Capabilities

Communicating the Science of Prosthetics and Orthotics

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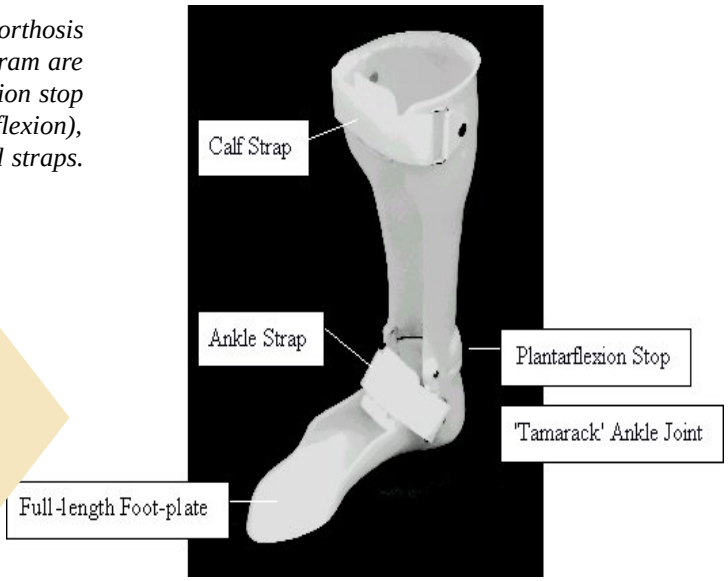

Figure 1: An articulated, thermoplastic ankle-foot orthosis (AFO) with full-length foot-plate. Indicated on the diagram are some of the key features of the AFO: the plantarflexion stop (posterior plastic reinforcement to limit plantarflexion), Tamarack ankle joints, foot-plate and straps.

NUPRL & RERP Launches New Orthotic Research

By Stefania Fatone, PhD, Bryan Malas, CO and Steven Gard, PhD

Relatively little research has been done in the area of orthotic-aided ambulation, so knowledge is somewhat sparse. Progress in the field during the past two decades has been inconsistent, and significant improvement through research towards understanding and development of lower extremity orthoses is needed. NUPRL&RERP has been successful in securing funding to study lower-limb orthotics. The project will use quantitative gait analysis to investigate how ankle-foot alignment and foot-plate length in Ankle Foot Orthoses (AFOs) affect the gait of subjects with hemiplegia following Cerebral Vascular Accident (CVA).

AFOs are lower limb orthoses designed to provide control of ankle motion in the presence of various foot and ankle pathologies (Figure 1). AFOs are presently the most commonly prescribed and used orthosis in the United States, and they have been proven clinically to be effective in enhancing the function of the ankle-foot complex (Bowker *et al.*, 1993). Despite their widespread use, they have not been studied in depth during the past two decades and many of the theories underlying AFO prescription remain unsubstantiated. Since the mid 1980's AFO research has focused to some extent on the pediatric population and less on adult and geriatric populations. This is of concern, as it fails to reflect the fact that orthotists are spending 71% of their time with adult and geriatric populations (Whiteside *et al.*, 2000). Given their widespread use, there is a distinct need for better scientific rationale for AFO design and for increased understanding about their effect on walking.

AFOs can be used to treat many different gait pathologies. Although an improved understanding of the effects on gait of ankle-foot alignment and support may be more broadly applicable, this project will focus on patients with hemiple-

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gia following stroke/Cerebral Vascular Accident (CVA). Stroke/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. The gait of patients with hemiplegia is usually less efficient and less safe than that of able-bodied individuals. The entire lower limb is often compromised and it is believed that AFOs offer the least cumbersome and most effective method of addressing abnormalities at the foot, ankle and, possibly, the knee. We will investigate ankle-foot alignment and support in AFOs in order to determine an AFO design that offers the best control of the ankle-foot complex and knee.

One reason for the popularity of AFOs is the belief among practicing orthotists that controlling ankle-foot alignment within an AFO not only assists function of the ankle-foot complex, but may influence and improve knee function as well. The theory is that the position of the ground reaction force (GRF) vector relative to the knee joint axis may be manipulated by altering ankle-foot alignment. This is regarded as an advantage for some pathological conditions affecting the knee for which the orthotic alternative would be a more cumbersome Knee Ankle Foot Orthosis (KAFO). However, many AFOs are aligned without consideration of the effect of shoe heel height on ankle alignment. Increasing shoe heel height causes the tibia to lean anteriorly (forward) relative to the floor (Figure 2). This would allow the GRF vector to move posterior to the knee joint axis resulting in a flexor moment (or bending force) at the knee.

