Motor Unit Measurement Technology for Training, Exercise and Functional Activities

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Technological Innovation in Motor Unit Measurement Technology

**Sensor Technology**
- Noninvasive
- Miniaturized footprint
- Small and large muscles
- Placement takes seconds, no gel
- Designed to detect distinct motor unit action potentials

**EMG Signal Acquisition**
- Record High-Fidelity sEMG Signals
- 4-channel sEMG signals

**Algorithm Advantages:**
- For dynamic functional activities
- Direct measure of motor unit action potentials
- No assumptions of motor unit firing behavior
- Fully automate processing and validation for all motor units
- Proven accuracy

Research & Clinical Applications

**Rehabilitation Exercise**
- Leg Squats
  - During exercises of the quadriceps muscle group, motor unit firing rates from various medialis showed clear differentiation between concentric and eccentric changes in knee angle.

**Strength Training**
- Bicep Curls
  - Firing rates during strength training of biceps brachii showed variations across different repetitions.
  - Relationships between firing rates and biomechanical parameters of muscles such as torque and fatigue can be further investigated.

**Fine Motor Control**
- Drinking Task
  - Firing rates of muscle groups in the hand showed synergistic activations of extensor and flexor digitorum muscles to accomplish the functional tasks such as drinking.
  - Extensor muscles that help opening the hand were supported by the activation of flexor muscles during grasp.

Conclusions
- Hierarchical changes in motor units during dynamic activities can provide insights to the control and regulation mechanisms of activities.
- Regulation of agonist/antagonist muscles during an activity can be revealed by the correlation of firing rates in the synergistic muscle pair.
- Motor unit data coupled with biomechanical information of muscle performance can delineate factors that influence motor control.

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