

Cindy Darius MS,RN; Kathryn Fitzgerald, ScD, Scott D. Newsome, DO; Moira Baynes, RN; Peter Calabresi, MD; Kathleen Zackowski, PhD, OTR
 Department of Neurology Johns Hopkins University School of Medicine & Kennedy Krieger Institute, Baltimore, MD, USA.

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Background

- Hand function is known to be impaired in individuals with multiple sclerosis (MS); however the extent of weakness in grip strength in MS remains unclear.
- Poor grip strength impacts quality of life.
- Grip strength decline over time may provide a means for tracking disease progression or intervention responsiveness.

Objective

- To assess whether longitudinally measured hand-grip strength declines in individuals with MS and to characterize whether this decline is faster among progressive patients.

Methods

- 55 individuals with MS, followed over five years.
- The data is an extension of a larger two-year study of grip strength.
- Bilateral hand grip strength was quantified using dynamometry (Jamar Hydraulic Hand Dynamometer; Lafayette, IN)
- Cross-sectional hand-grip strength was assessed in the MS group and with healthy controls (N=36).
- Longitudinal hand grip strength was assessed using mixed effects regression models with subject specific random intercepts. All models were adjusted for age, sex, disease subtype and symptom duration.
- We considered changes in the dominant hand-grip strength and changes in the weaker (the weakest hand regardless of hand-dominance) grip strength.

Figure 1. Dynamometer used in the current study



Results

Table 1. Demographics of Study Participants at Baseline

| Characteristics | MS Subtype | | Controls |
|------------------------------|-------------|---------------------|-------------|
| | Progressive | Relapsing-Remitting | |
| N, (%) | 20 (22) | 36 (38) | 34 (40) |
| Age, years (%) | 53.9 (8.2) | 39.6 (11.1) | 44.3 (10.8) |
| Female Sex, (%) | 13 (65) | 27 (79) | 21 (58) |
| Symptom duration, years (SD) | 25.0 (11.9) | 14.8 (6.3) | - |
| Follow-up time, years (SD) | 5.4 (1.1) | 6.5 (1.0) | - |
| Dynamometry Measures | | | |
| Weaker Hand*, lbs (SD) | 51.3 (26.3) | 69.5 (26.5) | 81.2 (26.3) |
| Dominant Hand, lbs (SD) | 63.4 (18.4) | 73.2 (26.6) | 88.5 (26.3) |

*Weaker hand denotes the weakest of the two hands, regardless of hand-dominance.

