

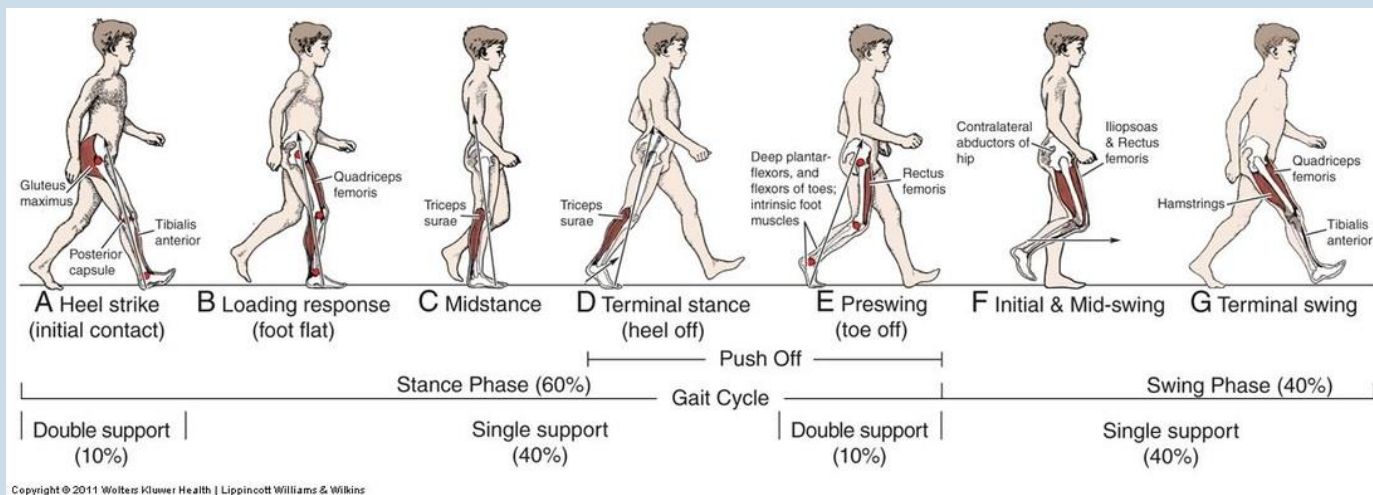
**“USING SINGLE-
LEGGED CYCLING
FOR QUADRICEPS
AVOIDANCE
REHABILITATION
POST-ACL
RECONSTRUCTIVE
SURGERY”**

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KNOWLES**

**FURMAN
ENGAGED
2015**

PATTERN OF QUADRICEPS AVOIDANCE IN ACL SUBJECTS OBSERVED IN GAIT ANALYSIS ~ ALSO OBSERVED IN CYCLING

- Most patients, after surgery, will alter their gait in order to avoid anterior displacement of the tibia which occurs with quadriceps contraction
- “...a pattern similar to quadriceps avoidance observed in gait (decreased quadriceps muscle activation, decreased knee joint extensor moment) also occurs during stationary cycling (M.A. Hunt et al. 2003)¹.”
- **Cycling ~ Walking/Running**



PURPOSE

To see if the factors associated with quadriceps avoidance are improved in single-legged cycling versus double-legged in ACL reconstructive surgery patients

Major Factor:

- Electromyography (EMG)

