UPPER LIMB EVALUATION WITH ROBOTIC EXOSKELETON. NORMATIVE VALUES FOR INDICES OF ACCURACY, SPEED AND SMOOTHNESS.

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ABSTRACT

BACKGROUND: Robotic rehabilitation devices for upper limb function (ULF) provide global indicators of a patient's ability, but the temporal evolution of motion related to motor control is disregarded.

OBJECTIVE: To determine normative values for indices of accuracy, speed and smoothness in the evaluation of upper limb function.

METHODS: Twenty-five healthy individuals performed the Armeo®Spring device "Vertical Capture" task. Custom stand-alone software was developed to provide the following indices: global Hand Path Ratio (HPR), local HPR in the target area (locHPR), vertical and horizontal overshoot (vertOS, horOS), maximum and mean velocity (maxVel, meanVel), mean/maximum velocity, number of peaks in velocity profiles (NVelPeaks) and normalized jerk (NormJerk). The dependence of indices on task characteristics was analyzed by an ANCOVA test. Indices inner relationships were assessed by a correlation and a factor analysis. Normative values were then provided.

RESULTS: 4,268 single reaching movements were analyzed. Four indices were not affected by movement direction. Indices were minimally influenced by the difficulty level. Based upon correlation and factor analysis indices and can be grouped into three assessment fields, dealing with precision, velocity and smoothness.

CONCLUSIONS: We have developed a tool to assess ULF in dynamic condition. Normative values were obtained to be used as references in assessing patients.