Figure 1. Descriptive Statistics of Baseline Grip Strength

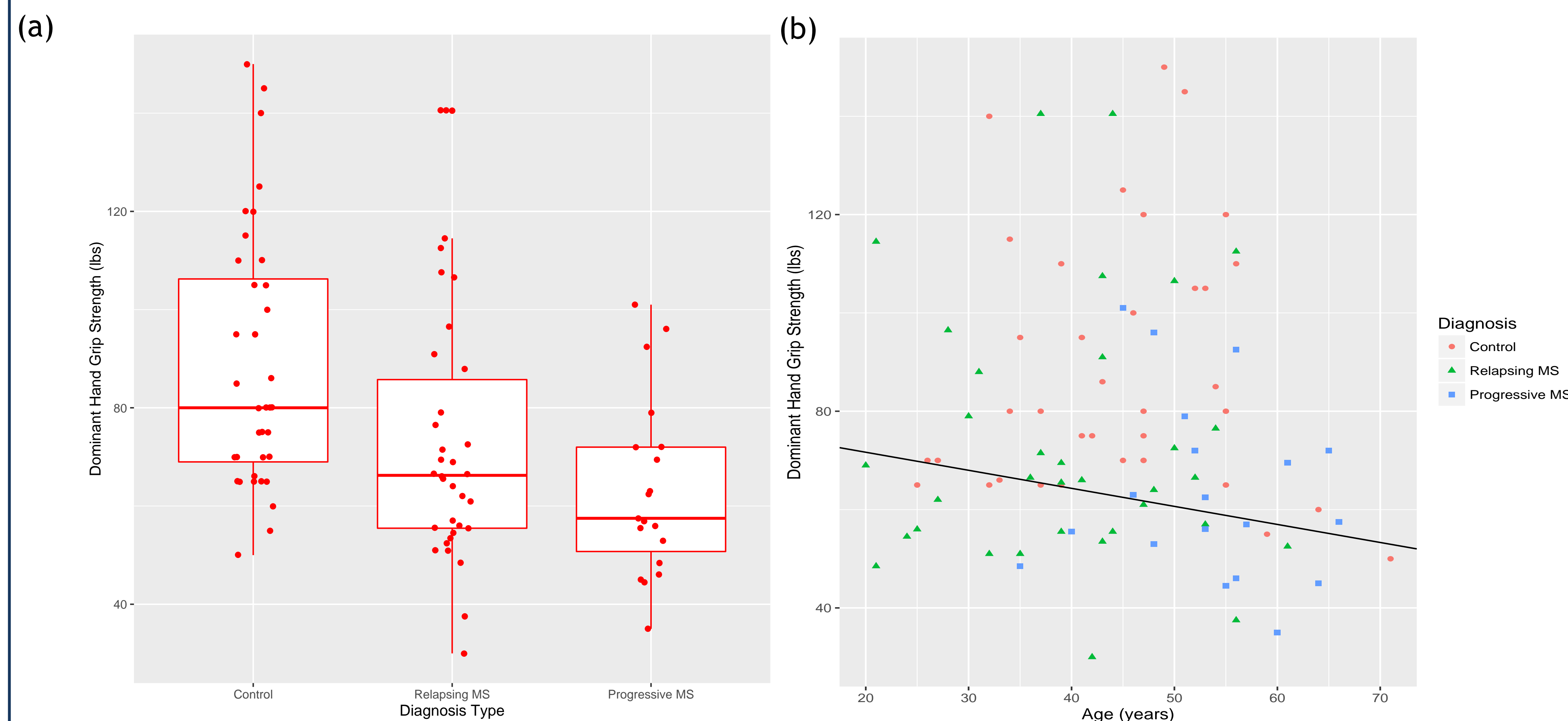


Figure 1: (a) Boxplot of mean and interquartile range of baseline dominant hand grip-strength by patient category (P for difference in means <0.001) (b) Scatterplot of dominant hand-grip strength vs. participant age at baseline. In cross-sectional analyses, older individuals have weaker grip-strength compared to younger participants ($P=0.01$).

