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Development of a New Motor Assessment for Spinal Cord Injury Patients

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A good neurorehabilitation intervention necessitates efficient techniques to evaluate the improvement rate. Recently we have reported significant sensory-motor improvement in chronic motor complete patients after a long-term neurorehabilitation program[1] promoting physical training and cortical plasticity.
Periodically we performed the ASIA[2], the golden standard neurological exam (done in horizontal/supine position). We have noticed cases where subtle motor improvements were neither visible to the patient nor the experimenter. It was particularly true for low scores (motor activation bursts that did not reach ASIA motor score 1) or when patients were able to make small movements but could not go against gravity (a score between 2 and 3).
To improve the resolution, we have proposed a motor evaluation in vertical position, analyzing voluntary leg movements, with feet on the ground and suspended in the air (closed and opened kinetic chain). We registered surface EMGs from 8 muscles per leg, associated with video and clinical score records. This position facilitates muscle activation; for instance, hip torque ratio to flex by an angle α in horizontal position compared to vertical one is 1/tan(α) (if leg = 90cm, to do a 10cm movement the effort is therefore 18x harder in horizontal position). Moreover, in the horizontal positon (but not in the vertical), the needed effort to perform hip abduction/adduction depends of friction forces exerted between the leg and the physiotherapy platform making hard to reproduce the tests conditions.
This evaluation was successfully tested with eight SCI patients during a 2 years long training protocol.

References:

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