Quantitative Techniques for Assessment of Upper Extremity Movement and Function

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I. Purpose

A. Surveillance / Monitor
B. Objective assessment of UE activity & performance
   a. Baseline
   b. Progress
   c. Response to interventions
C. Augmenting performance during intervention

II. Opportunities

A. Previously
   1. Videotape; parent diaries (Adolph et al., 1998)
   3. Direct supervision in rehab
B. Now
   1. Trackers / Inertial sensors / Markerless systems (i.e., Kinect)
   2. Wireless SEMG systems (Trigno™, Delsys, Inc)
   3. Indirect tele-rehabilitation
   4. Wearables

III. Trackers / Inertial sensors

A. Advantages
   1. Minimal set-up
   2. Portable - allows home & community monitoring
B. Inertial Measurement Unit Sensors (IMU) (Horak et al., 2015)
   1. 3 Axes of data collection
      a. Acceleration: Translational acceleration (m/s²)
      b. Gyroscope: Angular velocity (rad/s)
      c. Magnetometer: Magnetic heading (μT)
   2. 20-200 Hz sampling rate
   3. Stream in real time or log data to download later
   4. Demonstration (OPAL APDM, xSENS)
C. Clinical Applications
   1. Correlation with clinical assessments (Duff et al., 2016; 2017)
   2. Interlimb Coordination (Duff et al., 2017; Garrison & Wade, 2015)
IV. Triggered biofeedback
   A. Rational/Questions (Duff et al. 2007; Gilbert & Tassin, 1984; Waters & Pelijovich, 1999)
   B. Procedures – Results

V. Measures of muscle stiffness - Shearwave ultrasound elastography
   A. Uses – assess muscle stiffness pre and post BTx injection (Wolff et al 2018)
   B. Methodology

VI. Tele-rehabilitation
   A. Advantages – Challenges
   B. Sample programs (Burdea et al., 2011; Buick et al., 2016; Cason, 2009; Kanitkar et al., 2017)

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