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Validation of the Kinematic Knee Sleeve for Measuring Joint Angle Changes in Collegiate Athletes

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RCEU 2023 Project Proposal

Project Title

Validation of the Kinematic Knee Sleeve for Measuring Joint Angle Changes in Collegiate Athletes

Faculty Information

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Proposal ID: RCEU23-Conners-KIN-01

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I. Project Description

In the field of exercise science, standard criterion measures have been used in laboratory settings for the accurate assessment of human movement. However, these gold-standard measures often involve expensive equipment and can be inaccessible. As a result, there has been an increase in the creation and use of wearable technology to measure/monitor exercise performance. Wearable technology allows athletes to be tested outside of a laboratory setting and provide real-time feedback during conditioning, practice, or games. A specific piece of wearable technology that is new to the field of exercise science is the kinematic knee sleeve (Kitt), developed by Footfalls and Heartbeats (UK) Limited.

Kitt is a motion tracking knee sleeve, which contains a strain sensor, and provides immediate feedback in the form of angle and range of motion changes. This is state of the art textile technology assists with physiological monitoring and can be utilized in both sports' performance and rehabilitation settings. However, Kitt has not been previously validated against a criterion measure, such as electric goniometers. Thus, the purpose of this project is to validate the Kitt for measuring knee joint angle changes during open – and closed -chain movements in collegiate athletes compared to electric goniometry.

II. Student Duties, Contributions, and Outcomes

a. *Specific Student Duties*

The student will be expected to work closely with faculty mentor to perform following duties in the exercise physiology laboratory:

- Surveying current and relevant literature on kinematic knee sleeves, electric goniometers, and the use of wearable technology for measuring physiological demand in athletes during the 10-week period
- Creating and distributing participant recruitment flyers and emails
- Measuring and analyzing primary outcome measures, such as: body mass, height, knee flexion, knee extension, and changes in lower extremity joint angles with box jumps and drops.
- Preparation of the knee sleeves, EMG system (daily), cleaning of equipment (after each trial), and sanitation (once a week) of the research equipment and exercise physiology laboratory
- Conducting KITT exercise trials with UAH collegiate athletes

b. *Tangible Contributions by the Student to the Project*

- Ability to work with and become familiar with an EMG system, electric goniometers, and the motion tracking Kitt sensors.
- Assistance with participant recruitment and data collection.
- Opportunity to contribute to a journal paper and/or conference presentation, depending on the progress of the study

c. *Specific Outcomes Provided by the Project to the Student*

- Becoming CITI certified for conducting human subject's research
- Knowledge and experience of recruiting participants for a research project

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- Understanding of anatomical landmarks and skin preparation for the use of EMG and electric goniometers
- Understanding of the use of kinematic knee sleeves for measuring joint angles in an athletic population
- Comprehension of how to record, analyze, and disseminate results of a validation study.
- Having a deeper understanding of how to use statistical analysis software, wearable technology, and validating equipment against gold-standard criterion.

III. Student Selection Criteria

This project is designed for students of junior or senior standing. Additionally, this project is open to students from all academic disciplines.

IV. Project Mentorship

The faculty mentor will provide daily supervision and mentorship to the student. In the beginning of the RCEU program, the focus and daily mentorship will primarily focus on CITI training, human subjects research, and the background on the use of wearable technology in the field of exercise science. I will also mentor the student, through informational hands-on sessions on how to use EMG, electric goniometers, and the Kitt. The student will also get to interact and be mentored by Dr. Mark Faghy. Dr. Faghy is a professor for the University of Derby and a co-investigator in the research project. This will allow the students to network and to be mentored by a leading international author in the field of exercise science. In addition, the student is expected to update the mentor with a weekly progress report and during bi-weekly meetings. The following are the specifics.

- Weekly progress update report, which is written by the student:
 - To discuss recruitment efforts, lower body kinematics, wearable technology, data collection practices, student questions, and plans for the following week
 - Evaluation: the mentor will provide weekly feedback for all reports. Dr. Conners will assess and provide feedback on the writing, scientific progress, and quality of the work being performed.
- Bi-weekly progress update meetings with the student will cover:
 - The results and any issues that have arisen.
 - Status of data collection and data entry
 - Evaluation: Dr. Conners will provide detailed instructions for the on-going work and offer suggestions for improvement.