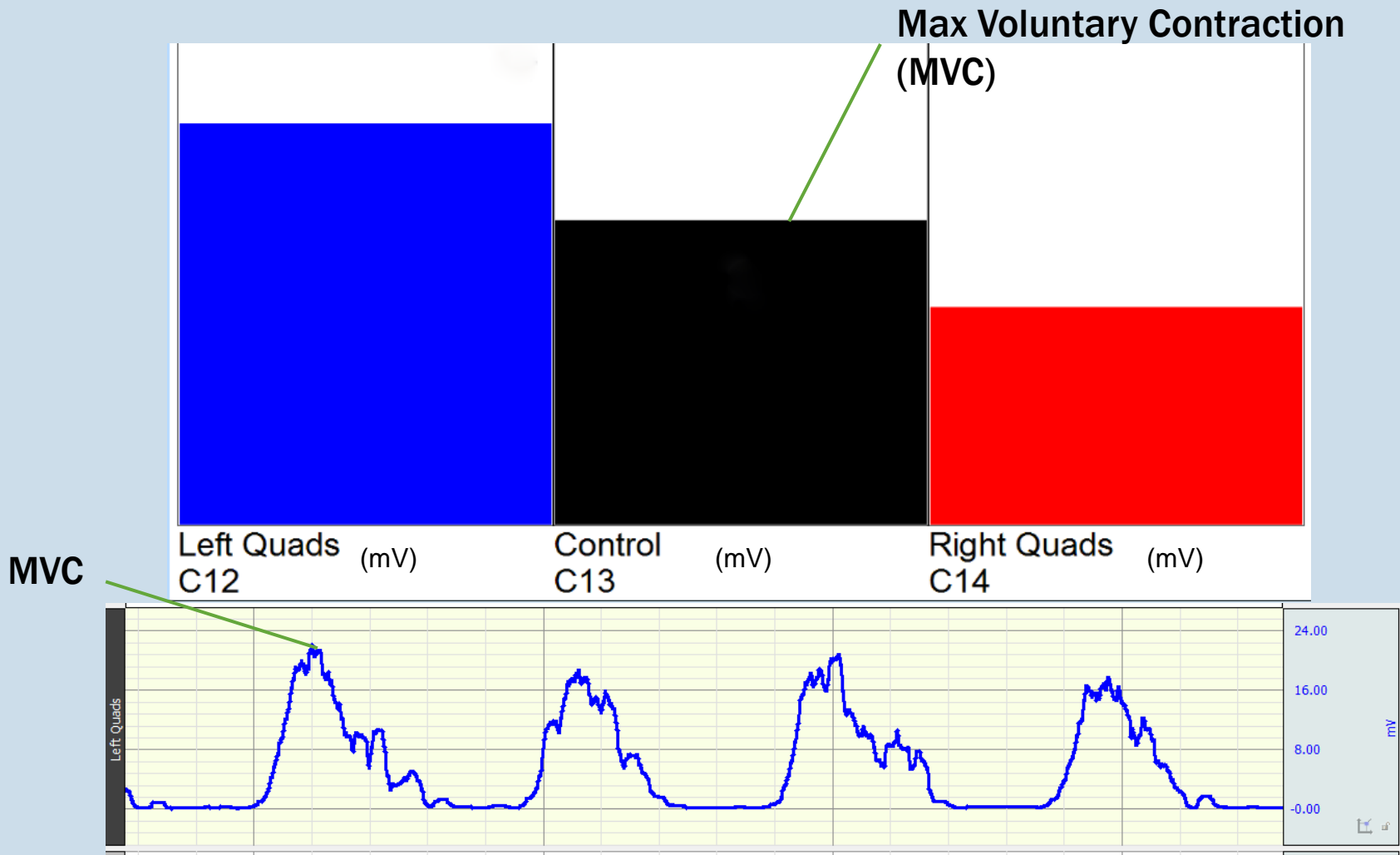
Additional Factors:

- Peak Knee Extensor Moment
- Pedal Force
- Joint Power of the Knee
- Joint Power of the Hip
- Joint Power of the Ankle

