300 word lay language summary of Ryan Mizner Research Grant for AOPT 2022

Our proposal is motivated by persistent quadriceps weakness and high reinjury rates after anterior cruciate ligament reconstruction (ACL-R). Patients with ACL-R show dramatic and long-lasting unloading their operated knee during movement and exercise. Clinicians' standard strategy for addressing weakness is progressive resistance exercises. However, our piloting found that adding weight to standard exercises fails to counter knee unloading and antithetically increases load asymmetries. Little is known about how patients unloading behaviors impact mechanical stresses on the knee during exercise. Clinicians also require the development of clinical exam tools to help identify those patients who present with knee load avoidant behavior. We propose a prospective, repeated measures cohort study that will complete standard clinical testing with 40 patients who are 3 months out from unilateral ACL-R over a two-year span. Patients will be retested at 5 months and thirty uninjured athletes will be tested to establish a normal comparative response. Testing will include motion analysis and musculoskeletal modeling of three standard knee exercises at each testing. We will change exercise load (±30%BW) without restricting joint mobility by using our custom body weight support (BWS) system and weighted vests. Knee load avoidant behavior will be determined via knee contact force and patellar tendon force deficits across all exercises and a failure to change load to exercise dose. We expect to reveal dramatic under-loading of the knee and quadriceps during exercise that robustly persists over time and across varied exercise loads. We will also provide a clinical predictive scheme to identify patients at high risk for knee load avoidant behavior. This knowledge will be used to inform participant selection and power analyses in future intervention trials. Ultimately, it will shape the manner in which exercise is used to ensure a rapid and safe patient recovery that minimizes the risk of knee osteoarthritic processes.