Ankle Alignment

Although the implication of footwear on AFO alignment has been previously considered, it appears to be neglected by many practitioners and has not been explored objectively by researchers. We recently surveyed some of the orthotic students at the Northwestern University Prosthetics and Orthotics Center and 28 of the 30 students surveyed indicated that the facility where they previously worked did not routinely consider heel height when aligning AFOs. Alignment is generally considered appropriate when the tibia-foot sagittal plane relationship describes an angle of 90° out of the shoe. This conventional alignment neglects the AFO's tibia-to-floor relationship, which is altered by the heel height of the footwear. Although one of the purported advantages of thermoplastic AFOs is that shoes are easily interchanged, alignment alterations introduced by changing shoes will alter gait. This can have serious implications for patients who have limited ankle (dorsiflexion) range of motion or knee instability in the sagittal plane.

We believe that lack of consideration of shoe heel height on AFO alignment is in direct contrast to the importance placed on ankle alignment in lower limb amputation and ankle arthrodesis (surgical joint fusion). Alignment of the prosthetic foot in lower limb prostheses is recognized as an important issue for achieving a successful prosthetic fit, and for safe and efficient ambulation. It is standard practice in prosthetics to include the shoe heel height in the alignment process and the importance of maintaining a consistent shoe heel height is stressed to the patient. Likewise, the angle that the ankle is fixed in an arthrodesis is critical to the functional success of such surgery. Mazur *et al.*, (1979) and Buck *et al*., (1987) have recognized the role of footwear of an appropriate heel height in assisting the restoration of normal gait in cases of ankle arthrodesis. In particular, the need to accommodate a foot fused in a plantarflexed position with shoes of an appropriate heel height, in order to limit hyperextension at the knee, has been highlighted.

We are aware of only a couple of studies that have suggested that sagittal plane alignment of an AFO can influence knee position during walking (Lehmann *et al.*, 1982, 1985). Regardless of whether the plantarflexors were functioning, both studies by Lehmann *et al.* (1982 and 1985) suggested that a 5º plantarflexion stop was more effective at restoring knee moments to normal than a 5º dorsiflexion stop. However, both studies were conducted on healthy, adult subjects wearing metal AFOs. Similar research needs to be un-

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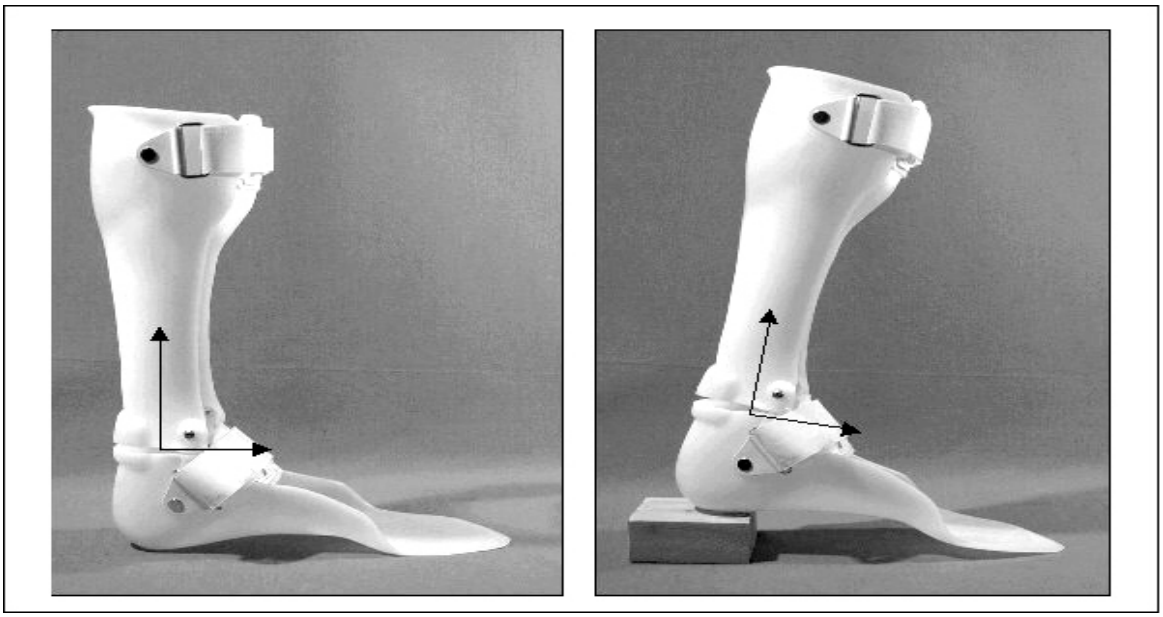
dertaken on subjects with gait pathologies requiring orthotic treatment. Some researchers have suggested that the sagittal plane alignment of an AFO may have an effect on gait kinematics and kinetics of the contralateral (opposite) limb (Stallard 1987; Schrag *et al.*, 1994; Ribaudo *et al.*, 1996). Unfortunately reports of investigations of the contralateral limb with AFO wear are limited. Schrag *et al.* (1994) reported a decrease in overall knee range of motion (flexion and extension) on the contralateral limb in 11 children with hemiplegic cerebral palsy walking with fixed AFOs, while Ribaudo *et al.* (1996) noted a decrease in contralateral knee flexion in 8 able-bodied adults wearing solid AFOs. No explanations for the observed effects were given.



