# Will Upper Extremity Performance Change Following Use of a Dynamic Orthosis Exercise Session in Individuals with Chronic Stroke?: A Pilot Study

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## Introduction

- Stroke affects over 700,000 people yearly as the primary cause of disability in the United States[1]
- Success has been shown with constraint-induced movement therapy (CIMT)[2], yet many do not qualify due to the strict inclusion criteria including full active wrist and finger extension
- This could cause discharge from therapy with residual motor deficits[3]
- Saebo Inc developed an orthosis, the SaeboFlex® which places the hand in an extended position, provides passive finger extension as well as spring loaded resistance to finger flexion as a strengthening exercise[4]

- Little research has been done on the SaeboFlex® and its effectiveness on improving function for individuals who do not qualify for CIMT
- **The purpose of this pilot study was to evaluate the short-term effectiveness of a 60 minute SaeboFlex® training protocol on functional grasp, passive range of motion (PROM) of wrist extension, tone of wrist flexors, and grip strength in individuals with chronic stroke**

## Methods

**Design:** Single group pretest-posttest (3 posttests)
**Participants:** 9 individuals; Ages 41-73 (mean 56.1, SD 11.7). Time since stroke 1-12 years (mean 3.8, SD 3.8). *Inclusion Criteria:* ≥ 18 years old, hemiparesis secondary to stroke occurring at least 6 months prior, owned a Saeboflex®, ability to follow multi-part instructions. *Exclusion Criteria:* flaccidity or joint contractures in affected limb
**Training:** Each participant completed a 60 minute exercise program focusing on grasp and release activities. The four, 15 minute stations were as follows: Crate right and left, Four tiered ball activity, Target and large ring station, Supination/pronation small ring station.

**Outcome Measures:** Taken before donning the orthosis (Pre), immediately following training (Post1), 30 minutes (Post2) and 60 minutes following training (Post3).

- Box and Block (B&B) for functional grasp – move blocks across partition in one minute
- Modified Tardieu Scale for wrist flexor tone – difference between PROM of wrist extension (R2V1) and the fast velocity angle of muscle catch (R1V3) equals the amount of spasticity
- Goniometry for PROM – wrist extension
- Muscle Catch Angle for wrist flexor tone – goniometric measurement of fast velocity muscle catch, average of three measures
- Handheld Dynamometry for grip strength – average of three measures

Testers were blinded to all previous measurements
**Data Analysis:** Nonparametric statistics were run for the B&B outcome, including a Friedman's analysis of variance (ANOVA) & Wilcoxin Signed Rank Test. Parametric statistics including a repeated measures ANOVA as well as a post-hoc were conducted for all remaining outcomes. Significance level set at p<.05. SPSS Version 16.0 was used.

## Results

Of the nine participants, one dropped out.
Data from 8 participants was analyzed.
The following results list Pre, Post1, Post2 & Post3 measures respectively.

- **B&B** – The medians were 0, 1.5, 1, and 0 blocks; Friedman's ANOVA (p=0.121); Wilcoxin Signed Rank between Pre and Post1 (p=0.042) *See Figure 1*
- **PROM** – The means were 48.1, 72.5, 66, and 63.9 degrees; ANOVA (F=12.085, p=0.010). Post-hoc between Pre and Post1 (p=0.05); A trend for improvement was found between Pre and Post3 (p=0.095); *See Figure 2*
- **Muscle Catch Angle** – The means were 16.2, 30.6, 42.2, and 44.4 degrees; ANOVA (F=15.994, p=0.005); Post-hoc between Pre and Post1 (p=0.014); between Pre and Post3 (p=0.002). *See Figure 3*
- **Modified Tardieu** – The means were 31.9, 41.9, 37.5, and 31.4 degrees; ANOVA (F=2.764, p=0.140).
- **Grip Strength** – The means were 10, 8.7, 10.4, and 7.7 lbs; ANOVA (F=1.020, p=0.346).

