

StabiliKnee: A Novel EMG and Pneumatic Compression Knee Sleeve

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Motivation

- The anterior cruciate ligament (ACL) is a crucial stabilizer of the knee¹
- Approximately 150,000 ACL tears occur each year in the US, creating a \$17.7 billion rehabilitation industry¹
- Injuries to the ACL leave significant strain on muscles located in the hamstrings and quadriceps²
- Compression aids in reducing the fatigue of these muscles while expediting the healing process²

Design & Methods

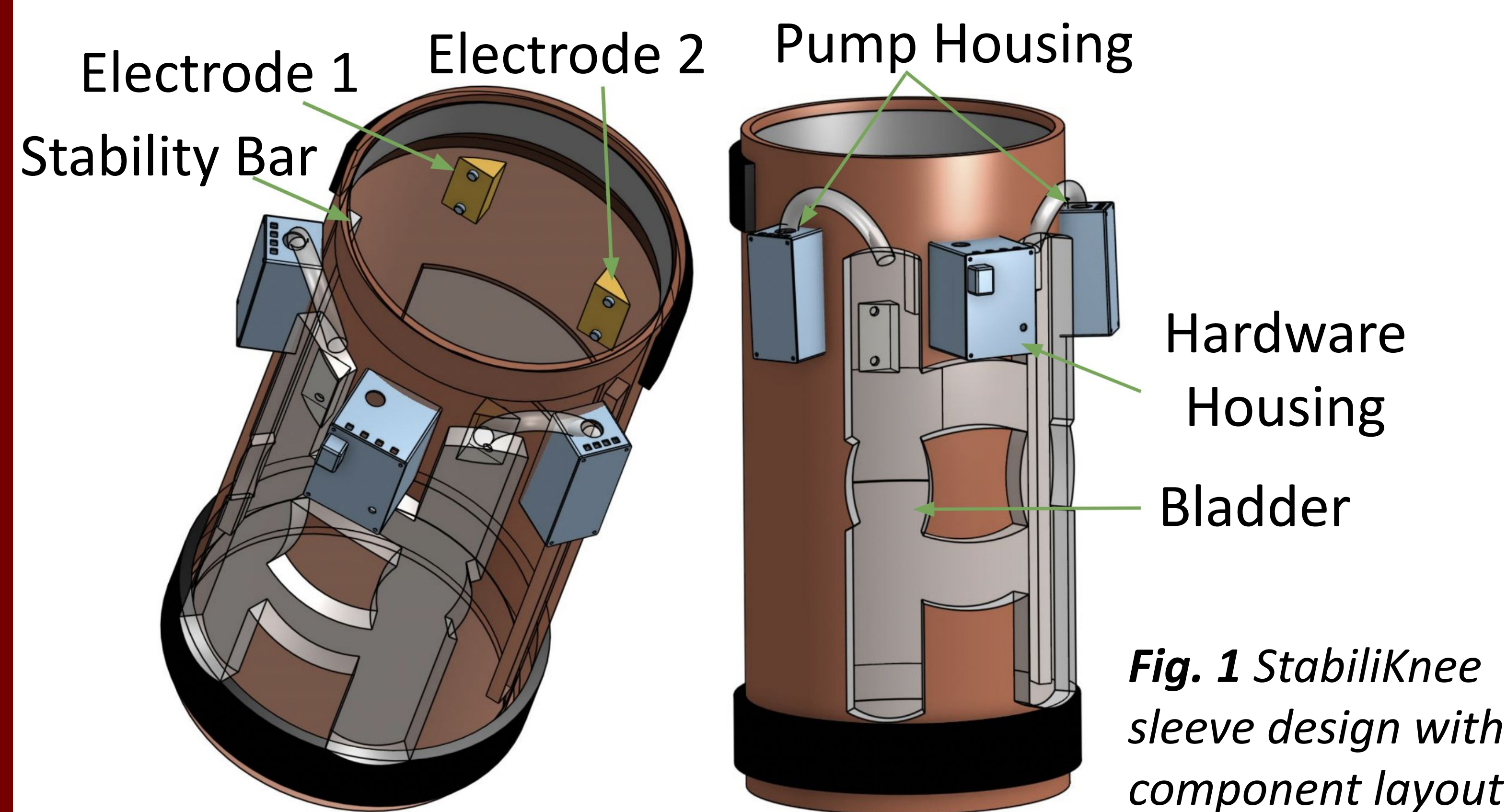


Fig. 1 StabiliKnee sleeve design with component layout

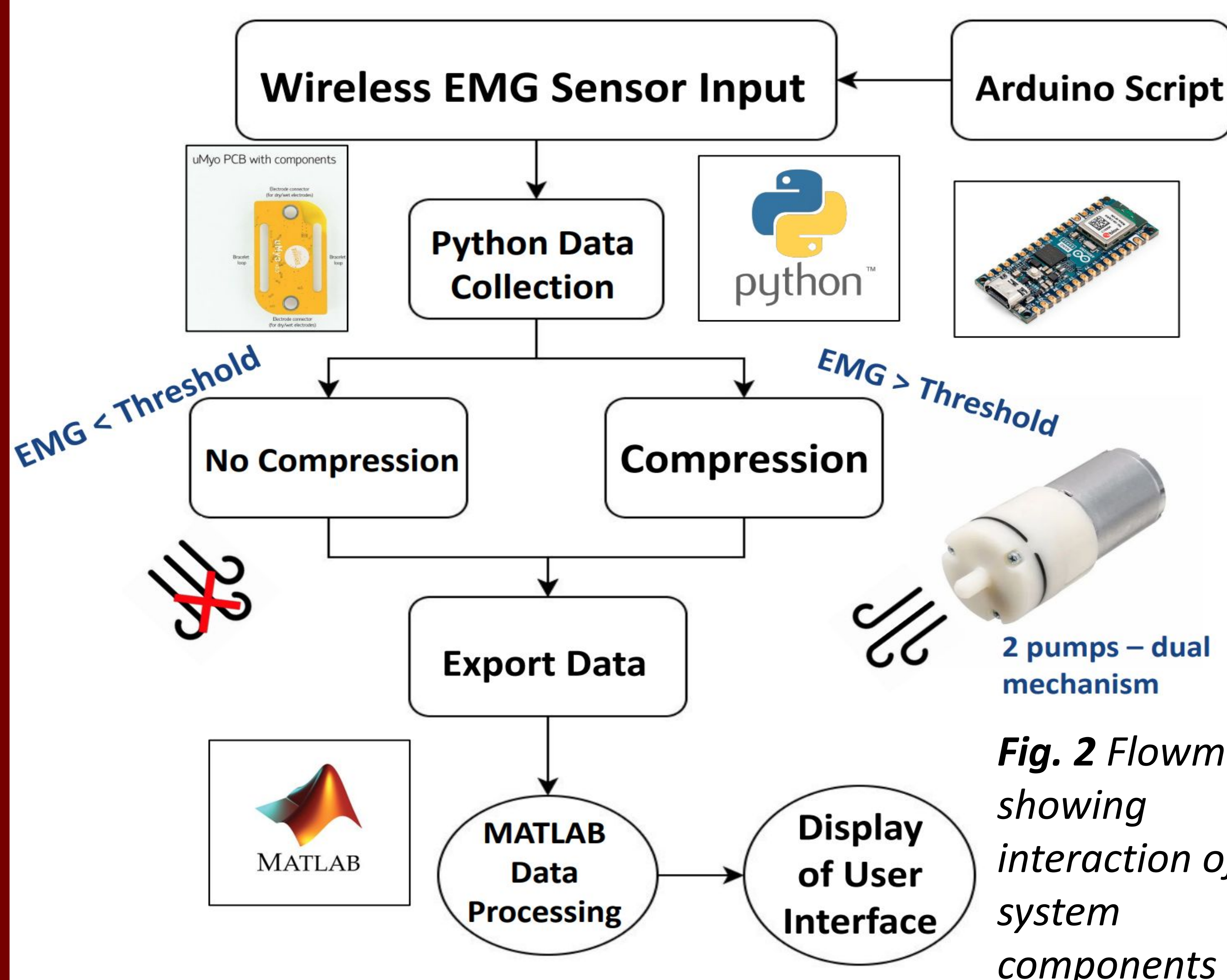


Fig. 2 Flowmap showing interaction of system components

Objective

The purpose of StabiliKnee is to restore knee stability through quantifying muscle activity after ACL injury. Using targeted compression and muscle signals, StabiliKnee optimizes rehabilitation and recovery.