(a) **(b)**

Figure 2: The effect of shoe heel height on the sagittal plane alignment of a custom-molded, thermoplastic AFO with a 90^0 plantar flexion stop is illustrated above. (a) In a conventionally aligned AFO — 90^0 between the long axes of the tibia and the foot — the tibia is vertical with respect to the floor when not in the shoe. (b) When the AFO is placed in a shoe, the heel height of the shoe causes the tibia to lean anteriorly or forward relative to the floor.

Foot-plate Length

There is also no clearly defined rationale in the orthotic literature for AFO foot-plate length. There are basically two choices of AFO foot-plate length: either three-quarter length (trimline proximal to the metatarsal heads, i.e. just behind the ball of the foot), or full-length, in which the entire sole of the foot is in contact with the orthosis. Clinically, the choice of foot-plate length is based on: (1) remaining growth (in children); (2) limited extension at the metatarsal phalangeal joint/s (toes); and (3) the desire to facilitate a knee extensor moment. However, it appears that most of these criteria have not been substantiated. The few studies that mention foot-plate length are with respect to the Floor-Reaction AFO which advocates the use of a full-length foot plate to facilitate an extensor moment at the knee (Saltiel, 1969; Rubin and Danisi, 1975; Yang *et al.*, 1986). These investigations suggested that to effectively facilitate a knee extensor moment and stabilize the knee in the sagittal plane, the center of pressure must move anteriorly along the sole of the foot. Keeping the ground reaction force vector anterior to the knee is facilitated by plantarflexion of the ankle in this orthosis (Lehman *et al.*, 1985). Foot-plate length in conventional AFOs may also influence moments at the knee by allowing the center of pressure to progress further along the foot and altering the position of the ground reaction force vector with respect to the knee axis. However, the effect of foot-plate length on gait has not been investigated objectively.

We believe that quantitative gait analysis can be applied to help us better understand the biomechanics of orthotic-aided gait and enable us to evaluate the benefit of particular orthotic devices such as AFOs. Hence, for this research study, AFOs that are custom-molded, articulated and conventionally aligned will be compared with AFOs having heel-height-compensated alignment. Also, AFOs

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Project Update

By Richard F. ff. Weir, PhD

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Restoration of gait is frequently a primary goal of rehabilitation. Consequently, there is a need to provide quantitative measures of a person's gait to supplement the qualitative observational abilities of rehabilitation service providers. There is a need for inexpensive yet effective, easy-to-use, instruments that can provide performance and outcome measures in a clinical setting

Present day motion analysis systems, while they provide a wealth of data, are beyond the reach of most clinicians both in terms of cost and ability to maintain and operate them. We believe the development of simpler instruments with automated data processing algorithms which can measure the temporal and spatial properties of the body center-of-mass (BCOM) during gait will benefit the clinician in the small clinical facility.

