Effect of maximal strength training on gait and balance in persons with Multiple Sclerosis

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Introduction

- Persons with MS have impaired muscle strength and activation.(1-2)
- The decreased muscle activation indicates a CNS phenomenon
- These limitations result in impaired mobility.

Introduction

- Strength training has been used in MS to address mobility deficits
- Relatively low loads and intensities, presumably to limit fatigue
- Improvements seen generally attributed to improved force production
- Higher loads are thought to result in greater CNS activation
- Little research on hi intensity strength training in MS

Introduction

- Fimland (3) hypothesized that maximal strength training in persons with MS would not only improve strength but CNS activation and enhance "neural drive".
- Using EMG analysis found MST training augmenting the magnitude of efferent motor output of spinal motor neurons.
- No adverse events.
- 1RM improved; effects on mobility were not measured

Introduction

- Hill et al (4) found improved performance in chronic stroke patients after MST in 6MWT and TUG.
- No significant changes in walking economy, peak aerobic capacity, Four-Square Step Test.
- Strength improvements found in both the affected and unaffected leg.
- No adverse events

Purpose and hypothesis

- Effect of MST on mobility measures of gait and balance in pwMS has not been examined.
- The purpose of this pilot study was to examine the effects of MST in pwMS on measures of mobility
- Based on the results of the previous studies, we hypothesize that persons with MS who undergo MST training will experience improvement in mobility
- Secondary hypothesis- how well will the intervention be tolerated

METHODS

- A Pilot pretest posttest non randomized non controlled design was used
- Subjects were recruited from MS specialty practices in NYC
- Study approved by Hunter College IRB

Inclusion/exclusion criteria

- Ability to ambulate for 6min Independently with or without A the study
- Exacerbation or use of Methylprednisolone two weeks before or during the study
- No cognitive, orthopedic, or neurologic limitations

Pretest/postest measures: Objective

- Subject characteristics- Age, gender, EDSS, years since dx, medications
- Six minute walk test (6MWT)- total and minute by minute
- Berg Balance Scale
- Unilateral (L&R) leg press one-repetition maximum

Subjective measures

- Multiple Sclerosis Impact Scale-29 (MSIS-29)
- Fatigue Severity Scale (FSS)
- Visual Analog Fatigue scale (VAFS)- given before and after each training session

1RM protocol- based on guidelines

-Subjects started with very low weights on a standard leg press to get comfortable with performing the exercise.

-Load was increased to a level the patient felt was about 50-75% of their maximum to perform 2-3 reps

-Single repetitions were performed with increasing weight (2.5-5.0 lb/rep) until only one repetition could be completed.

-The greatest load with a single rep was determined as their 1RM

MST training protocol

- 15 min seated rest
- 5 min aerobic wrmp on recumbent bike
- Muscular Warm Up - 5 repetitions at 50% of 1 RM for initial leg
- 4 sets of 4 repetitions at 85-95% 1RM (VAFS measurements taken immediately before 1st set and after last
- Procedure repeated for opposite leg.

MST training protocol

- 2 MST sessions a week for 8 weeks
- Concentric and eccentric contractions performed in a 1:2 ratio
- The leg not being trained would be held off the leg press machines by examiner to minimize compensatory use
- Verbal exhortations were utilized to facilitate maximal effort

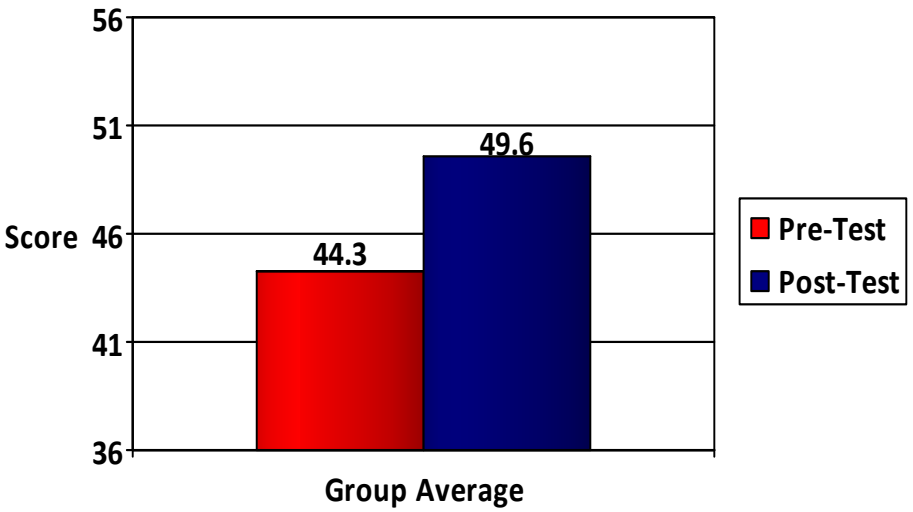
Results: Demographics/subject characteristics