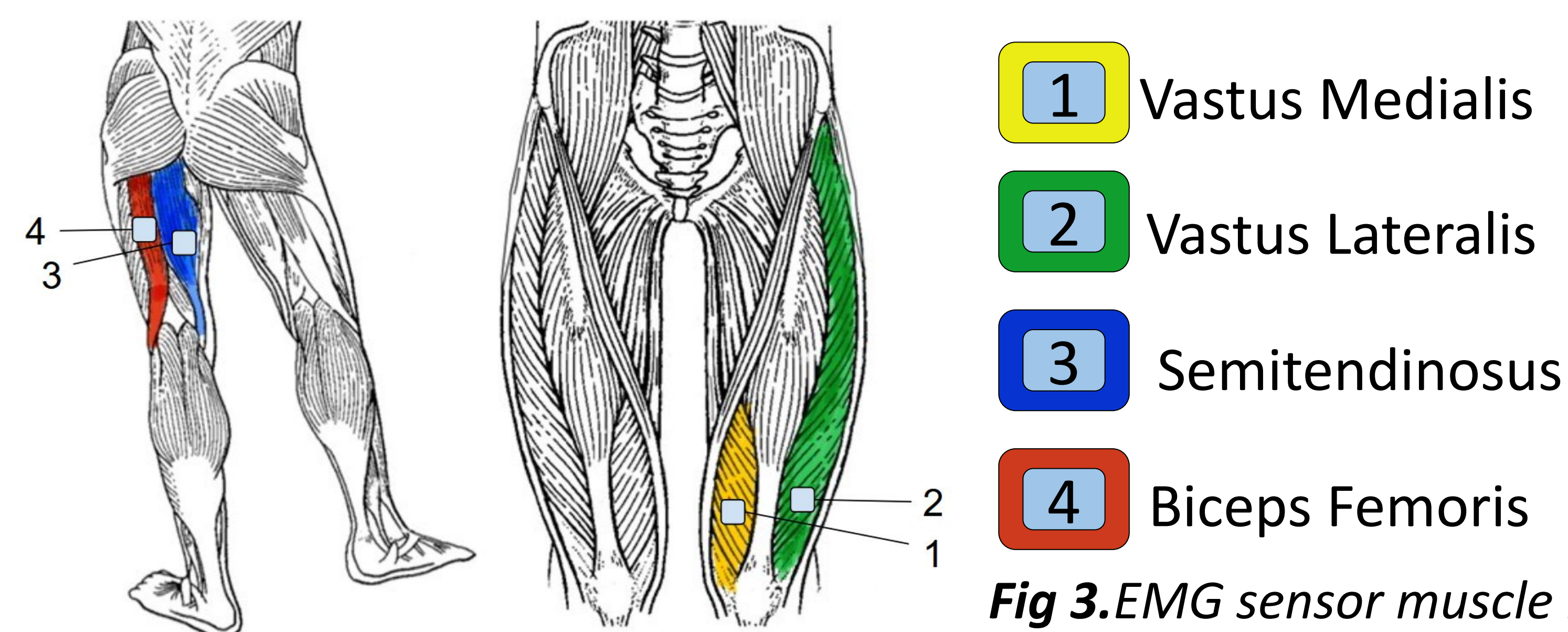


Fig 3. EMG sensor muscle locations

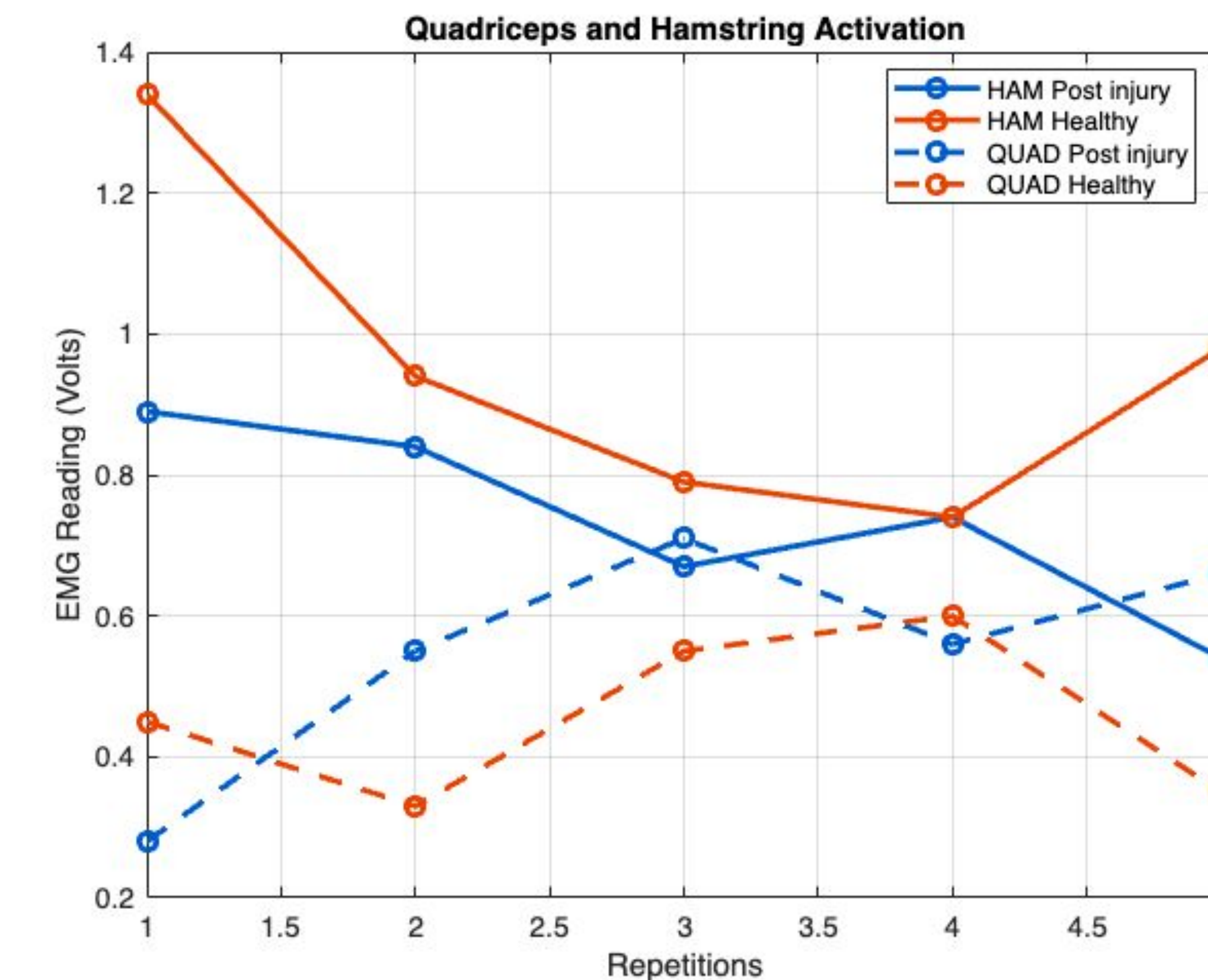


Fig 4. Hamstring and quadriceps muscle activation in post-inj. vs healthy patients

