Validity and reliability of the Motor Function Measure, 32-item version, in children (2–5 years) with neuromuscular disorders

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Background

• Spinal muscular atrophy (SMA) is a rare, genetic, progressive neuromuscular disease with a broad range of severity.
• The Motor Function Measure, 32-item version (MFM32) is a 32-item assessment of motor function and is valid and reliable in individuals with neuromuscular disorders (NMDs) aged 2–6 years.¹ — It is being used as the primary endpoint in SUNFISH, a placebo-controlled, double-blind study investigating the efficacy and safety of risdiplam as a treatment for patients with Type 2 or 3 SMA aged 2–25 years.¹
• An abbreviated 20-item version of the MFM was developed for use in children with NMDs <7 years old to address the concern that age-related development (i.e. changes in function unrelated to disease) would limit the cross-sectional comparison between young children and older individuals.¹

Objective

To investigate the measurement properties (validity and reliability) of the MFM32 in children with NMDs, aged 2–5 years.

Methods

Analysis population

• The analysis dataset was extracted from the MFM database provided by Hospices Civils de Lyon.
• The dataset included all patients with NMDs aged 2–5 years with at least one time point of MFM32 data.

Outcome assessments

MFM32

• The MFM32 assessment includes 32 items across three domains.²

• Items were scored using a 4-point Likert scale to rate the participants’ maximal ability without assistance.³

• The raw sum score of the 32 items was converted into a 0–100 scale, where lower scores indicate poorer functional ability.

Vignos grade*¹

• Assessment of lower limb function was rated by the clinician using the Vignos grade, a single-item assessment with 10 response options (Table 1).

Table 1. Vignos grade response options

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Walks (no assistance)</td>
</tr>
<tr>
<td>2</td>
<td>Walks with assistance</td>
</tr>
<tr>
<td>3</td>
<td>Walks with cane</td>
</tr>
<tr>
<td>4</td>
<td>Walks with braces and cane</td>
</tr>
<tr>
<td>5</td>
<td>Walks with braces</td>
</tr>
<tr>
<td>6</td>
<td>Walks with braces and cane</td>
</tr>
<tr>
<td>7</td>
<td>Walks with cane</td>
</tr>
<tr>
<td>8</td>
<td>Walks with cane</td>
</tr>
<tr>
<td>9</td>
<td>Walks with limitations</td>
</tr>
<tr>
<td>10</td>
<td>Cannot walk</td>
</tr>
</tbody>
</table>

CGI-S*¹

• Overall disease severity was rated by the clinician using the CGI-S.

• It has four response options: mild, moderate, severe, very severe.

Vignos grade and CGI-S were not completed for all patients, nor were they completed for all patient visits.

Analyses

Sociodemographic descriptive statistics

Descriptive statistics were calculated for the patients’ demographic characteristics at baseline.

Reliability

Internal consistency

• Internal consistency of the MFM32 was assessed by calculating Cronbach’s alpha⁴ using the earliest complete MFM32 data for each patient.

Test-retest reliability

• Test-retest reliability of the MFM32 total score was assessed by comparing scores at two time points in patients classified as stable.

Validity

Convergent validity

• Convergent validity of the MFM32 total score was assessed using Spearman rank correlations with Vignos grade (3–5 years only) and with CGI-S scores.

• Correlations >0.4 were anticipated.

Known-groups validity

• Known-groups validity was assessed by comparing mean total MFM32 scores via analysis of covariance (controlling for age and gender) with groups defined by CGI-S score (mild and moderate vs. severe and very severe) and Vignos grade (1–5 vs. 6–10).

• Statistically significant differences provide supportive evidence.

Results

Patient demographics

A total of 84 patients with NMDs were included in the analysis, including 26 with DMD and 17 with SMA (Table 2, Figure 1).

Table 2. Patient demographics: Age, gender and MFM total score

<table>
<thead>
<tr>
<th>Variable</th>
<th>Age, years, mean (SD; min–max)</th>
<th>Gender, n (%)</th>
<th>Male</th>
<th>Female</th>
<th>MFM total score, mean (SD; min–max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients (N=84)</td>
<td>4.87 (0.95; 2–5)</td>
<td>54 (64.7)</td>
<td>30 (35.3)</td>
<td>69.92 (20.55; 7-2-96.85)</td>
<td></td>
</tr>
</tbody>
</table>

Conclusions

• The findings of this study provide strong evidence that the MFM32 is a valid and reliable measure of motor function in children with NMDs aged 2–5 years.

• Excellent evidence of reliability was demonstrated by test-retest reliability in a subset of patients with no change in global disease severity (CGI-S, Vignos), and by a high Cronbach’s alpha.⁵

• The MFM32 was able to discriminate between patients with mild/moderate versus severe/very severe global status (CGI-S, Vignos), and between those who can versus cannot walk unassisted (Vignos).

• These results provide supportive evidence for the use of the MFM32 total score in studies involving children aged 2–5 years with NMDs.

Abbreviations

CGI-S, Clinical Global Impression of Severity; DMD, Duchenne muscular dystrophy; ICC2,1, a 2-way, random, single-measure analysis of variance (subject by visit) was calculated to assess the test-retest reliability.

References

4. doi:10.1371/journal.pmed.1000533.
7. The Motor Function Measure, 32-item version, in children (2–5 years) with neuromuscular disorders.

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