

Feasibility evaluation of a novel wearable clothing technology that can be worn at home to assess real life gait analysis

A Guez¹, A Rai^{2,3}, D Pathak¹, A Rai¹, C Holland³, J Bevins³, M Corbett³, upLYFT UK¹, Consultant Rheumatologist WAH NHS Trust, Worcestershire, UK², The Motion and Performance Centre (MPC) School of Sport and Exercise Science, University of Worcester, Worcester UK³

Background

- **Traditional gait analysis** is limited to laboratory settings, providing brief and **episodic measurements** of rehabilitation progress
- upLYFT integrates **movement analysis into clothing**, which enables **decentralised, at-home rehabilitation** assessments

Purpose

- The **upLYFT textile-based wearable** enables **user-centred at home rehabilitation**, by integrating **movement analysis** with patient-facing **gamified exercises** and **real-time feedback**, while providing **objective data to support clinician decision making**
- Applications in:
 - **Early detection of movement disorders**
 - **Illness prevention**
 - **Fall risk mitigation**

Methods

- Leggings embedded with **IMU and force sensors**
- Sensors connected via **machine-washable conductive textile**
- Powered by **single removable pelvic unit**
- **Real-time processing** enables **interactive, gamified rehabilitation control**
- **Cloud-based processing** enables **in-depth kinematic and kinetic analysis**

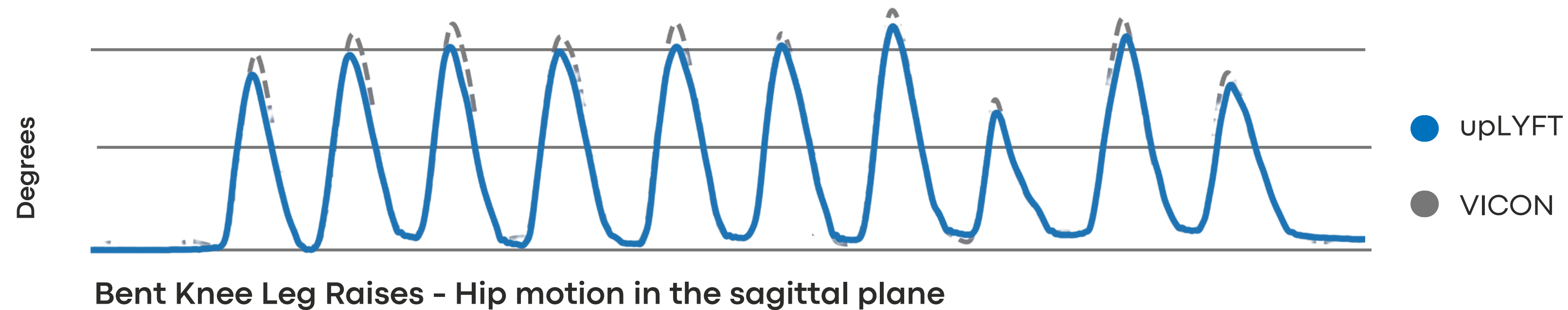
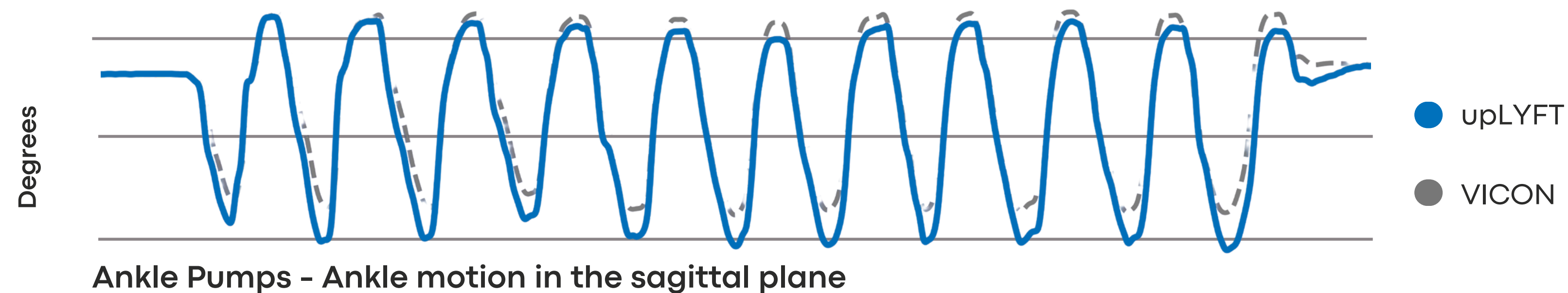
Validation study: Standard **bed-bound rehabilitation exercises** were performed and assessed against the **Vicon Motion Capture System** to prove usability in remote post-orthopedic rehabilitation

