

INTRODUCTION

Rationale:

- 6.8 million people have suffered a stroke [1].
- Stroke survivors have reduced hand function due to sensory deficit in the hand.
- Vibrotactile noise may enhance hand grip function in stroke survivors via sensory enhancement in the hand [2].

Objective:

- To evaluate the effectiveness of remote vibrotactile noise in increasing stroke survivors' hand grip function.

METHODS

- 10 chronic stroke survivors performed four hand function tasks

Box and Block Test (BBT): Scored the number of blocks moved in 1 minute

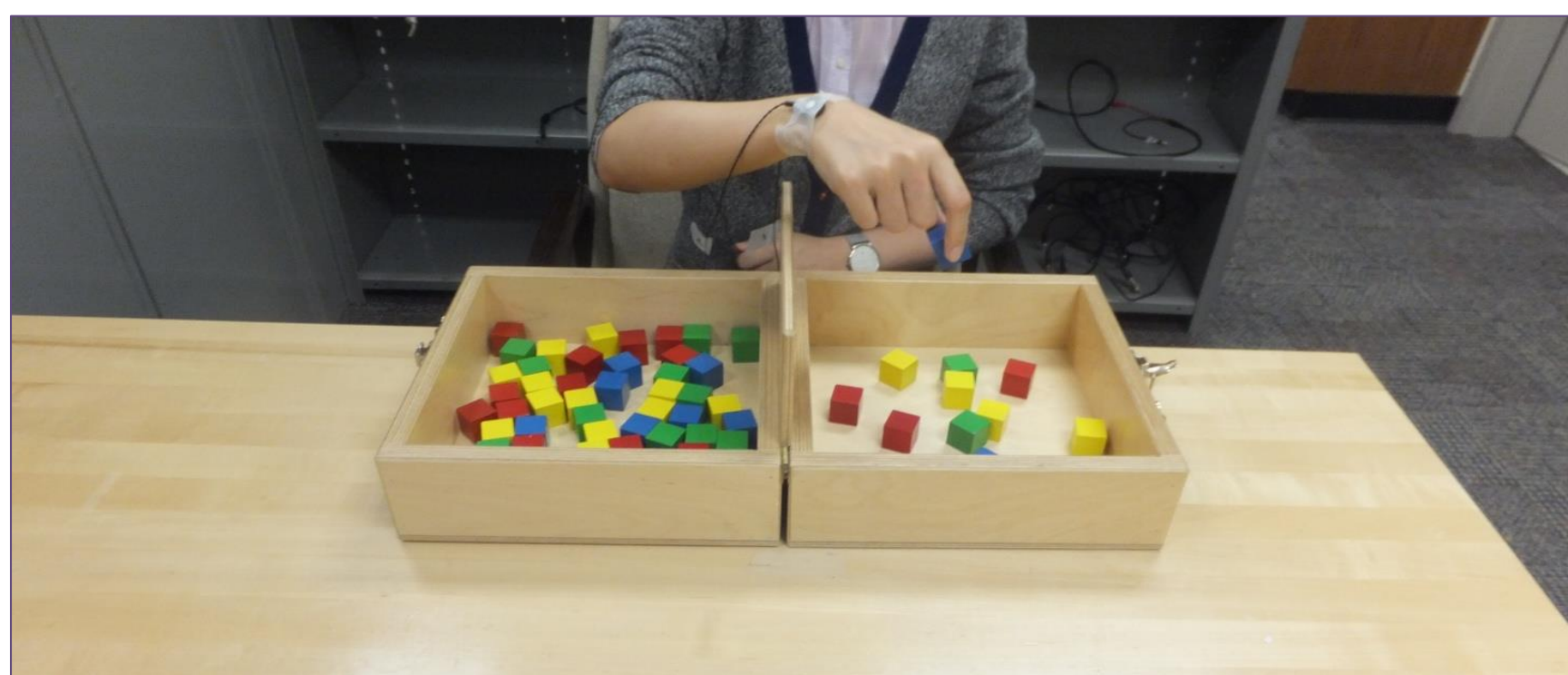


Figure 1: Box and Block Test

Nine Hole Peg Test (NHPT): Timed how many seconds to place nine pegs into holes and move them back to starting position