We have built a prototype system based on an earlier device that will measure the position of the BCOM during walking in 3 dimensions (3-D). The device uses the same direct ultrasound (US) ranging technology of the previous system (*Capabilities*, Vol. 9, No. 1, January 2000; *Capabilities*, Vol. 6, No. 2, April 1997) to simultaneously measure the distance between a transponder worn by the subject posteriorly at the approximate level of the BCOM and at least three US receivers. Through triangulation, instantaneous anterior-posterior (A-P) [fore-aft], medial-lateral (M-L) [sideways], and vertical [up-down] displacements, velocities, and accelerations of the BCOM can be measured.

We have been able to demonstrate the validity of using three receivers on supports one meter in diameter as a means to accurately triangulate position over a fifteen-meter distance. This was important since the error of the sideways and vertical coordinates of the position increases linearly with distance, while the motion of the BCOM during walking is limited to about 4 cm vertical and sideways motion. Consequently we were concerned that these distance measurements would be swamped by the error. However, this is not the case and from these data many parameters and symmetry indices can be obtained. The vertical excursion with A-P and vertical velocities will enable the total mechanical energy and change in total mechanical energy of the BCOM to be approximated. Measurement of M-L displacement will allow measurements of the amount of 'sway' to be quantified, an important measure in pathological gaits.

To date, a functioning prototype has been developed that will record BCOM data from an individual walking from 3 m to 15 m. This system continues to undergo testing, calibration and verification■

This project is funded by the National Institute on Disability & Rehabilitation Research (NIDRR)of the Department of Education under grant #H133E980023.

tion Update

By Jan Little

September 27 to 29 were packed with information and activity for the 30 prosthetists and orthotists enrolled in the first American Academy of Orthotists and Prosthetists (AAOP) Advanced Training Course on gait analysis for prosthetists and orthotists. The course was held at the Northwestern University prosthetic and orthotic research and educational facilities in the Rehabilitation Institute of Chicago.

The course, "Overview of Gait Analysis for Prosthetists and Orthotists", began Thursday morning, September 27, with presentations of the history of gait analysis, terminology and a general overview of biomechanical theory. The kinematics, kinetics, electromyography and metabolic energy expenditures of normal gait were also discussed. Course attendees broke into groups in the afternoon for demonstrations of the Veterans Administration Chicago Motion Analysis Research Laboratory (VACMARL), Direct Ultrasound Ranging System (D.U.R.S.) and Novel Pedar system for analyzing various components of gait. Case studies of able bodied walking were also used as instruction in the afternoon. Thursday ended with the first self-assessment exam of the course.

A reception in the Prince Faculty Commons of the Tarry Research Building of the Northwestern University Medical School allowed the course attendees and instructors to relax and get to know one another. However, homework in the form of five chapters of *Gait Analysis*, by Jacqueline Perry, M.D. encouraged an early ending to the social occasion.

Friday sessions included biomechanics of orthotic and prosthetic gait and case studies of examples of the gait of individuals with spina bifida, cerebral palsy, cerebral vascular accident, unilateral transtibial prostheses, unilateral transfemoral prostheses, bilateral transfemoral prostheses and hip disarticulation. Again, the students were sent off with nightly reading assignments in the form of journal articles to review.

On Saturday morning, information from Thursday and Friday's classes were used by the course attendees to participate in a number of analysis activities. Reports of several NUPRL&RERP research projects were presented on Saturday afternoon to relate gait analysis to the fields of prosthetics and orthotics. The reports included vertical movement of the body during gait by Steven Gard, crutch ambulation by Laura Miller, foot alignment and support in ankle foot orthoses by Stefania Fatone and analysis of spinal motion during gait by Gina Konz. Dudley Childress introduced the topics with and overview of the philosophies of NUPRL&RERP research.

The summary of the course evaluations by the participants indicated that the course content was relevant to the work of prosthetists and orthotists. In fact, a number of the participants said the course covered more than they had anticipated. ■

NOTE: The Capabilities date designation has been changed from "January, April, July and October" to "Winter, Spring, Summer and Autumn" to more accurately reflect our quarterly nature. Volume and number designations remain the same.

Andrew H. Hansen Receives Graham Fellowship

Andrew H. Hansen has been awarded one of six Dissertation Year Graham Fellowships for 2001-2002 by the McCormick School of Engineering and Applied Science. McCormick departments nominated 21 outstanding senior graduate students for dissertation-year full fellowships. Hansen's research for his doctoral dissertation focuses on the process of transtibial prosthesis alignment More information on Andrew's work was published in the July 2000 issue of *Capabilities*.

