Docket #: S18-290

Real-time electromyography feedback to change relative muscle activity

Stanford researchers have developed a novel, real-time biofeedback system that may help reduce pain for patients suffering from movement disorders such as osteoarthritis, patellofemoral pain syndrome, or stroke. This system trains patients to change their coordination strategy (activate different, redundant muscles) to achieve a desirable clinical outcome during dynamic movements such as walking. For example, changing which calf muscle an individual with knee osteoarthritis uses during walking can reduce the forces in the knee which has been shown to reduce pain. Surface electromyography (EMG) measures the activation of individual muscles, processes the signal, reduces the complex signals into a small set of understandable, relevant values, and gives the user real-time feedback. The feedback could be visual, haptic (touch), or auditory. The current implementation uses a desktop computer and tools in a motion capture laboratory, but a future implementation will be a simple, wearable device for at-home rehabilitation.

Figure:

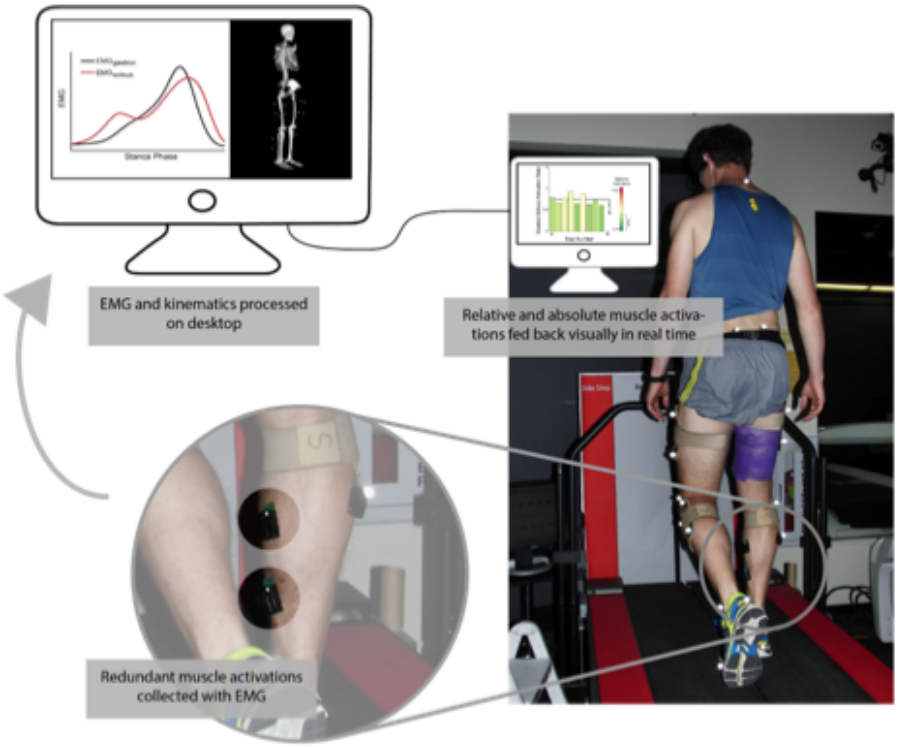

Figure Description: Real-time EMG feedback setup

Stage of Research:

- Lab-based prototype
- Demonstrated ability of humans to modulate activations of redundant muscles with visual feedback. The resulting coordination and walking pattern yielded reductions in knee contact force.

Applications

- **Physical Therapy:** could help physical therapists train individuals to use appropriate muscles for movement in clinic
- **At-home treatment**
- **Could fill treatment gap between pain medications/injections and knee replacement**
- **Can potentially delay more invasive treatments such as knee replacement**

Advantages

- **Real-time feedback** via sensors to determine which muscles are activating and being trained
- **New algorithms** to process electromyograms from multiple muscles
- **Can replace braces** which are uncomfortable
- **Could slow disease progression**
- Goal is to implement as a **simple, wearable mobile device**
- **Big market size** - 8 million American patients below age of 65 who are probably too young for knee replacement

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.

Patents

- Published Application: 20210290104
- Issued: 12193808 (USA)

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