Both **kinematics** (joint angles) and **kinetics** (power) were analysed and compared across systems

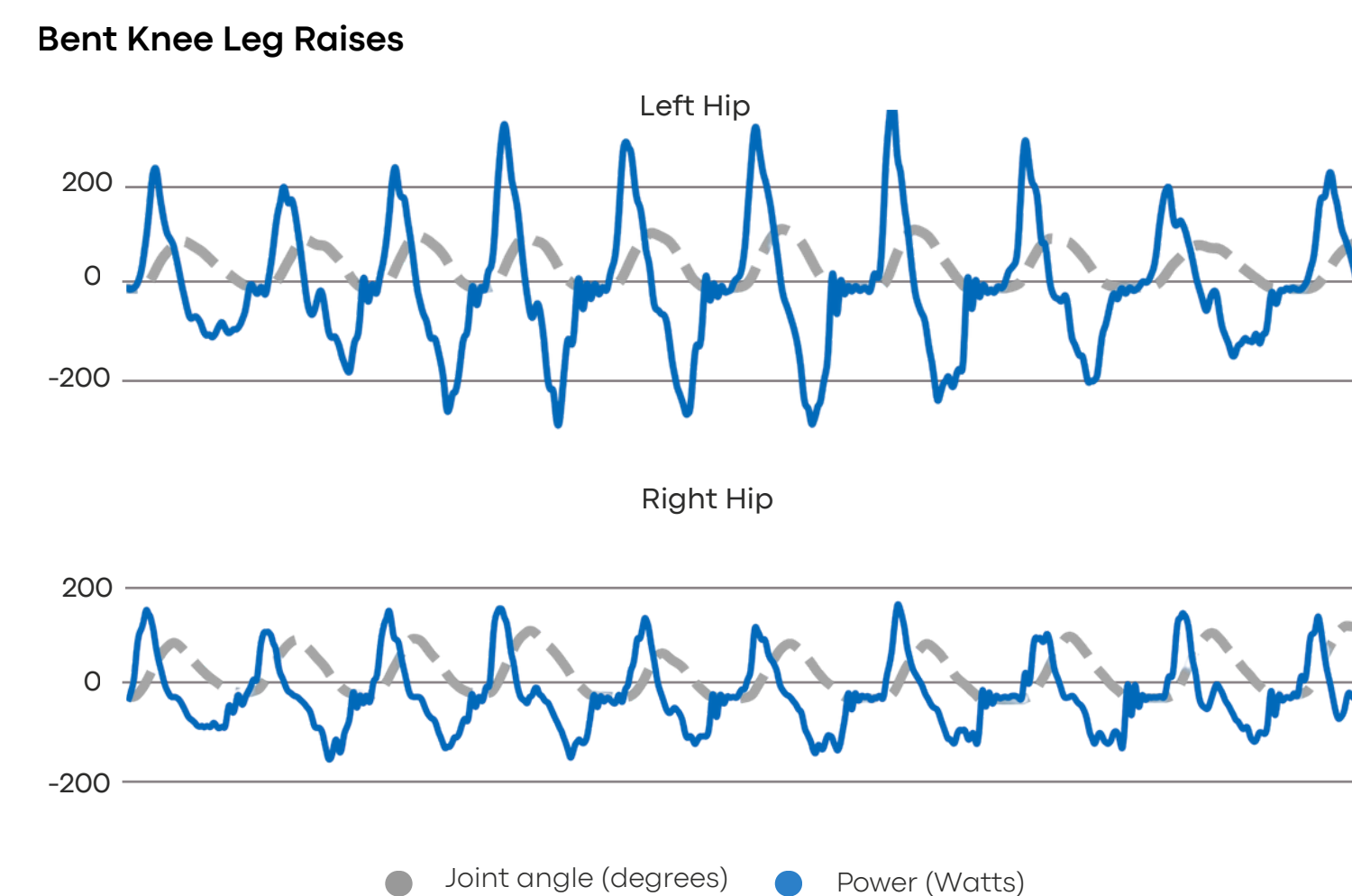
Results

Mean 97.1% ± 1.9% correlation with Vicon (primary movement axes)

