Automatized assessment of motor function in patients with NMD: MFM-Digital Study
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To cite this version:

HAL Id: hal-01925920
https://hal.archives-ouvertes.fr/hal-01925920
Submitted on 18 Nov 2018

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The Motor Function Measure (MFM), a validated and sensitive tool applicable to ambulant and non ambulant patients with neuromuscular disorders (NMD), is currently used as outcome measure in clinical studies. By using digital technologies, we want to create an automatized assessment based on MFM. The objectives are to improve the MFM reliability and its acceptability by turning the assessment into a serious game. Feasibility studies assessing the relevance of digital systems to capture postures and motions during a MFM test have shown that on 32 items of the MFM, 14 could be recognized by the Kinect and 3 by a digital tablet. Here we present preliminary studies to the conception of automated scoring systems.

## MATERIAL and METHOD

- Patients with Spinal Muscular Atrophy (SMA) type 2 or 3 (study 1: 10 from the Escale department and study 2: 14 from the National SMA study - NCT02391831) were included in the MFM-Kinect study. 14 items were scored by a therapist through standard MFM completion and from a blind scoring based on digital data coming from Kinect.

- Patients with a NMD from 5 neuromuscular disorder departments were included in the MFM-Tablet study. Items 18, 19 and 22 were scored by a therapist through standard MFM completion on paper or using a digital tablet application.

## RESULTS MFM-KINECT

119/140 records were interpretable. Some digital data were not analyzed because of capture problems with distortion skeleton, for example for patient with small amplitude movements or sitting on a wheelchair. On interpretable records, a great agreement between items scoring by a therapist and items blind scoring on captured digital data were found (75.6%).

Differences between both studies concern as well concordance than interpretable capture.

## RESULTS MFM-DIGITAL-TABLET

37 patients were included in the MFM-tablet (with inclusion still on-going), with 11 DMD, 7 neuropathies, 6 SMA and 13 others. Median age of patients were 15.8 years [IQ: 9.4 - 43.8] and median of % MFM total score were 81.2 % [IQ: 59.4 - 87.5]. The agreement between scoring on paper vs tablet is excellent (p < 0.01) for Items 18 and 22, good (p < 0.01-0.08) for Item 19.

## DISCUSSION and CONCLUSION

Results are encouraging to support the development of an automatized MFM. Additional work is needed to improve Kinect capture for weaker patient and to resolve interference problems. In study 2, MFM-Kinect protocol was included in a long list of tests during Nathlis-SMA, which could explain result differences between studies. The MFM-tablet results place the tablet in the assessment tools of the upper limb. The children showed a greater interest for the tablet application. The data supplied by the system MFM-digital bring additional data, in particular the timing of items’ exercises and kinematic parameters which could refined the sensitivity of MFM. We explore avenues of improvement of the system, in particular concerning the capture for weaker patients. The next step will be to use algorithms providing automatic scorings based on digital data and we are still looking for new digital technologies able to capture additional items.