Results

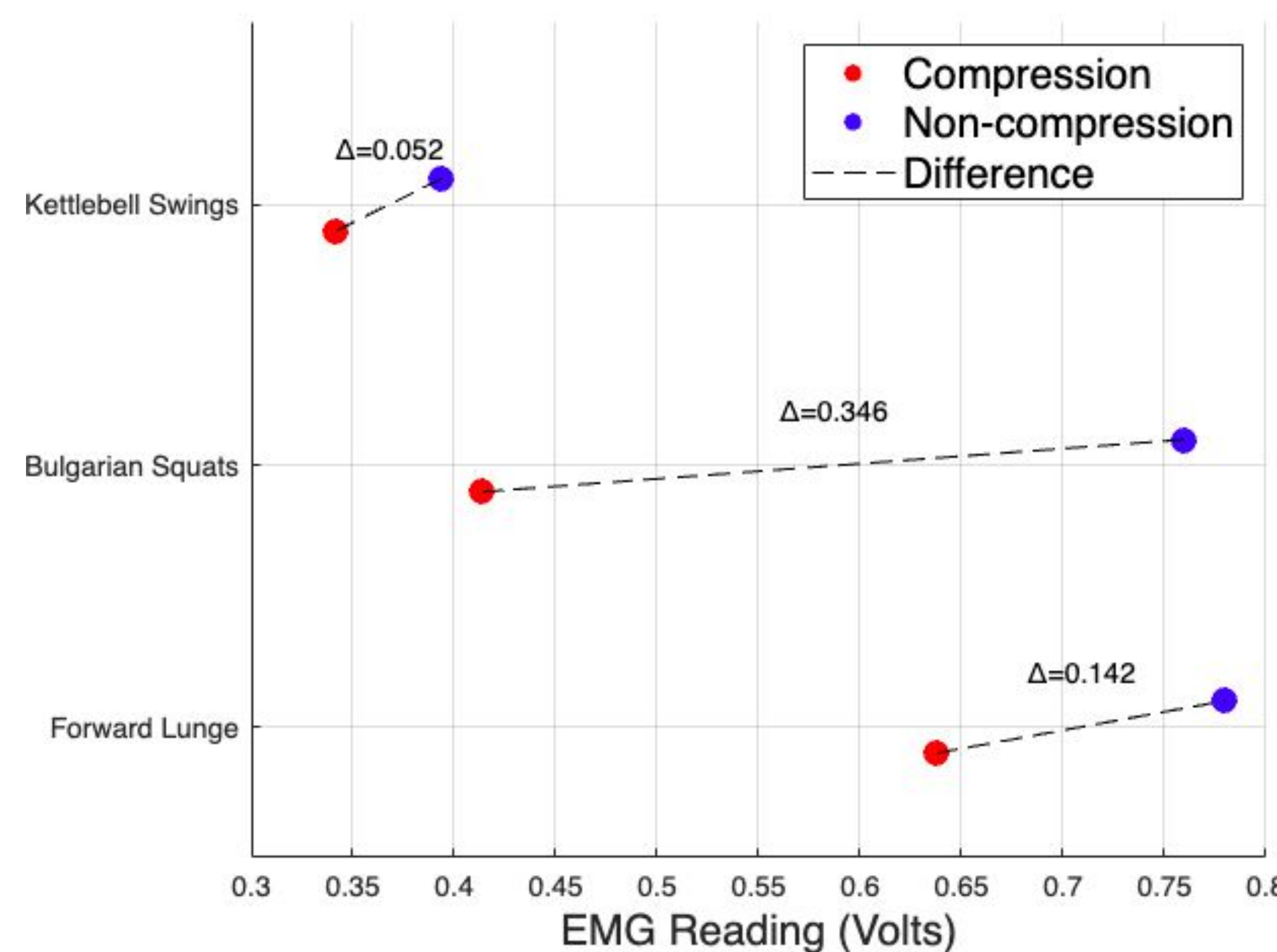


Fig 5. Quadriceps EMG readings in compression vs non-compression exercises

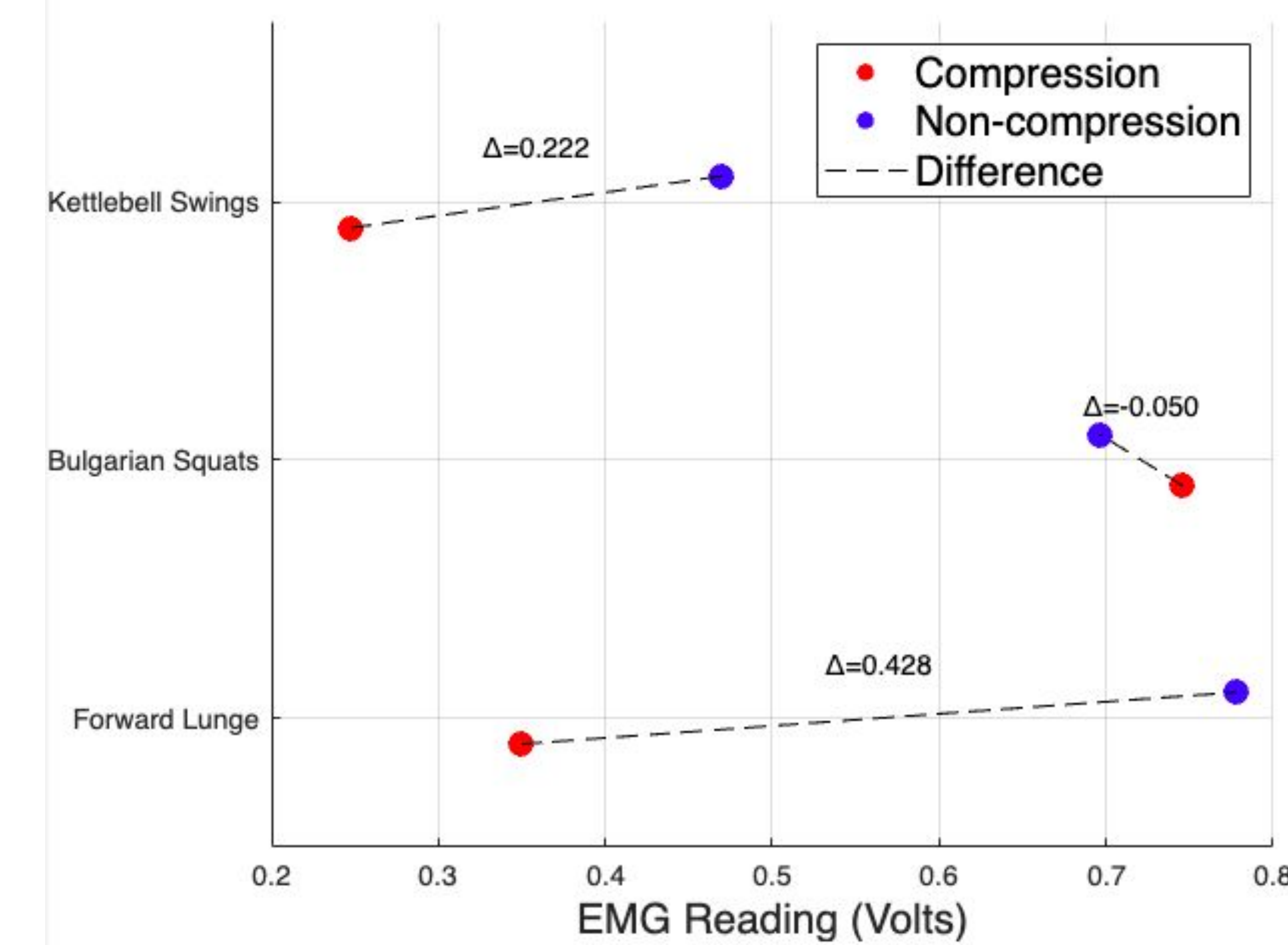


Fig 6. Hamstrings EMG readings in compression vs non-compression exercises

Conclusion

- Pneumatic compression feedback aids in detection of muscle fatigue and imbalance
- Quantified muscle activity enhances preventive injury exercises
- Production cost < \$200 for a novel tool that addresses 150,000+ ACL rupture cases annually

References

- Evans, Jennifer. U.S. National Library of Medicine (2023),
- Mather, Richard C 3rd et al. The Journal of bone and joint surgery (2013)

Future Directions

- Develop a compact/efficient system by optimizing sizing, power management, & electrode location
- Implement an automated decompression mechanism
- ML integration for improved dynamics

Acknowledgments

Mohammed Ahmed & Yasith Weerasinghe, PhD
Tylor Bene, JoVaun Wooden, & Larimee Heh, DPT
Garrett Gnemier, Computer Science Undergrad