

Date: July 21, 2022

Data: sent to Chapple via email by PT Courtney Ellerbusch

Goal: Evaluate 7 patients with MS on functional scale prior, during, and post participation in a rehab program

Note: 7 patients is a very low sample size to have any kind of confidence in our results, especially since this is a heterogeneous group of patients with varying disease severity. These results should be considered a pilot and interpreted with caution.

Analyses:

A within subjects repeated measures ANOVA with no between subject factor was used to assess for linear and quadratic (for variables measured at all 3 time points) trends for continuous variables.

Continuous variables were: quad length, 25 foot walk test, HS length, TUG test, HIP IR ROM, HIP ER ROM. Results from these analyses are shown on page 2 (top portion of table).

Paired samples t-tests were used to assess for mean change over time for continuous variable measured at 2 timepoints (pre and post). SPSS version 28.0 was used for analyses. Results from these analyses are shown on page 2 (bottom portion of table).

The MAT and MMT measures were analyzed descriptively (no p-values). Counts and percentages are reported in table on page 3.

Summary of Statistically Significant Findings:

1. A linear trend emerged for HIP IR ROM for both the right and the left side. With ROM increasing over time.
 - a. Right side means: 6.9, 12.1, 15.3; P=.003
 - b. Left side means: 10.7, 13.4, 17.9; P=.016

Table of means over time for tests that are considered continuous measures. Variables highlighted in yellow are statistically significant. In both cases hip internal rotation increased in a significant linear fashion throughout the 3 time points.

The tests below were administered at all three time points. A repeated measures model with time as the within subjects variable and no between subjects variable was used to assess for linear and quadratic trends. There were no quadratic trends reported. There were 2 significant linear trends reported, Hip IR ROM left and right side

| Test | Mean (Std Error), pre | Mean (Std Error), during | Mean (Std Error), post | P-value |
|--------------------|-----------------------|--------------------------|------------------------|---------|
| Quad Length R | 122.5 (5.9) | 130.8 (1.6) | 130.0 (2.6) | 0.312 |
| Quad Length L | 121.7 (5.6) | 130.0 (1.3) | 130.8 (2.4) | 0.210 |
| 25 foot walk test | 21.4 (5.2) | 20.7 (5.9) | 15.0 (1.3) | 0.370 |
| Hamstring length R | 67.5 (4.4) | 52.5 (18.7) | 55.0(15.6) | 0.470 |
| Hamstring length L | 64.0 (7.8) | 72.0 (4.6) | 74.0 (3.7) | 0.189 |
| TUG Test | 27.2 (9.2) | 23.6 (6.9) | 16.5 (0.4) | 0.321 |
| Hip IR ROM R | 6.8 (1.8) | 12.1 (2.1) | 15.3 (2.1) | 0.003 |
| Hip IR ROM L | 10.7 (2.3) | 13.4 (1.3) | 17.9 (1.5) | 0.016 |
| Hip ER ROM R | 34.3 (6.3) | 38.6 (5.5) | 38.3 (6.0) | 0.199 |
| Hip ER ROM L | 35.0 (5.8) | 38.6 (5.0) | 40.0 (5.7) | 0.134 |

The data below were collected at 2 timepoints. Means from pre to post were compared using a paired samples t-test. Means \pm standard deviations are reported. P -values are not significant.

| Test | Mean \pm SD, pre | | Mean \pm SD, post | p-value |
|--------|--------------------|----|---------------------|---------|
| EDSS | 6.8 \pm 0.8 | -- | 6.8 \pm 0.8 | NA |
| MSIS29 | 97.3 \pm 25.2 | -- | 85.0 \pm 20.2 | 0.397 |
| MSWS12 | 0.89 \pm 0.14 | -- | 0.70 \pm 0.28 | 0.277 |

On the following page assessments for categorical measures are shown by the count and percentage of patients who improved, stayed the same, and worsened over time (from pre to post).