Figure 2: Grip Strength Declines Over Time

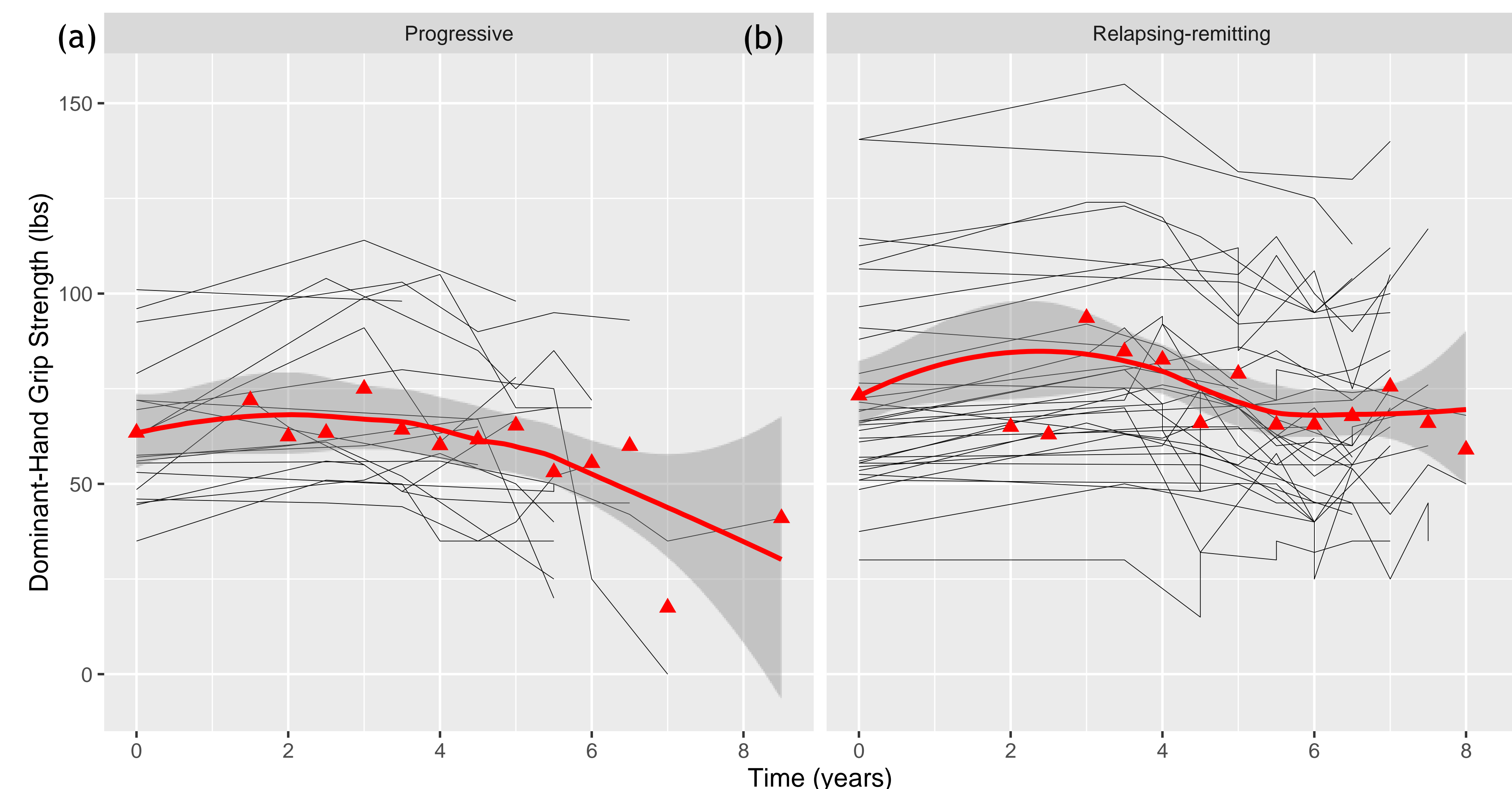


Figure 2: Spaghetti plots depicting change in dominant grip strength over time for individuals with progressive MS (a), and individuals with relapsing remitting MS (b). Plotted triangles represent group mean grip strength at each time point. Solid lines are individual participants, the shaded regions represent local regression curves and associated 95% CIs for changes occurring over follow-up. Results of formal statistical models are displayed in Table 2.

Table 2. Results of Mixed Effects Regression Models Assessing the Rate of Change in Grip Strength Among MS Patients

| Weaker* Hand | β (95% CI)** | P value |
|---------------------|------------------------|-----------|
| Overall | -0.75 (-1.31 to -0.18) | 0.009 |
| MS Subtype | | |
| Relapsing-remitting | -0.44 (-1.68 to 0.81) | 0.24 |
| Progressive | -1.53 (-2.59 to -0.47) | 0.005 |
| P for interaction | | 0.09 |
| Dominant Hand | β (95% CI)** | P value |
| Overall | -0.91 (-1.46 to -0.36) | 0.001 |
| MS Subtype | | |
| Relapsing-remitting | -0.68 (-0.57 to 1.92) | 0.14 |
| Progressive | -1.53 (-0.47 to 2.59) | 0.006 |
| P for interaction | | 0.19 |

*Weaker hand denotes the weakest of the two hands, regardless of hand-dominance. All models are adjusted for age, sex and symptom duration.

Conclusions

- Grip strength is significantly impaired in our MS cohort compared with healthy controls.
- We can quantitatively measure grip strength using a dynamometer and these measurements can detect changes over time.
- In our cohort, results suggest individuals with progressive MS may have a potentially faster rate of decline in grip strength compared to individuals with relapsing remitting MS.
- Grip strength has the potential to be used as a surrogate marker of MS disease progression.
- Grip strength may be useful as an outcome measure to assess effectiveness of disease-modifying treatments and rehabilitative therapies.

Grants

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