- N=7
- 5 female, 2 male; Average age 52+/-13 years, Range (34-69)
- Average years since diagnosis: 14 years+/-12 years, Range (3-35)
- EDSS: Average of 3.5 +/-1.2, Range (2.5-4.5)
- MSIS-29: Average of 69.1 +/- 18.4, Range (43-81)

Results: BBS

- Pretest (*M* = 44.29, *SD* = 8.34)
- Posttest (*M* = 49.57, *SD* = 5.83)
- *p* = .008

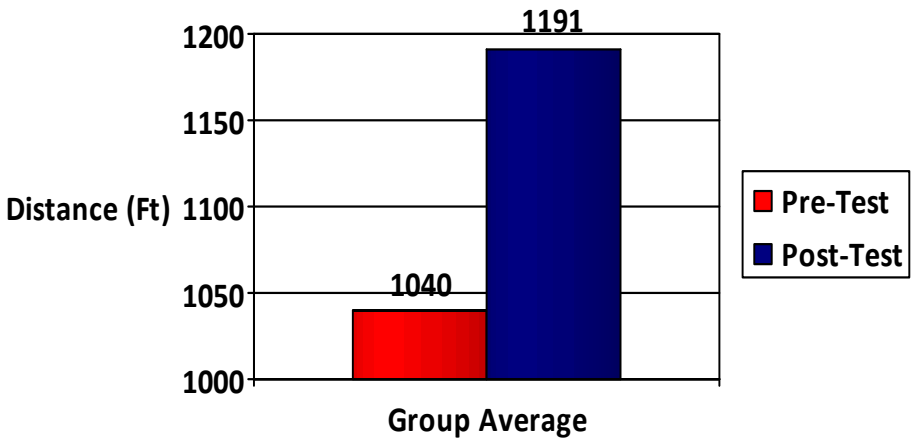
Berg Balance Scale



Results 6MWT

- Pretest (*M* = 1040.04, *SD* = 429.25)
- Posttest (*M* = 1190.73, *SD* = 579.95)
- *p* = .045

6 Minute walk test



Results - 1-Repetition Max

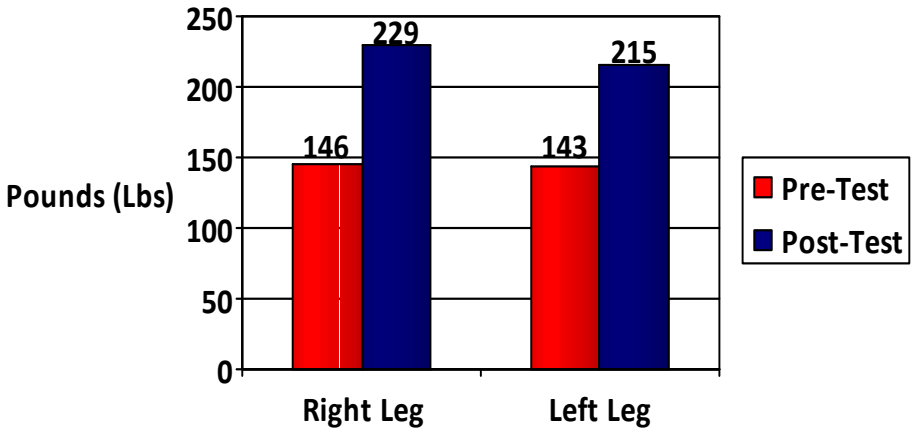
Maximal right sided leg press

- pretest (*M* = 146.07, *SD*=93.36)
- posttest (*M* = 228.93, *SD* = 95.98)
- *p* = .004

Maximal left sided leg press

- pretest (*M* = 142.86, *SD* = 100.87)
- posttest (*M* = 215.00, *SD* = 114.07)
- *p* < .001

1-repetition Max



Results

- No significant changes in VAFS, MSQOL, FSS
- No adverse events
- One subject dropped out due to an injury unrelated to the MST

Discussion

- Significant improvements in BBS, 6MWT, and (B) 1RM following 8 weeks of MST.
- No gait training or balance training during this period
- All of these patients had had strength training in the past but at much lower volume and intensity

Mechanism

- Neural drive?-the MST caused greater CNS activation
- Lower extremity strengthening?- MST was responsible for greater force production
- Confidence- most subjects were very surprised at how much they could lift

Limitations

- Study design- non- controlled, non randomized pretest post-test
- Sample size-7
- Ceiling effect of the BBS
- Selection bias

Future research

- Larger sample
- Control/comparison group
- Measures-MiniBesttest-

  -Spasticity measures

  -Functional tasks that require muscle strength (e.g. stairclimbing)
- Include other lifts-knee flexion, plantiflexion

Questions/Comments???

Thank You!!!