Docket #: S18-290

Real-time Electromyography Feedback to Change Relative Muscle Activity

Stanford researchers have demonstrated clinical proof of concept that a real-time biofeedback system can reduce pain and slow joint degeneration in patients with movement disorders such as knee osteoarthritis. The system trains individuals to adjust muscle coordination and foot angle during walking, decreasing knee load.

A personalized adjustment to foot angle relieved knee osteoarthritis pain as effectively as medication. This modification also slowed cartilage degradation over a year-long randomized controlled trial verified through MRI. Using motion capture and pressure-sensitive treadmills, researchers determined each participant's optimal gait modification to offload the knee.

The biofeedback system builds on this principle, using surface electromyography (EMG) to monitor muscle activation and provide real-time visual, haptic, or auditory cues that guide movement.

This technology is now supported by Stanford's HIT Fund to optimize delivery of the intervention and continue studying efficacy in knee osteoarthritis.

Figure:

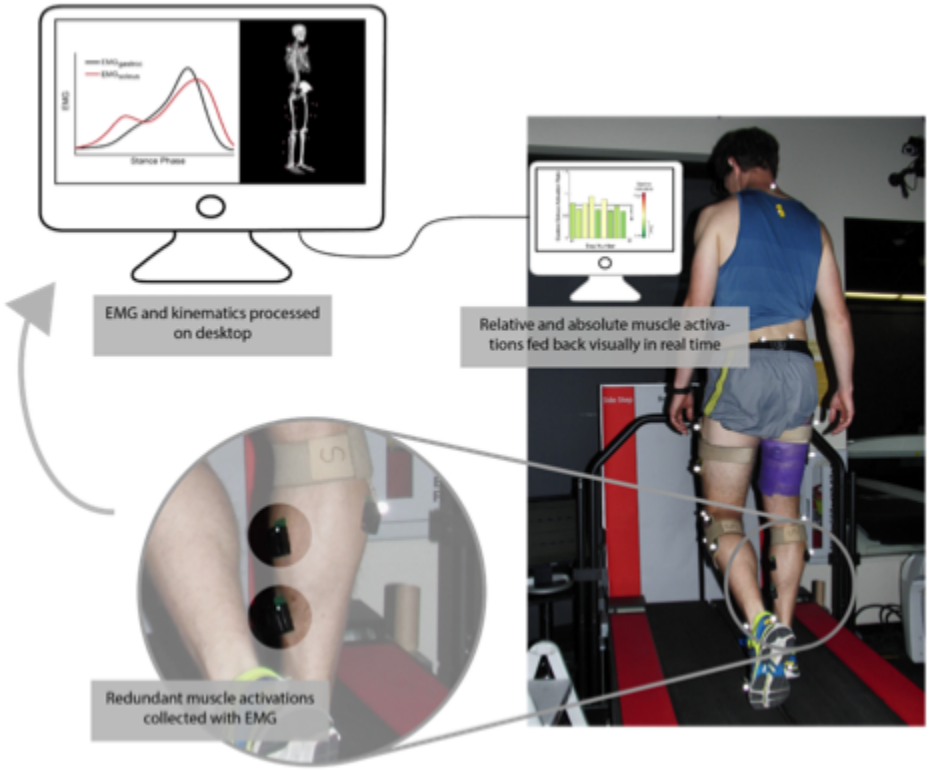


Figure Description: Real-time EMG feedback setup (credit: the inventors).

Stage of Development
Clinical Trials: In Human Efficacy

Applications

- Physical Therapy
- Knee pain
- Muscle rehabilitation
- Gait retraining

Advantages

- Non-invasive
- Applicable to large market size

- Real time feedback
- Wearable

Publications

- Uhlrich S.D., Silder A., Kolesar J.A., Delp S.L. (2018). Voluntary Modulation of Redundant Muscle Activity during Gait Using Visual Feedback. *Proc. of World Congress of Biomechanics*. Dublin, Ireland.
- Uhlrich S.D., Mazzoli V., Silder A., et al. (2025). Personalised gait retraining for medial compartment knee osteoarthritis: a randomised controlled trial. *The Lancet*.

Patents

- Published Application: 20210290104
- Issued: 12,193,808 (USA)

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