Motor Function Measure: construction of a short form (MFM-20) for children with neuromuscular disease aged between 2 and 6

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Background: It is important to know the natural history of each neuromuscular disease to measure objectively the impact of new therapies in clinical trials especially for young children. The Motor Function Measure (MFM) [Bérard, ref. 1] is a validated tool designed for neuromuscular diseases, applicable in ambulant and non ambulant patients whatever the severity. The MFM comprises 32 items in 3 functional dimensions: standing and transfers (13 items), axial and proximal motor function (12 items) and distal motor function (7 items). An example of the scores of a Duchenne patient is given in Fig. 1.

The MFM is not validated for children younger than 6 years. The objective of the study was to define a short form MFM suitable for children under 6 years old.

Methods: First, healthy children aged between 2 and 6 years recruited from schools and among contacts of staff were studied to estimate the suitability of items. Exclusion criteria were neuromuscular disease, delayed psychomotor development, recent surgery and medical conditions interfering with motor function. Parents gave their written consent. The evaluation was performed by 4 MFM-trained physiotherapists. The 32 items in the standard MFM were rated by percentage of children achieving maximal score (3 points) these items were incorporated into the short form if >80% carried out the task as instructed and achieved a maximum score.

Second, data from the MFM-32 validation study [ref. 1] was used to check whether the psychometric properties of the reduced scale were maintained.

Results:

Item testing by healthy children 4 physiotherapists, from L’Escale-Lyon (N=48), Gui de Chauliac-Montpellier (N=21), l’Archet-Nice (N=15) and AFM-Evry (N=106) participated in the study.

190 children, 96 boys and 94 girls, were included. Mean age was 4.5 ± 1.2 y (Fig. 2).

Average completion time was 18.4 ± 6.3 minutes (range, 9 to 41 minutes). There was no significant correlation between completion time and age (Fig. 3).

Cooperation was rated as optimal in 88% of cases and moderate in 12%. Four infants (2%), age 2 - 3, refused to carry out the test and were excluded.

Maximum score was not achieved in >80% of subjects for 9 items (8, 16, 17, 19, 20, 26, 28, 29, 31), particularly those involving fine motor skills and balance. For 3 further items (2, 13, 15) the tasks could not be assessed accurately according to the criteria given in the Reference manual [ref. 2].

These 12 items (Fig. 4) were therefore removed, and the MFM scale for children aged under 6 years old was constituted of 20 items, among which the distribution of items among the 3 dimensions of the scale was approximately maintained: 8 items for dimension 1 (versus 13 in the standard MFM), 8 for dimension 2 (versus 12) and 4 for dimension 3 (versus 7).

Validation of items Internal consistency of the 3 dimensions (Table 1) assessed with Cronbach’s alpha coefficient was 0.98 for D1, 0.95 for D2, 0.81 for D3 and 0.97 for the total score. D3 was thus slightly reduced compared with the MFM-32.

Intra and inter-rater reliability was similar with Intra-class coefficients (ICC) of the 3 dimensions > 0.95.

For Criterion validity, correlations with other measures (functional grades of Brooke and Vignos, FIM, CGI severity, VAS of global impairment or per dimension given by examiners and clinicians) were identical between the 2 MFM versions.

Responsiveness to change (Table 1) was studied in a sub-sample of 41 Duchenne patients evaluated twice at a one year interval. Results, expressed as Standardized Response Means (SRM), were close to those for the 32-item version, slightly better for D3 and the total score.

Construct validity. The only difference consisted in a 2- instead of 3- dimensional solution after Principal Component Analysis (PCA), with D3 combining with D2. This result could be explained by the reduced number of items in D3 (4 instead of 7) and the low representation of pathologies with distal impairment in the initial validation sample.

Conclusions: The reduced version of the MFM scale for use in children under 6 years of age showed good acceptability and can be completed in a timeframe compatible with the clinical evaluation of young children. The instructions for patients on how to perform each task needed minor adaptation but the assessment criteria, using a four point range (0-3) for each task as defined in the reference manual [2], were unchanged.

The construction of this scale showed the importance of considering cognitive and motor development in childhood when planning neuromuscular evaluations. The validation of this reduced version is ongoing in over 80 patients with neuromuscular disease aged 2 to 6 years.