Ph.D., Steven A. Gard, Ph.D. and Margrit Meier, Ph.D., CPO; "The C-leg ® and the 3R60 Prosthetic Knee Joint: A Comparison Between a Microprocessor-Controlled and Passive Prosthetic Knee Joint" by Margrit R. Meier, Ph.D., CPO, Steven A. Gard, Ph.D., and Dudley S. Childress, Ph.D.; "The Effect of Thoraco-Lumbo-Sacral Orthoses on Gait" by Regina Konz, M.S., Stefania Fatone, Ph.D. and Steven Gard, Ph.D.; and "The Shape & Roll Prosthetic Foot: Design and Development of Appropriate Technology for Low-Income Countries" by Michel Sam, M.S., Andrew H. Hansen, Ph.D., Dudley S. Childress, Ph.D., Margrit R. Meier, Ph.D., CPO, Steven Steer, M.S., and Sophie Lambla, M.S.

NUPRL & RERP Host Gait Course

On November 4 through 6, 2004, NUPRL & RERP, in conjunction with the American Academy of Orthotists and Prosthetists (AAOP), held the third Advanced Training Course: An Overview of Gait Analysis for Prosthetists and Orthotists. Twenty participants from throughout the United States attended the course which featured lectures and case studies designed to increase knowledge about able-bodied, orthotic and prosthetic gait.

Motion analysis videos and graphs accompanied lectures and case studies, enabling prosthetists and orthotists to familiarize themselves with the diagnostic features of gait analysis and data

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9th Annual Gait and Clinical Movement Analysis Society Meeting (GCMAS)

Members of NURERP presented papers at the 9th Annual GCMAS meeting, held in Lexington, Kentucky on April 21 through 24, 2004.

Presented papers included: "A Method for Determining a Best-Fit Single Radius Lower Limb Rocker in Normal Walking" by Michel Sam, Ph.D., Andrew H. Hansen, Ph.D. and Dudley S. Childress, Ph.D. Findings indicated that the cycloids approach is a useful way to find the radius and A-P placement of a best-fit radius rocker.

"An Investigation of Foot Alignment and Support in Ankle Foot Orthoses" by Stefania Fatone, Ph.D., Steven A. Gard, Ph.D., Dudley S. Childress, Ph.D. and Brian S. Malas, MHPE, CO, suggested that a small change in the ankle angle of an AFO will result in changes in the moments about the knee; ankle alignment (and the effect of heel height on alignment) should be considered carefully, particularly where knee control and motion are altered.

"Temporal-spatial Symmetries During Gait Initiation and Termination" by Steve Miff, M.S., Dudley S. Childress, Ph.D., Andrew Hansen Ph.D., Steven Gard, Ph.D. and Margrit Meier, Ph.D.,CPO, indicated that the time needed for gait initiation and for rapid gait termination appears to be approximately 1.6 seconds, relatively constant with walking speed, and does not change for subjects with UTT limb loss.

"Stance-Phase Knee Flexion in Persons with Unilateral Transfemoral Amputations Walking on an Otto Bock 3R60 EBS Knee: A Preliminary Report" by S. R. Koehler, Steven A. Gard, Ph.D., Margrit Meier, Ph.D., M. Cassar, and R. Lipschutz, CP, indicated that although the 3R60 knee unit is capable of providing up to 15º of stance-phase flexion, subjects had very little stance-phase flexion in their prosthetic knee, suggesting that more focused and intensive gait training could improve stance-phase knee flexion.

"The Effect of Thoraco-Lumbo-Sacral Orthoses on Gait" by Regina Konz, M.S., Stefania Fatone, Ph.D. and Steven A. Gard, Ph.D., found that spinal restriction of all subjects with customized fiberglass body jacket resulted in decreased peak-to-peak pelvic obliquity and pelvic rotation range of motion (ROM) with shorter step lengths but increased cadence at faster walking speeds.

NUPRL & RERP Host Gait Course

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interpretation. A binder and nightly reading assignments augmented the daily course work. Participants evaluated the course highly.

Not all was work without play. Participants and instructors attended an evening reception at Allerton Crowne Plaza where they relaxed and became better acquainted.

Faculty for the gait course included Dudley S. Childress, Ph.D., Steven Gard, Ph.D., Stefania Fatone, Ph.D., Margrit Meier, Ph.D., CPO, Andrew Hansen, Ph.D., and Rebecca Stine, M.S. from NPRL & RERP; Bryan Malas, CO, Mark Edwards, CP, Laura Miller, M.S., CP and Robert Lipschutz, CP from NUPOC and Robert Novak M.S. from the Motion Analysis Center at Children's Memorial Hospital, Chicago.

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News from RERP, PRL and NUPOC

New Position

Bryan S. Malas, MHPE, CO, has taken a new position as Director of the Orthotics Department at Children's Memorial Hospital, Chicago.

Appointments

Stefania Fatone, Ph.D., and Andrew H. Hansen, Ph.D., joined the faculty as Research Assistant Professors of the Department of Physical Medicine & Rehabilitation, Feinberg School of Medicine, Northwestern University, Chicago.

In March 2004, Michael Brncick, CPO, M.Ed., joined the faculty of Physical Medicine and Rehabilitation as the new Administrative Director of Northwestern University's Prosthetics Orthotics Center.

Theses Defenses

Steve Miff, Ph.D., defended his doctoral dissertation entitled "Gait Initiation and Termination in Non-Disabled Ambulators and in People with Unilateral Lower-Limb Loss" and graduated from Biomedical Engineering at Northwestern University, Evanston, Illinois.

Lissette Ruberte, M.S., defended her Masters thesis entitled "Design of a Locking Humeral Rotator for Above-Elbow Prostheses," for the degree of Master of Science in Biomedical Engineering at Northwestern University, Evanston, Illinois.

Brian Ruhe, M.S., defended his Masters thesis entitled "The Kinematic Compensatory Motions Employed by Persons with Bilateral Transfemoral Amputations" for the degree of Master of Science in Biomedical Engineering at Northwestern University, Evanston, Illinois.

Mark L. Edwards, MHPE, CP, defended his Masters thesis entitled "A Web-based Needs Assessment for the Development of Graduate Degree Programs in Prosthetics and Orthotics," for the degree of Master in Health Professions Education at University of Illinois, Chicago.

Grants Awarded

Dudley S. Childress, Ph.D. and Steven A. Gard, Ph.D. were awarded a five-year grant from the National Institute on Disability and Rehabilitation Research (NIDRR) for "Rehabilitation Engineering Research Center in Prosthetics and Orthotics."

Mark L. Edwards, MHPE, CP, was awarded a three-month grant from the American Academy of Orthotists and Prosthetists (AAOP) for "Professional Continuing Education Course Development for Post-operative Management Strategies of Major Lower Limb Amputations."

Steven A. Gard, Ph.D. was awarded a three-year grant from the Department of Veterans Affairs (VA) for "Study of Residual Limb/Prosthetic Socket Compliance in Transtibial Amputees."

Richard F. *ff*. Weir, Ph.D. was awarded a five-year grant from the National Institute of Biomedical Imaging and Bioengineering (NIH) for "Multifunctional Prosthesis Control Using Implanted Sensors."

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- ☐Ambulation, Gait & Posture
- ☐Biomaterials
- ☐Below Knee Prosthetics
- ☐Computer-Aided Engineering/Design/Manufacturing
- ☐Pediatric Prosthetics
- ☐Prosthetic Feet
- ☐Prosthetics & Orthotics: General
- ☐Upper Limb Prosthetics & Orthotics

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