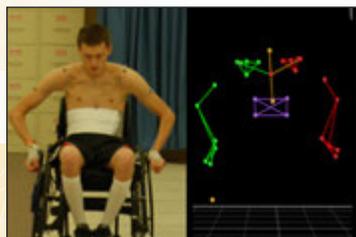


Movement Analysis for Biomedical Innovation and Technology

Prediction of Shoulder Injury for Disease Prevention in Children and Adults with Spinal Cord Injury Using Advanced Biomechanical Modeling and Diagnostic Imaging



► **Aim:** Manual wheelchair users with spinal cord injury (SCI) present significant secondary medical conditions such as pain, musculoskeletal dysfunction, and overuse injuries throughout their lifespan. This proposal seeks to determine the relationships among age of SCI onset, variability of shoulder joint dynamics, wheelchair propulsion patterns, pain, and pathology in children and adults for enhanced health and quality of life. These findings are essential for developing targeted strategies to prevent and treat symptoms of overuse transitionally from childhood to adulthood and over the lifespan in persons with SCI.

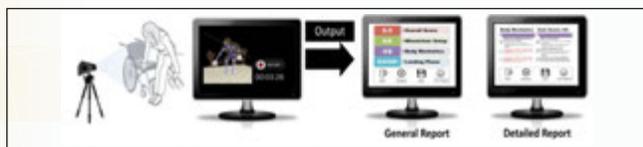
- **Collaborators:** Shriners Hospitals for Children-Chicago, Medical College of Wisconsin, Virginia Commonwealth University, Milwaukee VA Medical Center (VAMC), Northwestern University
- **Funding:** National Institutes of Health (NIH) NCMRR/NICHD (Grant # R01HD098698-01)

IntelliWheels: The Automatic Transmission for Manually Propelled Wheelchairs

- **Aim:** To develop a multi-speed geared wheel system for manual wheelchair users. This system will enhance function while reducing joint forces and moments through a multi-gearing mechanism.
- **Collaborators:** IntelliWheels, Inc., TiLite, University of Illinois at Urbana-Champaign, Milwaukee VA Medical Center (VAMC)
- **Funding:** National Institutes of Health (NIH) Eunice Kennedy Shriver National Institute of Child Health & Human Development Small Business Innovation Research (SBIR) Phase II (Grant # 2R44HD071653-02)



Development of TransKinect: A Clinically Robust System for Transfer Assessment



► **Aim:** This study seeks to develop an automated transfer assessment system for clinical settings that can help therapists and their patients to identify improper transfer motions and provide guidance on how to improve their technique.

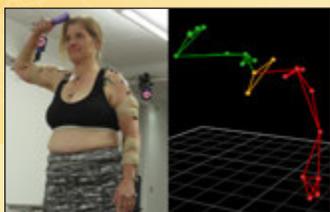
- **Collaborators:** University of Pittsburg, Milwaukee VA Medical Center (VAMC)
- **Funding:** Department of Veterans Affairs, Rehabilitation Research and Development Service (Grant #1 I01 RX002794-01A2)

Defining the Biomedical Phenotype in Hypermobile Ehlers-Danlos Syndrome (hEDS)

- ▶ **Aim:** To characterize the biomedical phenotype of hEDS, a rare genetic disease in its infancy for diagnosis and treatment. Full body biomechanical analyses of motion, strength, and muscle activity during activities of daily living will be performed, along with quantification of balance and pain. Genomic sequencing will also be performed to evaluate genetic variants with gene expression data. The knowledge gained may lead to the design of rehabilitation interventions and pain management strategies to improve clinical care, and quality of life of youths with hEDS.
- ▶ **Collaborators:** The Medical College of Wisconsin, Children's Hospital of Wisconsin, Children's Hospital of Wisconsin Genetics Center
- ▶ **Funding:** UWM CHS Stimulus Program to Accelerate Research Clusters (SPARC)



Pre-operative versus Post-Operative Kinematics and Muscle Activation Assessment of the Upper Extremity Following Rotator Cuff Repair



- ▶ **Aim:** To identify compensatory upper extremity joint kinematics and muscle recruitment patterns used before repair and throughout post-operative recovery. Knowledge of the movement strategies employed may help to improve rehabilitation strategies, interventions, and patient outcomes; ultimately enabling a quicker return to work and activities.
- ▶ **Collaborators:** Medical College of Wisconsin
- ▶ **Funding:** Medical College of Wisconsin Department of Orthopedic Surgery Intramural Grant Program

A Comparative Analysis of Shoulder Biomechanics in Able-Bodied and Wheelchair Lacrosse

- ▶ **Aim:** To characterize the biomechanics of overhead throwing in able-bodied lacrosse players and wheelchair lacrosse players with spinal cord injury (SCI). The long-term goal is to quantify joint dynamics that may be risk factors for shoulder injury in wheelchair lacrosse and to contribute to the development of the Wheelchair Lacrosse USA Official Rule Book from a musculoskeletal perspective. The intent of this research is to protect athletes from potential injury due to altered shoulder demands required in wheelchair lacrosse.
- ▶ **Collaborators:** Clement J Zablocki Veterans Affairs Medical Center, Milwaukee, WI
- ▶ **Funding:** The Medical College of Wisconsin, Department of Physical Medicine and Rehabilitation, Research Administration Committee Grant Program



Motion Analysis and Compensatory Patterns in Neonatal Brachial Plexus Injury (BPI)

- ▶ **Aim:** To gain a better understanding of movement symmetry and position of the trunk, pelvis, and upper extremity joints in patients with BPI through the identification of compensatory patterns. This knowledge has the potential to markedly improve diagnostic and treatment processes, including surgical interventions, as well as long-term patient outcomes.
- ▶ **Collaborators:** Cincinnati Children's Hospital Medical Center