

# Assessing Wolf Motor Function Test as Outcome Measure for Research in Patients After Stroke

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**Background and Purpose**—The Wolf Motor Function Test (WMFT) is a new time-based method to evaluate upper extremity performance while providing insight into joint-specific and total limb movements. This study addresses selected psychometric attributes of th(while)-442.dae -13ya(oplicted)-332.9intoe -13ya(toe -13yachrontric)-332.9s(Strokd)-332.9 d

TABLE 1. Total Scores for WMFT and FMA

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### **Training Raters**

Rater training was completed for both tests by using a separate sample of 4 subjects (2 after stroke and 2 without stroke). Training concluded when all 4 raters scored, independently and concurrently, all tasks among all subjects within 0.20 seconds (WMFT) and with exact agreement (FMA).

### **Procedure**

All instruments were calibrated before data collection and on every fourth subject. For each subject, testing sequence and rater pair, from among 4 raters, were 12 to 16 days apart.

### **Data Analysis**

Nonparametric analyses were used for all data not normally distributed, on the basis of Shapiro-Wilk test results. Interrater reliability of the WMFT and FMA total scores per limb per session was determined by Intraclass Correlation Coefficient (ICC), model (1,1). Interrater reliability also was determined for WMFT (ICC) and FMA ( $\kappa$  statistic) individual tasks of the affected limb in subjects after stroke. Rater total scores for each test were compared by the

Wilcoxon signed rank (paired sample) test. Internal consistency of each test was determined by Chronbach's  $\alpha$ . Each WMFT and FMA total score was compared between groups by the Wilcoxon 2-sample test. The WMFT and FMA total scores for the most affected poststroke limb were related by using the Spearman rank correlation coefficient. Only primary examiners were used in analyses, except for the reliability tests. For all analyses, the criterion  $\alpha$  level was 0.05, and power was  $\geq 0.90$  for WMFT scores (effect size 1.22,<sup>1</sup>  $n=19$ ) and for FMA scores (effect size 0.94,<sup>2</sup>  $n=19$ ).

### **Results**

Total scores for the WMFT and FMA are presented in Table 1. Interrater reliability for the WMFT ranged from 0.97 to 0.99. Reliability for the more affected extremity of subjects after stroke for the FMA was ICC 0.96 ( $P<0.0001$ ). A ceiling effect was observed in FMA scores for the less affected extremity of subjects after stroke and for both extremities of subjects without impairment, prohibiting interrater reliability



**TABLE 3. Wilcoxon 2-Sample Test Values Comparing Test**

10. Pick up paper clip (front): Subject attempts to pick up paper clip by using a pincer grasp.
11. Stack checkers (front): Subject attempts to stack checkers onto the center checker.
12. Flip cards (front): Using the pincer grasp, patient attempts to flip each card over.
13. Turning the key in lock (front): Using pincer grasp, while maintaining contact, patient turns key fully to the left and right.
14. Fold towel (front): Subject grasps towel, folds it lengthwise, and then uses the tested hand to fold the towel in half again.
15. Lift basket (standing): Subject picks up basket by grasping the handles and placing it on bedside table.

### **FMA: Upper Extremity Portion**

- I. Reflex activity
  1. Biceps
  2. Triceps
- II. Flexor synergy
  3. Shoulder retraction
  4. Shoulder elevation
  5. Shoulder abduction
  6. Shoulder outward rotation
  7. Elbow flexion
  8. Forearm supination
- III. Extensor synergy
  9. Shoulder adduction/inward rotation
  10. Elbow extension
  11. Forearm pronation
- IV. Movements combining synergies
  12. Hand move to lumbar spine
  13. Shoulder flexion 0° to 90°
  14. Elbow 90°, pronation/supination
- V. Movements out of synergy
  15. Shoulder abduction 0° to 90°
  16. Shoulder flexion 90° to 180°
  17. Elbow 0°, pronation/supination
- VI. Reflex activity
  18. Normal reflex activity, biceps and triceps
- VII. Wrist
  19. Elbow 90°, wrist stability
  20. Elbow 90°, wrist flexion/extension range of motion
  21. Elbow 0°, wrist stability
  22. Elbow 0°, wrist flexion/extension range of motion
  23. Wrist circumduction
- VIII. Hand
  24. Fingers, mass flexion
  25. Fingers, mass extension
  26. Grasp a: First and radial surface of second digit pinch paper.
  27. Grasp b: First and second digit pinch paper.
  28. Grasp c: First and third digit pinch pencil.
  29. Grasp d: First, second, and third digit grip coke can.
  30. Grasp e: All digits grip tennis ball.
- IX. Coordination/speed
  31. Tremor
  32. Dysmetria
  33. Speed

should be given to delineation and development of quantitative performance-based functional tests and measures, such as used in the present study.

## **Appendix**

### **General Description of the WMFT**

All tasks are performed as quickly as possible and are truncated at 120 seconds. Tasks are as follows:

1. Forearm to table (side): Subject attempts to place forearm on the table by abduction at the shoulder.
2. Forearm to box (side): Subject attempts to place a forearm on the box by abduction at the shoulder.
3. Extend elbow (side): Subject attempts to reach across the table by extending the elbow (to the side).
4. Extend elbow (to the side), with weight: Subject attempts to push the sandbag against outer wrist joint across the table by extending the elbow.
5. Hand to table (front): Subject attempts to place involved hand on the table.
6. Hand to box (front): Subject attempts to place hand on the box.
7. Reach and retrieve (front): Subject attempts to pull 1-lb weight across the table by using elbow flexion and cupped wrist.
8. Lift can (front): Subject attempts to lift can and bring it close to lips with a cylindrical grasp.
9. Lift pencil (front): Subject attempts to pick up pencil by using 3-jaw chuck grasp.

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