**Figure 1**

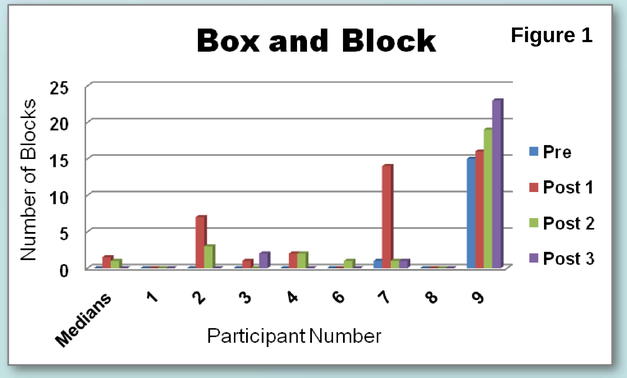



**Figure 2**

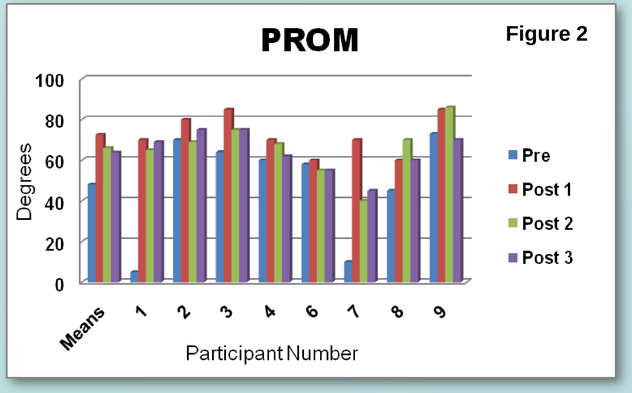
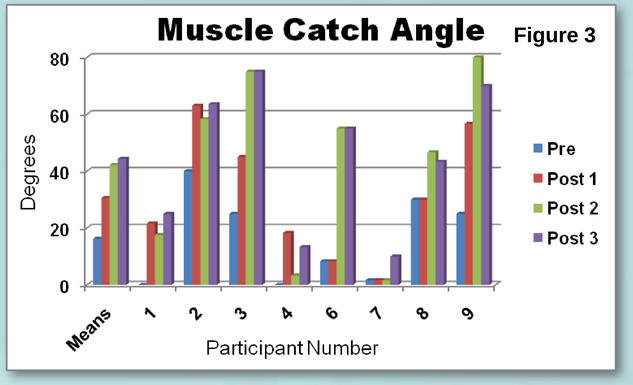



**Figure 3**




## Discussion

**Limitations:**

- Small number of participants
- No control group

**Discussion:**

The results of this study showed significant increases in functional grasp, PROM and muscle catch angle (from Pre to Post1). Current literature shows that prolonged muscle stretch (PMS) can improve PROM and spasticity in a neurological population.[5,6] We believe that the PMS provided by the SaeboFlex® caused the improvements in PROM and tone. The increases seen in functional grasp were likely attributable to the PMS, as well as practicing grasping activities with the orthosis. The SaeboFlex® offers the opportunity to grasp, which could cause an unmasking of potential that was hidden secondary to learned nonuse.

The increases noted with PROM remained into the Post3 measurement. Although only a trend was found, the results were clinically significant because the change was larger than the measurement error of goniometry.[7](>5˚)

While there was no statistical significance noted in the Modified Tardieu outcome, there were significant increases in PROM and muscle catch angle (R1V3). We believe that there was a decrease in spasticity but the results of the Modified Tardieu were overshadowed by the large increases in PROM.

**Suggestions for Future Research:**

- A larger randomized sample with a control group looking at the effects of the SaeboFlex® over time

**Conclusion:**

- This study showed that one hour of SaeboFlex® training yielded significant improvements in grasp, PROM and tone in individuals with chronic stroke
- We feel that the methods of this short-term study could be useful in determining individuals who would benefit from SaeboFlex® use

## Acknowledgements

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**References available upon request.**