| | N worse | N same | N Improve | %worse | %same | %Improved |
|--|---------|--------|-----------|--------|--------|-----------|
| MATR hip fleX change | 0 | 5 | 2 | 0.0% | 71.4% | 28.6% |
| MATL hip flex change | 0 | 6 | 1 | 0.0% | 85.7% | 14.3% |
| MATR hip ext change | 1 | 2 | 4 | 14.3% | 28.6% | 57.1% |
| MATL hip ext change | 2 | 4 | 1 | 28.6% | 57.1% | 14.3% |
| MATR knee flex change | 1 | 4 | 2 | 14.3% | 57.1% | 28.6% |
| MATL knee flex change | 0 | 3 | 4 | 0.0% | 42.9% | 57.1% |
| MAT R knee ext change | 1 | 5 | 1 | 14.3% | 71.4% | 14.3% |
| MAT L knee ext change | 0 | 3 | 4 | 0.0% | 42.9% | 57.1% |
| MAT R ankle DF change | 1 | 6 | 0 | 14.3% | 85.7% | 0.0% |
| MAT L ankle DF change | 0 | 7 | 0 | 0.0% | 100.0% | 0.0% |
| MAT R Ankle PF change | 1 | 1 | 5 | 14.3% | 14.3% | 71.4% |
| MATL ankle PF change | 2 | 0 | 5 | 28.6% | 0.0% | 71.4% |
| MMT R psoas Change | 0 | 3 | 4 | 0.0% | 42.9% | 57.1% |
| MMT L psoas Change | 0 | 2 | 5 | 0.0% | 28.6% | 71.4% |
| MMT Rec Abd change | 0 | 3 | 3 | 0.0% | 50.0% | 50.0% |
| MMT R Quadratus Change | 0 | 2 | 5 | 0.0% | 28.6% | 71.4% |
| MMT L Quadratus Change | 0 | 3 | 4 | 0.0% | 42.9% | 57.1% |
| MMT R Rec Fem Change | 1 | 2 | 4 | 14.3% | 28.6% | 57.1% |
| MMT L Rec Fem Change | 1 | 3 | 3 | 14.3% | 42.9% | 42.9% |
| Vastus R lateralis medialis MMT Change | 1 | 1 | 5 | 14.3% | 14.3% | 71.4% |
| Vastus L lateralis medialis MMT Change | 0 | 0 | 7 | 0.0% | 0.0% | 100.0% |
| MMT R Glut Med Change | 0 | 0 | 7 | 0.0% | 0.0% | 100.0% |
| MMT L Glut med Change | 0 | 3 | 4 | 0.0% | 42.9% | 57.1% |
| MMT R Hip Add Change | 1 | 1 | 5 | 14.3% | 14.3% | 71.4% |
| MMT L Hip Add Change | 0 | 2 | 5 | 0.0% | 28.6% | 71.4% |
| MMT R Fibularii Change | 3 | 2 | 2 | 42.9% | 28.6% | 28.6% |
| MMT L Fibularii Change | 2 | 3 | 2 | 28.6% | 42.9% | 28.6% |
| MMT R Tib anterior CHANGE | 0 | 2 | 5 | 0.0% | 28.6% | 71.4% |
| MMT L Tib anterior Change | 1 | 1 | 5 | 14.3% | 14.3% | 71.4% |
| MMT R Tib posterior Change | 3 | 2 | 2 | 42.9% | 28.6% | 28.6% |
| MMT L Tib posterior Change | 2 | 3 | 2 | 28.6% | 42.9% | 28.6% |
| MMT R toe Ext Change | 1 | 2 | 4 | 14.3% | 28.6% | 57.1% |
| MMT L toe Ext Change | 2 | 3 | 2 | 28.6% | 42.9% | 28.6% |
| MMT R toe flex Change | 2 | 2 | 3 | 28.6% | 28.6% | 42.9% |
| MMT L toe flex Change | 1 | 4 | 2 | 14.3% | 57.1% | 28.6% |
| MMT lumbar ext B | 1 | 0 | 4 | 20.0% | 0.0% | 80.0% |
| MMT R glut max Change | 0 | 3 | 4 | 0.0% | 42.9% | 57.1% |
| MMT L glut max Change | 2 | 2 | 3 | 28.6% | 28.6% | 42.9% |
| MMT R biceps Fem Change | 0 | 2 | 4 | 0.0% | 33.3% | 66.7% |
| MMT L biceps Fem Change | 0 | 1 | 5 | 0.0% | 16.7% | 83.3% |
| MMT R semitendinosis semimembranosis | 0 | 2 | 5 | 0.0% | 28.6% | 71.4% |
| MMT L semitendinosis semimembranosis | 1 | 4 | 2 | 14.3% | 57.1% | 28.6% |

