**Tardieu Validity Studies:**

There are only a limited number of studies exploring the validity of the Tardieu Scale. Most validity studies aim to correlate the Modified Tardieu Scale (MTS) with other clinical measurements of spasticity, neurophysiological measures, or biomechanical indices or test the sensitivity of the MTS to detect changes after treatment.

The results are highly variable. Although several studies did not support the validity of the MTS in a particular population or muscle group for specific laboratory measures, others provide evidence that the MTS is a valid tool for the use of assessment of spasticity in adults and children.

It is important to note that some of these studies provide little information about the subjects, protocol for assessment, or other aspects of the study, not only making comparisons difficult but also making it difficult to critically examine the results. Furthermore, many studies have small subject numbers or restrict the assessments to only one or two muscle groups.

For any study using the MTS, it is critical that inclusion and exclusion criteria are clearly defined, a standardized protocol of how to assess a muscle group (patient & limb position, number of times to repeat the measurement, speed, etc.) is utilized as well as precise definitions of the various scores be established.

**VALIDITY STUDIES WITH PEDIATRIC SUBJECTS:**

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| **RESEARCH STUDY**  **SUBJECTS** | **COMPARISONS/**  **LABORATORY MEASURES** | **RESULTS/**  **CONCLUSION** |
| **Alhusaini et al. (2010)**  1 Lower limb muscle group (Plantar flexors)  Content validity  Ashworth Scale vs Tardieu Scale  N=27 Children with CP | Ashworth Scale and Tardieu Scale compared to laboratory measures (stretch-induced electromyographic activity) of spasticity and contracture. | Compared to laboratory measures, the Tardieu Scale was more effective than the Ashworth Scale in identifying the presence of spasticity (88.9% PEA, к=0.73), the presence of contracture (77.8% PEA, к=0.503), and the severity of contracture (r=0.49). However, neither scale was able to identify the severity of spasticity. |
| **Bar-On et al. (2014)**  1 Lower limb muscle group (medial hamstrings)  Responsiveness  Predictive ability  MAS vs MTS  N=31 Children with CP | Comparison of clinical scales (MAS & MTS) and instrumented spasticity assessments both biomechanical (position & torque) and electrophysiological (surface electromyography) after BTX treatment and casting. | Both clinical & instrumented parameters improved post-BTX, but showed a low percentage exact agreement.  However, the MTS identified 12 responders compared to 25 responders identified by instrumented parameters.  Responsiveness: Detection ability: Compared with the instrumented parameters, both clinical scales were less sensitive than the instrumented assessments to detect change in spasticity.  Both the MTS and MAS showed no predictive ability.  Intra-rater reliability ICC for the MTS was 0.82 compared to the ICC for the MAS of 0.59. |
| **Boyd et al. (1998)**  1 Lower limb muscle group  Validity: Sensitivity to Change  MTS vs Ashworth  N=16 Children with CP.  Subjects with combinations of adductor spasticity and contracture were scheduled to receive BTX-A to the adductors (n=8) or saline (n=8). | Examination of the validity of an adapted version of the Tardieu Scale compared to the Ashworth Scale to quantify spasticity in children with CP.  The measures of spasticity were tested in the context of a randomized double-blind placebo controlled clinical trial that was being performed for another reason.  One blinded assessor assessed children prior and one-week post and judged whether the child had received BTX-A or saline based on the Tardieu measure. Parents recorded their impressions independently. | The physiotherapist correctly judged 14 of 16 subjects’ treatment (seven of eight BTX-A group, seven of eight placebo group) and the parents judged 11 of 16 (four of eight in the BTX-A group, seven of eight in the placebo group).  Mean change in Tardieu (°):  BTX-A group = 11.5° (SE of mean=1.6°)  Placebo group = -0.62° (SE of mean=2.9°)  P<0.01  In the BTX-A group there was a significant increase in the dynamic range following treatment which was quantifiable using the MTS. The investigators concluded that the Tardieu Scale had a significant ability to detect change following spasticity treatment. |

**VALIDITY STUDIES WITH ADULT SUBJECTS:**

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| **RESEARCH STUDY**  **SUBJECTS** | **COMPARISONS/**  **LABORATORY MEASURES** | **RESULTS/**  **CONCLUSION** |
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| **Gholami et al. (2017)**  1 Lower limb muscle group (knee extensors)  Validity  MTS  N=30 Adults with stroke | Investigation of the relationship between the MTS and a biomechanical measure in assessing knee extensor muscle spasticity. An isokinetic dynamometer was used to move the knee passively from full extension to 90° flexion at various speeds to collect torque-angle data. The slope of the work-velocity curve was calculated using linear regression. | The mean of R2-R1 component of MTS was 19.73 (SD 29.85). The mean work significantly decreased as the speed increased (*p*<.001). The mean (SD) slope for the work-velocity curve was -0.83 (SD 0.73). There was no significant relationship between the R2-R1 of the MTS and the slope of work-velocity curve (*r*=0.09, *p*=.62). |
| **Naghdi et al. (2014)**  1 Upper limb muscle group (wrist flexors)  Concurrent Criterion Validity  MTS  N=20 Adults post stroke | Comparison of clinical (R2-R1 of the MTS) and electrophysiological assessment (H-reflex tests) of wrist flexor muscle spasticity. | There was no significant association between the MTS and H-reflex tests. |
| **Patrick and Ada (2006)**  2 upper/lower limb muscle groups  Construct Validity  Ashworth Scale vs  Tardieu Scale  N=16 Adult stroke patients | Ashworth Scale and Tardieu Scale compared the as well as laboratory measures of spasticity (stretch-induced EMG activity) and contracture. | Presence of Spasticity: PEA (Percentage of exact agreement) of Tardieu and laboratory measure of spasticity was 100% for elbow flexors (kappa=1.0) and 100% for ankle plantar flexors (kappa=1.0). This was significantly greater than the PEA of 63% for both muscles between the Ashworth Scale and laboratory measures of spasticity.  Severity of Spasticity: Pearson correlation coefficients between the Tardieu Scale and laboratory measures of spasticity were *r*= 0.86 for the elbow flexors and *r*= 0.62 for the ankle plantar flexors.  Presence of Contracture: the PEA between the Tardieu Scale and a laboratory measure was 94% for both the elbow flexors (kappa=0.88) and the ankle plantar flexors (kappa=.088).  Severity of Contracture: Pearson correlation coefficients between the Tardieu Scale and laboratory measure of contracture were *r*= 0.89 for the elbow flexors and *r*= 0.84 for the ankle plantar flexors. |