Quantitative and Portable Neuromotor Assessment

Typical neurological exams focus on several qualitative assessments, including obtaining a patient history, assessing the patient’s cognitive status, motor and sensory skills, and cranial nerve functionality. Common motor assessments include examining for pronator drift, testing range of motion, examining muscle tone, and touching the thumb to the fingers in rapid succession. Most of these skills are rated on very general scales with course gradations, making assessment of change difficult and also subjective. The same patient may be scored differently by two observers on the same occasion. As a result, assessment of neuromotor skills over time may lack objectivity, sensitivity, and consistency. Thus, there is a need in neurology to obtain an objective quantitative measure of patients’ neuromotor functionality using a non-subjective analysis methodology.

The Wyss Institute has developed a neuroassessment measure, which may serve as a unique neurologic assessment and diagnostic tool. This measure involves a simple visuomotor tracing task where the user traces a circle on a computer tablet. Deviations from the circular path are quantified using measures of control and adaptability based on non-linear time series analysis methods. These methods have previously been shown by Wyss Institute researchers to successfully quantify other biological phenomena and pathways, including cardiac functionality, red blood cell viability, and kinematic/kinetic performance. The Wyss Institute technology provides the ability to compute rapid (within minutes) quantitative measures that may provide insight into the visuomotor pathway, which then may assist with monitoring recovery post-injury, evaluating drug dosing for on and off-target responses, or evaluating new assistive technologies.

Studies Evaluating the Neuromotor Assessment technology
We studied data from 150 healthy people aged 21 to 95 who performed the visuomotor task and found highly significant differences among age groups in all measures. One measure in particular, the multiscale entropy measure, significantly decreased with use of the non-dominant hand and could form a strong candidate for measuring a patient’s function and adaptability. This cross-sectional study supports extending the neuroassessment technology to additional populations to examine how it may provide reliable, quantitative measurements in many different clinical applications, including the evaluation of drug dosing, assessment of brain trauma to the motor pathway in concussion and traumatic brain injury or implementation as a standard measure to examine when a patient has greater than natural declines due to aging.

We are currently evaluating the visuomotor task to determine if the calculated measures are sensitive to head injuries and concussion. We anticipate collecting baseline data for 300 participants. We compare the calculated measures from the visuomotor assessment, as well ImPACT scores (a standard concussion evaluation test metric), before and after injury. We are also developing plans to evaluate this technology in additional clinical settings, such as multiple sclerosis.