EXPERIMENTAL PROTOCOL

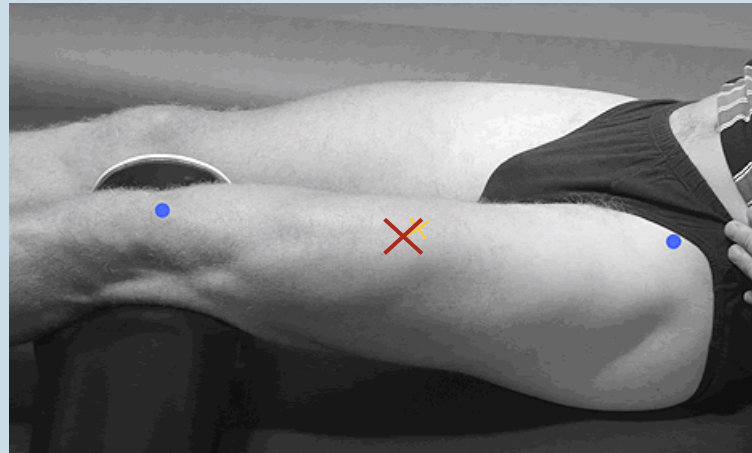
- 18 randomized trials, 15 seconds each
 - 3 Double Legged w/biofeedback
 - 3 Double Legged w/o biofeedback
 - 3 Left Legged w/ biofeedback
 - 3 Left Legged w/o biofeedback
 - 3 Right Legged w/ biofeedback
 - 3 Right Legged w/o biofeedback

BIOFEEDBACK

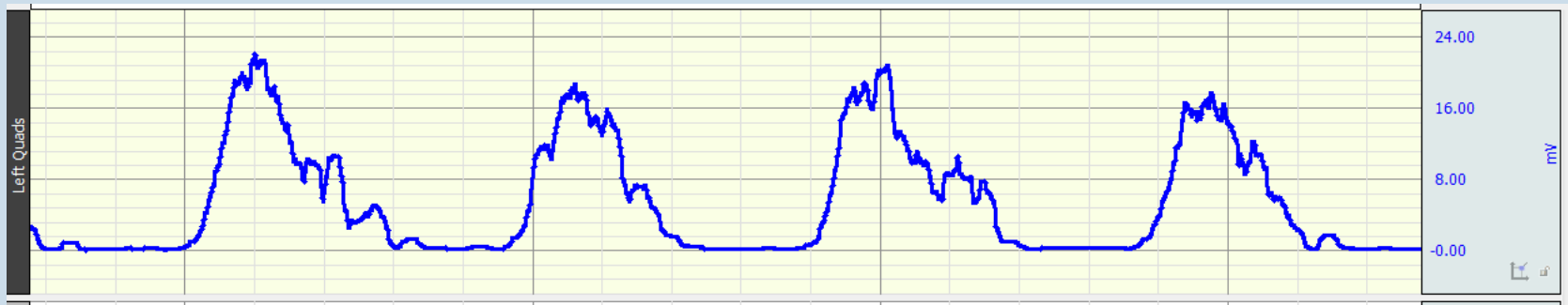


MUSCLE ACTIVITY RELATED TO VOLTAGE READING THROUGH EMG

- Record muscle activity of the quadriceps and the hamstrings. Muscle activity is related to voltage rating (mV)