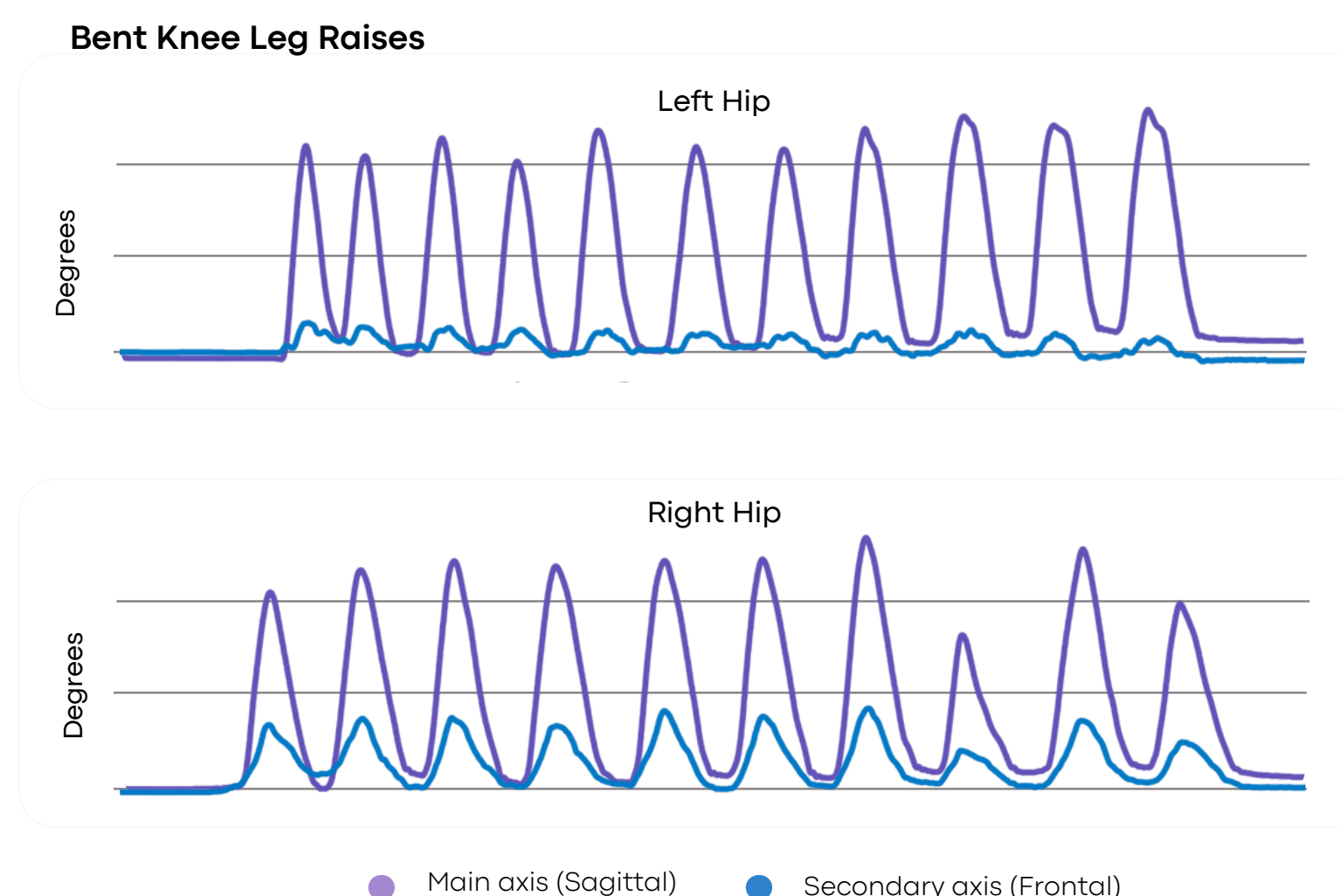
Average of **0.006 seconds** in **temporal alignment**



Precise movements were assessed for the hip and ankle joints across multiple planes of motion to measure the system's ability to capture detailed information about the user's kinematics against the current VICON Motion Capture standard.



Joint load and power monitoring ensures the intended muscle groups are being targeted, leading to more effective rehabilitation and faster recovery



Tracking secondary movement axes ensures proper form and detects compensatory movements in real-time.

Additional metrics

Through a complete kinematics and kinetics analysis, the upLYFT system can capture more advanced measurements, such as:

- **Range and speed** of motion
- **Holding times**
- Joint **loads / torques / power**
- Movement **quality**
- Perceived **exertion**

Conclusion

The UpLYFT wearable enables:

- **At-home, personalised rehabilitation** that can be gamified to improve patient adherence
- **Objective monitoring of gait/movement**
- Comparable performance to **lab-based motion capture systems**

Implications

- Enables **long-term data collection and trend analysis**
- Supports clinicians with **continuous patient monitoring**
- **Improves patient adherence to rehabilitation plans to reach functional milestones efficiently**
- **Applications:** Virtual hospital care, early post-operative discharge and more



Aalok Rai
Founder & CEO
upLYFT



Prof. Ashok Rai
Rheumatologist
University of Worcester



Dr. Annika Guez
Lead Research Eng
upLYFT



upLYFT website
uplyftwearables.com