Design of a Wearable Device for Return-to-Play for Lower Limb Injuries

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Background

- 50% sports injuries = lower extremity
- Current Return-to-Play assessment
  - Requires training
  - Not Quantitative
  - Does not account for fatigue
  - Not specific to individual
- No baseline for musculoskeletal performance

Purpose

- Data collection for Return-to-Play Assessment
- Design wearable device
  - Available to all athletes
  - Quantitative
  - Usable in game environment
  - Individualized baseline

Methods

•Data Collection

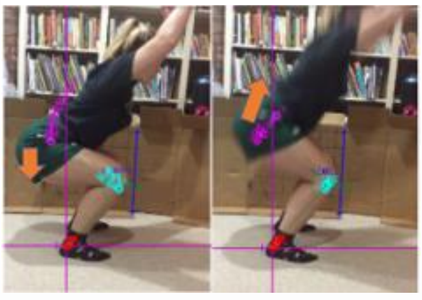
- Vertical Jump in Motion Lab

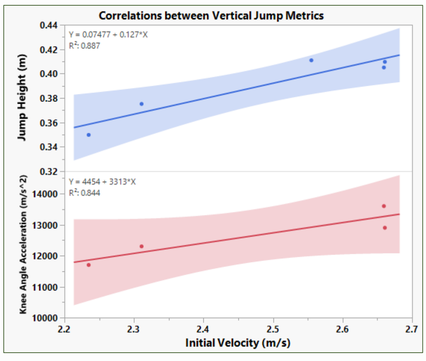
Knee Sensor

- Sensor mounted on knee sleeve with hinge

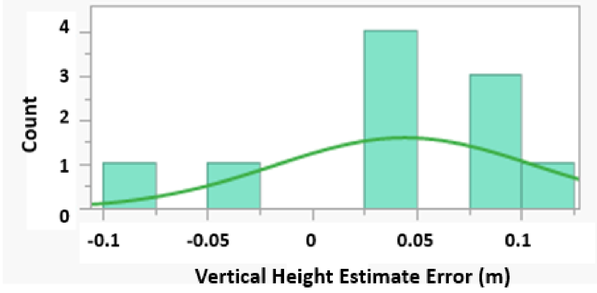
Algorithm

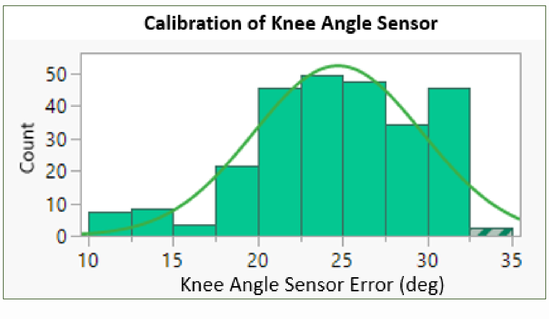
- Developed MATLAB algorithm to calibrate knee sensor and translate knee angle to performance metrics





Calibration of Vertical Height Measurement





Results

- Correlations:
  - Jump height And Hip Velocity at take off (R^2 = 0.89)
  - Hip Velocity And Knee Angle Acceleration (R^2 = 0.84)
- Algorithm estimates Jump height with 5 cm error
- Knee Sensor error = 24°

Conclusions and Future Work

- Knee sensor allows average athlete to get professional return-to-play assessment (based on baseline)
- Performance enhancement
- Different biomechanical movements