Dr. Wu Honored by ACA

The Amputee Coalition of America, at its annual meeting in Kansas City, June 14-16, named Yeongchi Wu, MD, as "Professional of the Year" for his continued work with people with amputations. Specifically, the ACA award cited Dr. Wu's work with victims of land mines through the Center for International Rehabilitation. Dr. Wu has been a key member of the Northwestern University and Rehabilitation Institute of Chicago staff for a number of years. In addition to clinical service, he has published articles on many topics including post-operative and pre-prosthetic management of residual limbs. An accomplished artist, Dr. Wu has had art exhibits in the Chicago area and was chosen to sculpt the bust of Henry B. Betts, MD, long time Medical Director of RIC.

Dr. Wu was also featured as the Virtual Mentor in the August 2001 *Virtual Mentor* on-line publication of the American Medical Association. Dr. Wu was cited for his many contributions to the field of rehabilitation including his widely-known methods of post-operative and pre-prosthetic management of residual limbs. Dr. Wu currently divides his time between his work as a sculptor and conducting research at the Center for International Rehabilitation. His most recent innovation builds on a low-tech procedure developed 50 years ago. He is using the concept of vacuum sealing to create positive and negative molds for fitting individuals with prosthetic limbs.

Brian Ruhe Named to USA Winter Paralympic Team

Brian Ruhe, who is studying for his master's degree in biomedical engineering has been named to the Sled Hockey Team which will represent the United States at the Winter Paralympics to be held in Salt Lake City, March 7– 16, 2002. Ruhe plays for the RIC Blackhawks, the Sled Hockey Team sponsored by the Rehabilitation Institute of Chicago and the Chicago Blackhawks professional hockey team.

Doug Pyle is new COO of the Center for International Rehabilitation

Doug Pyle joins the Center for International Rehabilitation (CIR) as Vice President and Chief Operating Officer. CIR, headed by William Kennedy Smith, MD, works to deliver low-cost, effective rehabilitation services to emerging nations. CIR also coordinates with NUPRL & RERP in development of prostheses suitable for the materials and level of professional service in such nations.

During the early 1990s, Doug contributed research and analysis to the work of several organizations concerned with economic and social development in Eastern Europe. He also worked on a project funded by the United States Agency for International Development (USAID) that promoted the development of small businesses and civil society organizations in Central and Eastern Europe. Before joining the CIR, Doug was a member of the senior management team with the Chicago Transit Authority.

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NUPRL&RERP/NUPOC News

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Studs Terkel, the well-known Chicago writer and sage has said, "If you touch one person's life and you die, you are alive as long as that person's alive." So, as long as Dudley Childress (center) lives, A. Bennett Wilson (right) and Colin McLaurin (left) are also alive.

Gift from Tatjana Mauch, Wife of the Late Industry Leader Hans Mauch, Supports Studies in Prosthetics and Orthotics

A major gift to Northwestern University byTatjana Mauch, the widow of HansMauch, is being used as an endowment to provide Mauch fellowships for students in the science of prosthetics and orthotics. The work of Andrew Hansen, Brian Ruhe and other students has been supported by the Mauch Fellowship program. Hansen's work with Michel Sam and Margrit Meier has led to a new foot, designed for low-income countries, that is durable under extreme environmental conditions and that can be fabricated quickly with simple tools. Ruhe's work concerns the gait of persons with bilateral limb loss.

Mrs. Tatjana Mauch is shown in a discussion with Dr. Rene Baumgartner (right) and Dudley Childress at the 7th World Congress of ISPO in Chicago during 1992.

Hans Mauch led the industry in improving the design of hydrualic knees. The Mauch S-N-S unit – the first clinically effective stance and swing control hydraulic knee – was developed by Hans Mauch in the 1950s and is still widely used. It is testimony to the quality of the design that the knee has served amputees for almost half a century. The system is a kind of mechanical logic system that, among other things, allows the knee to flex only after it has gone through an extension moment of the stance phase.

