Underseas and Overseas Investigations

Duffy Felmlee, MSPO, CPO, FAAOP, conducts O&P research in unexpected settings

Duffy Felmlee, MSPO, CPO, FAAOP, recently spent time in the Philippines working with under-served patients.

O&P Almanac introduces individuals who have undertaken O&P-focused research projects. Here’s what you will get to know: colleagues and healthcare professionals who have carried out studies and gathered quantitative and/or qualitative data relating to orthotics and prosthetics, and find out what it takes to become an O&P researcher.

University of Hartford (UH)

Associate Professor Duffy Felmlee, MSPO, CPO, FAAOP, is working on several projects designed to help improve the device options and safety for individuals with limb loss and limb difference. He also is involved in a project designed to ramp up telemedicine in developing countries. These projects keep him busy—as does traveling to different settings to complete his studies when he is not at the university or performing clinical duties.

Multitasking

At UH, Felmlee teaches several courses in orthotics, materials and methodologies, fabrication science, and scientific inquiry. He serves as a director of the Adult Balance Lab, where he oversees testing and supervision of rotational perturbation platform and 3D motion analysis equipment, as well as director of the Cromwell Fabrication Lab, where he works on design and the acquisition, maintenance, and coordination of equipment used by MSPO students.

He also spends time at the University of Connecticut, where he is pursuing a PhD from the Department of Kinesiology, with a specialization in exercise science. He serves as a guest lecturer there, speaking on O&P coursework. His dissertation focuses on direct quantification of balance among limited community ambulators using microprocessor prosthetic knees.

On top of his academic affiliations, Felmlee is a regional clinical consultant for Hanger Clinic. In that capacity, he assists local and regional clinicians in some of the specialized lower-extremity orthotic componentry, such as stance control knee braces and solutions for complex patients. Felmlee enjoys having a variety of responsibilities. He initially pursued an O&P career because he wanted to blend hand skills with intellectual ability. "After a few years in the clinical aspect, I wanted to assist in influencing future clinicians in learning from my successes and failures," he explains. He was asked to stay on board at UH’s MSPO program as adjunct faculty, eventually becoming full-time faculty in 2015. "After mentorship with fellow faculty, I began to lead my own scientific inquiry groups, and this set in motion my understanding of the value of research providing direction in certain aspects of the industry," Felmlee says. "Being full-time in the academic community has allowed me the time and resources to begin to investigate certain questions that should help the O&P industry and patient care."

Researching While Scuba Driving

Some of Felmlee’s most unique projects keep him motivated to go to work every day. For the past four years, he and Michael McCauley, MSPO, CPO, have represented the UH Department of Rehabilitation Sciences in partnering with the Combat Wounded Veteran Challenge in a project centered around studying amputee’s performance with and without their protheses in an underwater scuba-diving setting. Felmlee says the research team, which travels to the coast of Key West, Florida, to conduct its studies, has completed development of a protocol to be used in future research. "We are expecting to have a multiyear study in which we investigate various interventions relating to prosthetic componentry and already available swim items, such as fins, straps, and buoyancy control devices," he explains. "We will initially begin with modifications to currently available swim or water activity-intended componentry, and institute best practices for individuals with lower-extremity limb loss to participate in submerged swimming with scuba."

The research team has developed some unique investigation tools using items in an off-brand nature, which has allowed the team to quantify certain swim ergonomics underwater. And their work is getting noticed. Researchers from NASA “have observed our procedures in an effort to utilize them in achieving their goals,” says Felmlee.
The scuba research also has provided a unique platform for individual case studies, one of which is a harness that enables paraplegic divers to keep anatomical position in neutral buoyancy. The team has designed a custom device for a diver who is a bilateral short transfemoral amputee; the design allows him to use trunk flexion extension as a method for propulsion. As this project moves forward, "we are excited to finally begin testing hardware modifications to the current standards available on the market for water submerged or swimming prostheses," Felmine says. "Having a reliable protocol will allow us to change some of the variables on certain trials in the expectation that a certain combination of suspension, socket, knee (if applicable), and foot will be able to yield a more symmetrical gait pattern as well as improved experience by the diver."

Dryland Duties

At the global level, Felmine is currently participating in a project that involves protocol development and initial application of validating the efficacy of telem medicine in developing countries related to prosthetic use. He is working with international organizations to develop and test orthotic intervention—a swivel walker—used in custom segmental control for patients to use in their homes, in tandem with a specific therapy program for each of the subjects. "This intervention option was so well accepted by the subject and families, the researchers are moving forward into finding a more end-user-friendly design by using a modular system currently available on the market."

Increasing Access

In another key investigation, Felmine and his team at UAB are in the preliminary stages of subject recruitment to test a novel method for data collection of K2 ambulators using their prescribed knees compared to K3 microprocessor components. This work is supported by a grant from the U.S. Department of Defense. "It is our expectation that the data sets collected, both patient-reported and quantified, can provide useful information to clinicians to help justify the utilization of currently limited access components for our patients," he says. This research could have wide implications as we begin initial investigations into the K2’s feasibility of K3 components. We are very excited about the potential of using this methodology in various different types of orthotic systems—ankle-foot orthoses, knee-ankle-foot orthoses, and other prosthetic systems. Felmine believes the results of this investigation could have reimbursement implications. "A fall prevention is a serious consideration for third-party payors related to many aspects of healthcare," he explains. "Our investigation protocol may be able to quantify how componentry has a direct effect on reducing the likelihood of a fall. Depending on the findings of this initial investigation, the data may have impact on qualifications of users for certain microprocessor-based knee units, according to Felmine. In the future, Felmine would like to see additional research in this area move into the realm of orthotaxis. "Reduction in falls, or providing increased stability during walking and static activities, should come as a benefit to the O&P industry." Felmine says. He and his colleagues are helping to develop a model that could be used in other countries and is still in the planning stages. Felmine emphasizes, "Students are graduating with a significant amount of literature review experience and become intelligent consumers of research," he says. "It is our hope and expectation that all newly minted clinicians will be able to take published literature and apply it toward the justification procedures in an effort to obtain a successful outcome for the patient—and, of equal importance, be able to apply clinically evidenced-based methods toward patient care."

In his off-time, it comes as no surprise that this adventure enthusiast enjoys outdoor activities—and cycling in particular. "I enjoy traveling to different mountain bike destinations, visiting friends, and sampling different types of beverages at breweries around the country," Felmine says. And he makes sure to save some time for charitable endeavors. "I have been very fortunate to be included with different international organizations, providing my abilities in both clinical and educational arenas to help further a very significant and worthwhile endeavor of sharing resources, which have been just one of my passions."