Rectus Femoris²



MOTION CAPTURE & LABELING THROUGH QUALYSIS

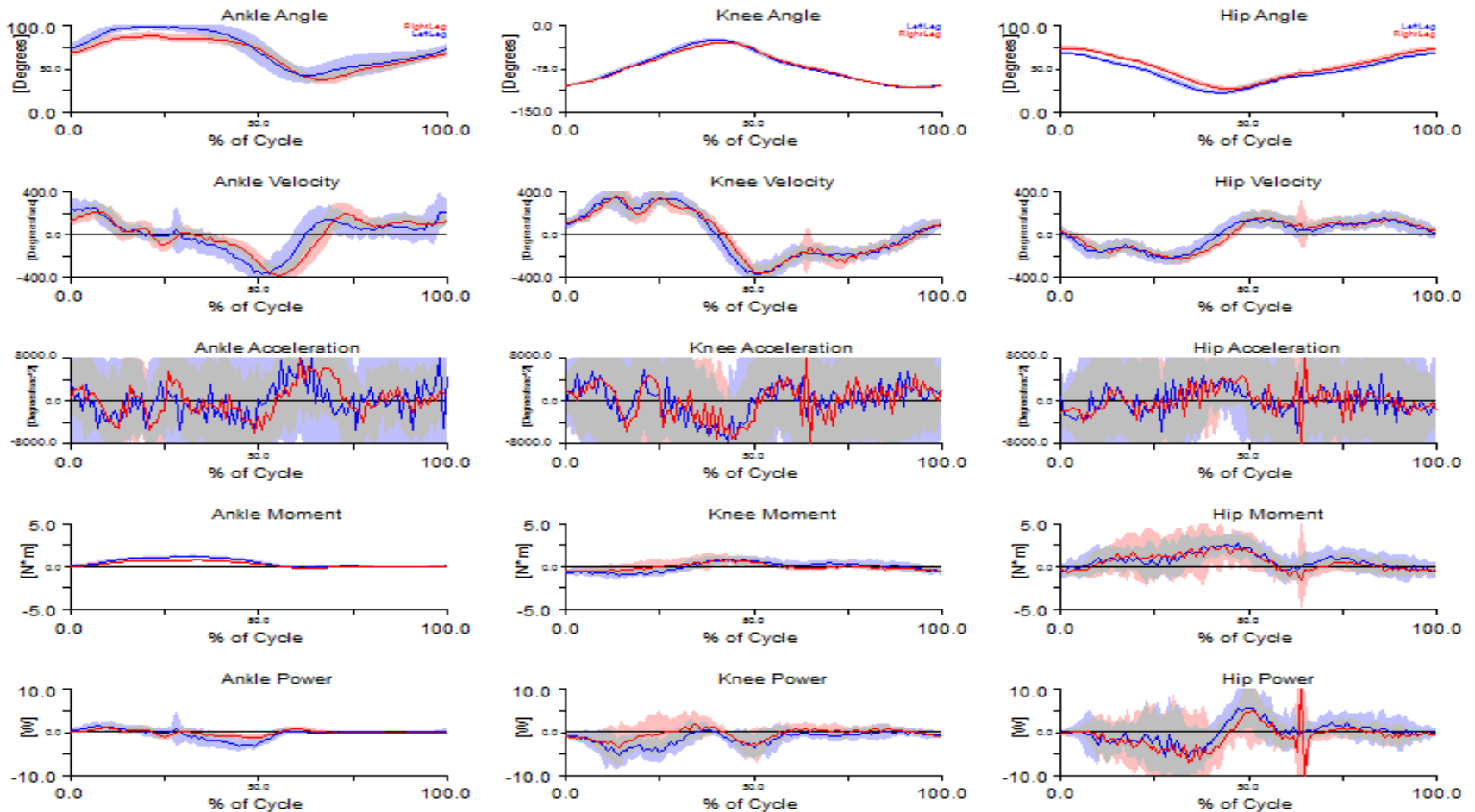
- Qualysis camera systems capture the motion of the kinematic markers through its 8 cameras.