Hans Mauch also designed a hydraulic ankle unit that went through VA clinical trials. Although it never entered the general market, it was well liked by those who used it in the trials. In addition, Mauch was involved with the development of a successful reading machine for persons with blindness. He was one of the outstanding engineers of his era. ■

NUPOC

Advanced Course for Spinal and Lower Limb Orthotics Well Received in India

By Bryan Malas and Desmond Masterton

From June 25-29, 2001, Desmond Masterton and Bryan Malas conducted a one-week advanced educational seminar in orthotics at the Indian Spinal Injuries Centre in Delhi, India. The seminar, "Advanced Course on Spinal and Lower Limb Orthotics" was cosponsored by the Rehabilitation Council of India and the Indian Institute of Health Education and Research and was attended by practitioners from around the country as well as several prominent physicians.

The course was preceded by two days of food, rest and relaxation at Missourie – a small hill station in the foothills of the Himalayas. After a nervous cab ride down the mountain passing cars and buses blindly around hairpin turns, Desmond and Bryan settled down for a five-hour train ride back to Dehli and preparation for the course the next day.

A large banner welcoming Northwestern University greeted the instructors at the Indian Spinal Injuries Centre. The course included 30 participants and began with an introduction from a well-respected local practitioner Vinod Bhanti. The course was a combination of didactic, case-based, and clinical learning. Throughout the course participants asked insightful questions that helped generate excellent discussion during each session.

An inauguration event took place the evening of the first day of the course and included a speech by one of the parliament members of India, Raghunath Jha and the chair of the Rehabilitation Council of India, Major H.P.S. Ahluwalia. Major Ahluwalia was on the first team from India to successfully reach the summit of Mt. Everest in 1965. Several years later a spinal cord injury resulted in quadriplegia during fighting in Kashmir. It was this injury that directed him towards the area of rehabilitation.

The most meaningful portion of the course came when two of the course participants presented a short talk on the orthotic and prosthetic work done after the Independence Day earthquake on January 26, 2001 in Bhuj. The number of volunteers and compassion shown by these individuals was very evident in the relief effort.

One example of the volunteer work done by these and other practitioners, who gave freely of their time and effort, concerned an infant who had lost both feet and no longer had the desire to bring her lower limbs to her hands and mouth – an important activity for muscle activation and integration of patterned movements. Due to the limited time and resources, the team was unable to fabricate custom prostheses for her. Wanting to address and facilitate normal development for the infant, two legs were removed from a doll

Raghunath Jha, Minister from Parliament, (third from right) welcomes the Northwestern instructors. From left to right: Anil Sulabh, J. P. Singh, B.P. Jain, Jha, Desmond Masterton and Bryan Malas.

Orthotic Course in India

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Vinod Bhanti, Col. S. K. Jain, Dr. Harvinder Chhabra, Bryan Malas, Desmond Masterton and Amit Bhanti.

and custom fit to the legs of the infant. The infant's response was immediate. She stopped crying and accepted the doll legs as her own.

The trip concluded with a one-day trip to Agra to visit the Taj Mahal. While the Taj Mahal was beautiful, it was the people of the country who made the trip. The hospitality and kindness shown was a stepping-stone to new and long lasting friendships that Desmond and Bryan will never forge■

A special thanks to Vinod and Amit Bhanti. Without their vision and perseverance this course would never have been possible.

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with full and 3/4 length foot-plates will be compared on the basis of their abilities to control the ankle-foot complex and influence knee moments.

Preliminary Data

We have collected preliminary data from both able-bodied persons and from persons with hemiplegia following stroke. Gait analysis data from seven able-bodied subjects walking with two AFO alignment – conventional alignment and heel-height-compensated alignment – suggested that ankle-foot alignment affects contralateral stance-phase knee flexion, ipsilateral knee moments and limb loading. All of the able-bodied subjects experienced an uncomfortable degree of pressure over the navicular when wearing the conventionally aligned AFO that was relieved when the alignment was modified. Clinically, this is a common site of pressure in AFOs and often requires modifications to be made to the AFO to provide relief. Our observation that navicular pressure was relieved by changing alignment without use of any other modification, suggests that appropriate ankle-foot alignment influences orientation and motion of the hind- and mid-foot joints. In the future, insoles lined with pressure sensors placed within the AFO, at the orthosis-foot interface, would allow us to determine the peak and average pressure being applied to areas of interest in the foot, such as the navicular, and assist in evaluating the effect of ankle-foot alignment on pressure distribution across the mid-foot. Although, testing able-bodied subjects initially allowed us to explore different ankle-foot alignments without the constraints imposed by pathology; however, to be clinically relevant, these ideas must be further explored in subjects with pathological gait in order to arrive at appropriate recommendations regarding AFO alignment.

