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Increased input and involvement of target populations

As biomechanists, we study the interactions between biology and mechanics to enhance and resolve quality of life issues. A primary focus of our efforts is directed towards addressing the problems and limitations experienced by injured or disabled people. As a member of the musculoskeletal biomechanics community, I believe we have made great strides towards identifying and deciphering movement fundamentals and translating this information into practice. For example, we have identified that patella-femoral pain in cycling can be alleviated in some people by using a wedge to adjust foot angles. However, as funding for scientific research is limited and as there has been greater motivation for translational research, it is important to generate research priorities that best serve the target populations. I believe that the best approach to determine and achieve these priorities is to involve members of the target population in the decision making process. A limitation from my own research serves to illustrate this point. I developed electrical stimulation timing patterns that, based on experimental results, would improve exercise outcomes of functional electrical stimulation (FES) pedaling for individuals with spinal cord injury. What I did not realize when developing the study is that fewer people than anticipated may benefit from these findings due to the current high cost of FES exercise bikes. While the financial obstacle to FES pedaling was not mentioned in the research literature, the problem would have likely surfaced in a focus group comprised of spinal cord injured individuals.

Validation of musculoskeletal model of human movement

The contribution of individual muscle forces to an activity can provide insight into neuromuscular coordination of movement under conditions of health and pathology. However, the determination of biomechanical measures such as individual muscle forces and joint contact forces in movement is not a trivial task. It is possible to make direct measures of muscle tendon forces, however, such measures and not practical for clinical applications due to the invasive nature of the process. Alternatively, musculoskeletal models can be, and have been, developed to estimate biomechanical measures in a movement of interest. While musculoskeletal models provide an alternative to invasive measures of muscle and joint contact forces, many of the fundamental assumptions upon which these models are based remain either unverified or valid under limited conditions. As the use of musculoskeletal models in the development of clinical interventions increases, it is necessary that we find methods to validate the model outputs and verify the assumptions upon which the models are based.

Creation of data repositories

One method to encourage collaboration and enhance discovery is through the sharing of data in repositories. Access to data from other labs would serve many purposes, including a means to verify the quality of one’s own data, identification of equipment or methodological errors, teaching resources, and the creation of larger data sets that could lead to the identification of phenomena not apparent in the isolated data sets. The NIH funded Simbios National Center for Biomedical Computation at Stanford provides a model framework for the creation of other similar repositories.