



Underseas and Overseas Investigations

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

O&P Almanac introduces individuals who have undertaken O&P-focused research projects. Here, you will get to know colleagues and healthcare professionals who have carried out studies and gathered quantitative and/or qualitative data related 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 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 amputees’ performance with and without their prostheses in an underwater scuba-diving setting. Felmlee says the research team, which

travels to the coast of Looe Key, 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, thrusters, 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.

PHOTO: Matilde Simas



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



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Felmlee, left, positioned inertial sensors on a subject alongside Michael McCauley, MSPO, CPO, during an underwater data collection session.

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 also 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,” Felmlee 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 swim pattern as well as improved experience by the diver.”

Dryland Duties

At the global level, Felmlee is currently participating in a project that involves protocol development and initial

application of validating the efficacy of telemedicine in developing countries related to prosthetic use. He is working with the international organization Dreaming and Working Together and researchers at Hartford Healthcare in this endeavor. The research is designed “to promote the capability of utilizing technology to allow for remote clinician consultation for challenging international cases.”

Refinement of this protocol and publishing of resultant data “may yield exciting opportunities for domestic and international clinicians to be able to collaborate using technology to improve the quality of life of the patient and to improve the educational exposure some clinicians may not have access to, due to geographic limitations,” predicts Felmlee.

Another area of interest is materials science. His first supervised project “utilized my skills of knowing how materials will interact with soft tissue” to study patients with cerebral palsy. “My involvement was in the construction of a superstructure onto a perturbation platform that would

stabilize the subjects at different trunk segmental levels,” he explains.

The field trial portion of the study involved an off-label use of an orthotic intervention—a swivel walker—used in custom segmental control for patients to use in their homes, in tandem with a specific therapy protocol 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, Felmlee and his team at UH 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 componentry. 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 componentry for our patients,” he says. This research could have widespread implications. “As we begin initial investigation into the K2 users’ feasibility of K3 componentry, we are very excited about the potential of using this methodology in various different types of componentry, such as ankle-foot orthoses, knee-ankle-foot orthoses, and other prosthetic systems.”

Felmlee believes the results of this investigation could have reimbursement implications. “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 falls.” 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 Felmlee.

In the future, Felmlee would like to see additional research in this area move into the realm of orthotics. “Reduction

in falls, or providing increased stability during walking and static activities, should come as a benefit to the O&P industry.”

Training Gen Z

In addition to his research and clinical responsibilities, Felmlee spends a great deal of time working with undergraduate and graduate students and research assistants.

“Students are graduating with a significant amount of literature review experience and becoming 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 evidence-based methods toward patient care.”

In his off-time, it comes as no surprise that this undersea adventurer enjoys outdoor activities—and cycling in particular. “I enjoy traveling to different mountain bike destinations,

visiting with friends, and sampling different types of beverages at breweries around the country,” Felmlee 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 avenues to help further a very significant and worthwhile endeavor of sharing resources, which I have been advantaged to, with others around the world.” **CP**

EDITOR'S NOTE: To read more about the underwater research being conducted by Duffy Felmlee, MSPO, CPO, and the University of Hartford Department of Rehabilitation Sciences in conjunction with the Combat Wounded Veteran Challenge, see the article “Diving Into O&P Research” in the October 2018 issue of *O&P Almanac*.

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