Preliminary data that we collected from two subjects with hemiplegia supported the observation that clinically AFOs are effective in enhancing the function of the ankle-foot complex and improving the efficiency of walking. Forward velocity increased by 15% when orthoses were worn compared with no orthosis. Both subjects spent a greater amount of time in stance-phase on the involved limb when the orthosis was worn. For one subject, the asymmetry in support time between limbs was improved by 30% with AFO wear and step length increased bilaterally. Sound side step length increased more than that of the involved side (24% and 15%, respectively). Improvements in temporal-spatial parameters such as walking speed are an important influence on how 'functional' the subject feels when performing activities of daily living and interacting with others in society. We also observed small changes at the knee in the two hemiplegic subjects when walking with and without AFOs. Onset of hyperextension of the involved knee was delayed and slightly decreased with the AFO. For one subject, there was a substantial decrease in the knee flexor moment during stance when wearing the AFO. These results indicate that AFOs may influence knee joint motion and mo-

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The VA Presents

News from the Department of Veterans Affairs

Prosthetics Clinical Management

Coordinated by Robert M. Baum
Prosthetic Network Manager, P&SAS SHG,
VA Headquarters, Washington D.C.

By: Robert M. Baum

The Department of Veterans Affairs (VA) has recently instituted a Prosthetic Clinical Management Program with the objective to coordinate the development of guidelines for prosthetic prescription practices, contracting opportunities, and for ease of access to prosthetic prescriptions and patient care. With the establishment of national-level prosthetic criteria and guidelines, when appropriate, best methods for gathering and accessing data will lead to outcome measures and analysis for research purposes. The goals of the Prosthetic Clinical Management Program are to enhance and standardize the quality of care, appropriate use of prosthetics, access, promote a uniform prosthetic clinical practice, improve patient training/education, improve patient safety, and support outcomes measurement and research.

Prosthetic Prescription Management Guidelines

A Prosthetics Clinical Advisory Panel, comprised of practicing VA physicians and researchers from facilities across the country are consulting in the development and refinement of prosthetic prescription management guidelines. These guidelines are intended to promote provision of quality, cost-effective patient care. Each Veterans Integrated Service Network (VISN) is currently establishing a VISN-wide committee composed of prosthetic personnel, clinical staff, logistics staff, and representation from veterans service organizations. They are responsible for reviewing and developing prosthetic prescriptions within the VISN.

Central Prosthetic Clinical Management staff has been allocated in order to support the initiative, provide administrative and information data management, manage utilization. PCM staff also manage purchasing and pricing databases, data monitoring and review, data analysis, tracking and patient prescription follow-up. They will establish a registry and conduct a comparison study of technology.

As always, our goal is excellence in quality, access, and effectiveness of delivered services, and this initiative is another example of our commitment to these goals.

Congratulations!!!

National VA Prosthetics Gait Lab Receives Prestigious Thranhardt Award

The National VA Prosthetics Gait Lab of VISN 22 Prosthetics Service Line, has been selected to receive the 2001 American Orthotic and Prosthetic Association (AOPA) Thranhardt Award for a scientific-clinical presentation on the “Preliminary Assessment of the C-Leg Knee Unit as Compared to Conventional Hydraulic Knee Units”.

The Thranhardt award, presented annually, is the most prestigious award given in the field of prosthetics for scientific and clinical presentations. The award presentation will be delivered at the annual AOPA National Assembly, Phoenix, Arizona on October 25th. This honor comes on the heels of receiving the “Presidents Choice” award of the American Academy of Orthotists and Prosthetists in March of 2001. Both awards were

presented by Ed Ayyappa, MS, CPO, Director of Clinical Activities, and Dana Craig, B.S., Lead Biomedical Engineer, both of National VA Prosthetics Gait Lab, Prosthetic Service Line, VISN 22. The Presidents Choice award was presented in March at Dallas, Texas for gait assessment and comparison of dynamic elastic response prosthetic feet compared to more historical designs. Assisting on both of these projects were Jay Sleeth, C.P., Jill Crussemeyer, Ph.D., Russ Ward, C.P., C.Ped, Richard Fite, C.P., Maurice Mulligan, C.P., and Michael Teel, C.P.O., all members of the clinical prosthetic staff. The National VA Prosthetic Gait Lab is part of the Affiliation for Clinical Excellence, Prosthetics Service Line, VISN 22 and has 5 certified C-Leg Fitters and a dynamic referral service to provide C-leg assessment and deliveries on station, responding to requests nationwide.