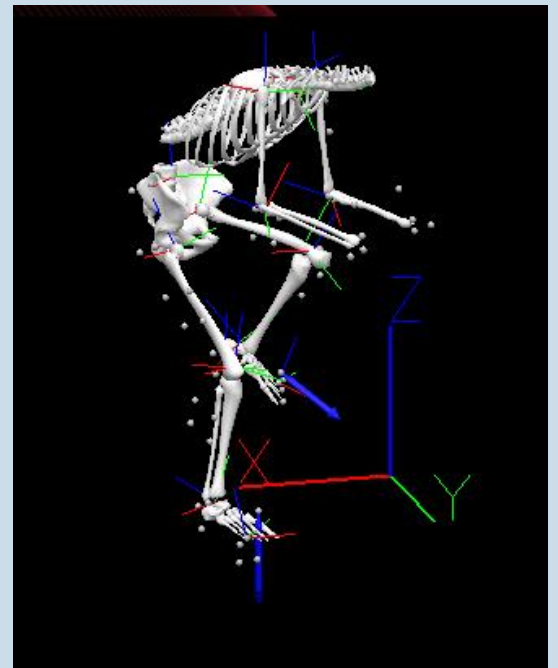
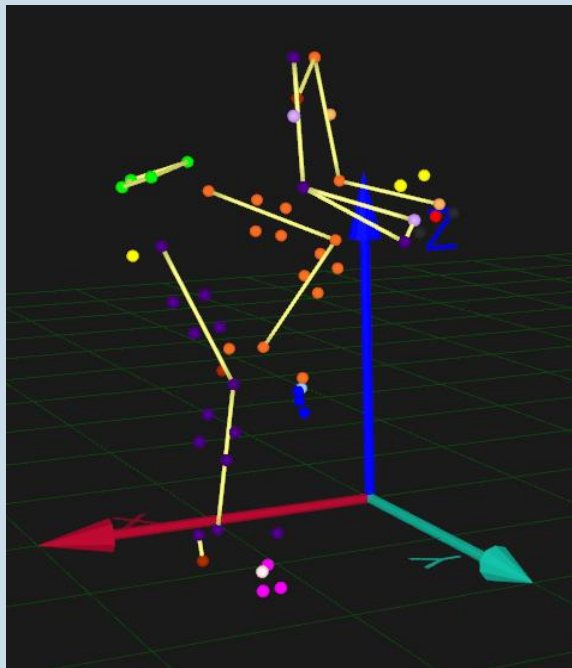
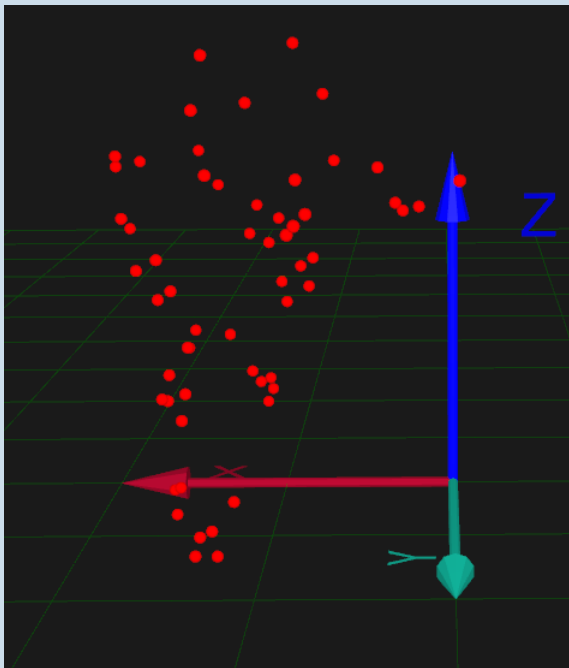
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 Rhumer	100.0%	1920 - 3600	Measured
 Relb	100.0%	1920 - 3600	Measured
 Rulna	100.0%	1920 - 3600	Measured
 Rrad	100.0%	1920 - 3600	Measured
 Rhand	100.0%	1920 - 3600	Measured
 Liliaccrest	100.0%	1920 - 3600	Measured
 Riliaccrest	100.0%	1920 - 3600	Measured
 LPSIS	100.0%	1920 - 3600	Measured
 RPSIS	100.0%	1920 - 3600	Measured

EVALUATING DATA IN VISUAL 3D TO LOOK AT JOINT EXTENSOR AND FLEXOR MOMENTS, JOINT POWER, AND FORCE FROM THE PEDALS

SINGLE leg LEFT vs SINGLE leg RIGHT (sagittal plane)



DEMONSTRATION



**QUESTIONS OR
COMMENTS?**

REFERENCES

- 1. Hunt, M.A., Sanderson, J., Moffet, H., Inglis, T., 2003, *Biomechanical changes elicited by an anterior cruciate ligament deficiency during steady rate cycling*. Clin. Biomech. 18 (393-400)
- Hermins, H.J., Freriks, B., *The State of the Art on Sensors and Sensor Placement Procedures for Surface ElectroMyoGraphy: A proposal for sensor placement and Procedure*. Roessingh Research and Development, 1997
- 3. Myers, J., Grove, K., Hutchison, R., DesJardins, J.D., Moss, R.F., *The Effect of Quadriceps Biofeedback on Muscle Activation During Cycling: A Case Study*. American College of Sports Medicine Annual Meeting, 2014