Michael Orendurff, MS

Measuring joint kinematics and kinetics using computerized motion capture systems has provided a detailed quantification of the outcomes for many orthopedic procedures. However little information is available to determine if the changes in joint function observed with high accuracy in the laboratory have an impact on real-world locomotor ability or patient satisfaction. We need some way of connecting the technical outcome of an intervention with detailed information about the characteristics of locomotor behavior in the community to determine the functional relevance of the technical outcome. For example we know that new non-surgical treatments for Clubfoot have pushed the standard of care from 95% of cases receiving surgical intervention to just 5% of cases. Ponseti serial casting and French functional physical therapy methods are resulting in much greater ankle power generation at 2, 5 and 10 year outcomes, but are these non-surgically treated individuals as active as their peers? New wearable sensors and novel processing methods are now poised to answer some of these questions.

RECOMMENDATION 1:
Use wearable sensors to evaluate community locomotor behavior as an outcome measure to connect technical changes observed in the laboratory to functional improvements in walking and running.
New wearable technologies and novel processing method can evaluate the intensity, duration and frequency of locomotor behavior following specific interventions which produce specific joint kinematic and kinetic changes. This will assist in defining what meaningful changes occur in real-world locomotor behavior due to small motion and force changes measures in the gait lab. Does capacity equal participation?

RECOMMENDATION 2:
Integrate biomechanical and physiological data to promote locomotor activity and health.
The molecular signaling response to human locomotor behavior has the potential to alter bone health, increase musculoskeletal development and performance, improve cardiovascular fitness and reduce risk factors for the Big Five killers of Americans: obesity, diabetes, stroke, cardiovascular disease and osteoporosis. The key is to reap the benefits of activity and exercise without incurring a musculoskeletal injury or coronary event. By focusing on quantifying the training dose associated with triggering the molecular signaling cascades for AMPK, mTOR, PGC-1α, integrated physiological and biomechanical investigations are poised to contribute substantially to public health. This would assimilate our methodologies into the current NIH focus on biochemistry and molecular genetics.

RECOMMENDATION 3:
Develop panels with biomechanical expertise to score biomechanical grants
The NIH is terrible at selecting the right panel members to review grant applications with biomechanical outcome measures. Even the program managers and other administrators admit it. If is it not a gel or a cell, a molecule or a gene, they just don't get it. Their comments are head-scratchers and the issues they raise are odd and off-target. It is just not their area of science, and they do not have enough expertise to fulfill the fiduciary responsibility of recommending the funding of the best grants in the area. For example, most panel members cannot tell the difference in surgical procedure between a Ganz periacetabular osteotomy and a Steele osteotomy to correct hip dysplasia, and have said so. Orthopedists, biomechanists and bioengineers should review these grants, not molecular biologists, geneticists or biochemists.

In summary, I believe that the priorities should be to connect technical gait metrics to real-world locomotor ability and patient satisfaction; to integrate biomechanical and physiological measures to establish a dose-response relationship to reduce risk-factors and improve public health; and to establish competent panel members with genuine expertise to review NIH grants with biomechanical content.