This award is a significant honor to the VA who has numerous unsung heroes among its many excellent managers and clinical prosthetists. ▯

Please send us your articles, success stories, comments or suggestions for future issues in the VA Presents. E-mail: Robert.Baum@Mail.VA.Gov. Address: PSAS SHG (113), 810 Vermont Ave., NW, Washington, DC 20420. Phone (202) 273-8515. Fax: (202) 273-9110.

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ments but that the extent to which they are effective in doing so should be further explored.

Conclusion

Despite some recognition of the importance of footwear to the function of an orthosis, current clinical practice often does not account for the impact shoe heel height may have on AFO alignment. Many of the assumptions made by practicing orthotists about the effect on the lower extremity during gait of sagittal plane alignment and foot-plate design of an AFO are unsubstantiated. We believe that there exists a need for carefully designed orthotic research. We will investigate the effects ankle-foot alignment and foot-plate length have on the gait of adult subjects with hemiplegia following stroke. We believe that quantitative gait analysis can be applied to help us better understand the biomechanics of orthotic-aided gait and enable us to evaluate the benefit of particular orthotic devices such as AFOs. This research should raise awareness among orthotists of the effects of shoe heel height on alignment, help provide a rationale for orthotic prescription, and may lead to improvements in the design of AFOs. It is of considerable clinical relevance as it reflects directly on the current practice of orthotists.■

References

1. Bowker, P., Condie, D.N., Bader, D.L. and Pratt, D.J. Biomechanical Basis of Orthotic Management. Oxford: Butterworth Heinemann, (1993).

2. Buck, P., Morrey, B.F. and Chao, E.Y.S. The optimum position of arthrodesis of the ankle. *Journal of Bone and Joint Surgery* (1987) 79A(2):241-246.

3. Lehmann, J.F., Ko, M.J. and deLateur, B.J. Knee Moments: Origin in Normal Ambulation and their Modification by Double-Stopped Ankle-Foot Orthoses. *Archives of Physical Medicine and Rehabilitation* (1982) 63:345-351.

4. Lehmann, J.F., Condon, S.M., deLateur, B.J. and Smith, J.C. Ankle-Foot Orthoses: Effect on Gait Abnormalities in Tibial Nerve Paralysis. *Archives of Physical Medicine and Rehabilitation* (1985) 66:212-218.

5. Mazur, J.M., Schwartz, E. and Simon, S.R. Ankle Arthrodesis: Long-term Follow-up with Gait Analysis. *Journal of Bone and Joint Surgery* (1979) 61-A(7):964-975.

6. Ribaudo, T., Kerrigan, D.C., Krug, R. and Chiang, C. Kinetic and kinematic analysis of contralateral limb in subjects using an ipsilateral ankle-foot orthosis. *Gait and Posture* (1996) 4(2):185.

7. Rubin, G. and Danisi, M. A knee-stabilizing ankle-foot orthosis. Orthotics and Prosthetics (1975) 29(3):11-14.

8. Saltiel, J. A one-piece laminated knee locking short leg brace. Orthotics and Prosthetics (1969) 23(2):68-75.

9. Schrag, D.R., Rodgers, M.M. and Albert, M.C. Compensatory responses to fixed ankle foot orthoses in the uninvolved limb of hemiplegic cerebral palsy children. *Gait and Posture* (1994) 2(1):59.

10. Stallard, J. Assessment of the mechanical function of orthoses by force vector visualization. Physiotherapy (1987) 73(8):398-402.

11. Whiteside, S.R., Alaimo, J., Barringer, W.J., Beiswenger, W.D., Bulgarelli, T., Hentges, C.J., Lin, R.S., Miller, T.E., Parr, R.G., Reynolds, J.H. and Stills, M.L. *Practice Analysis of the Disciplines of Orthotics and Prosthetics.* Practice Analysis Task Force, American Board for Certification in Orthotics and Prosthetics, Inc. (2000).

12. Yang, G.W., Chu, D.S., Ahn, J.H., Lehneis, H.R. and Conceicao, R.M. Floor Reaction Orthosis: Clinical Experience. Orthotics and Prosthetics (1986) 40(1):33-37.

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