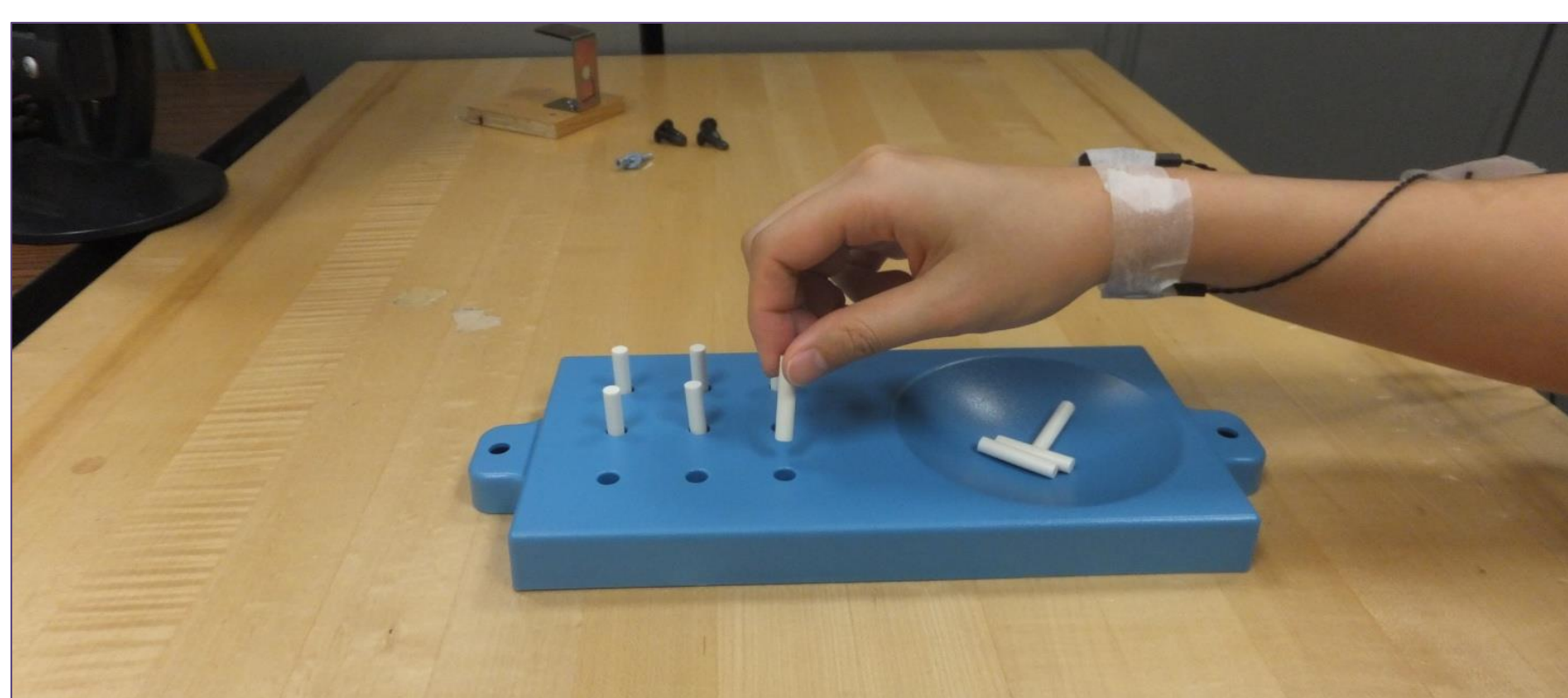


Figure 2: Nine Hole Peg Test

Range of Motion (ROM): Active ROM measured, at the wrist, using a goniometer

Maximum Pinch Grip: Measured maximum force of pinch and control

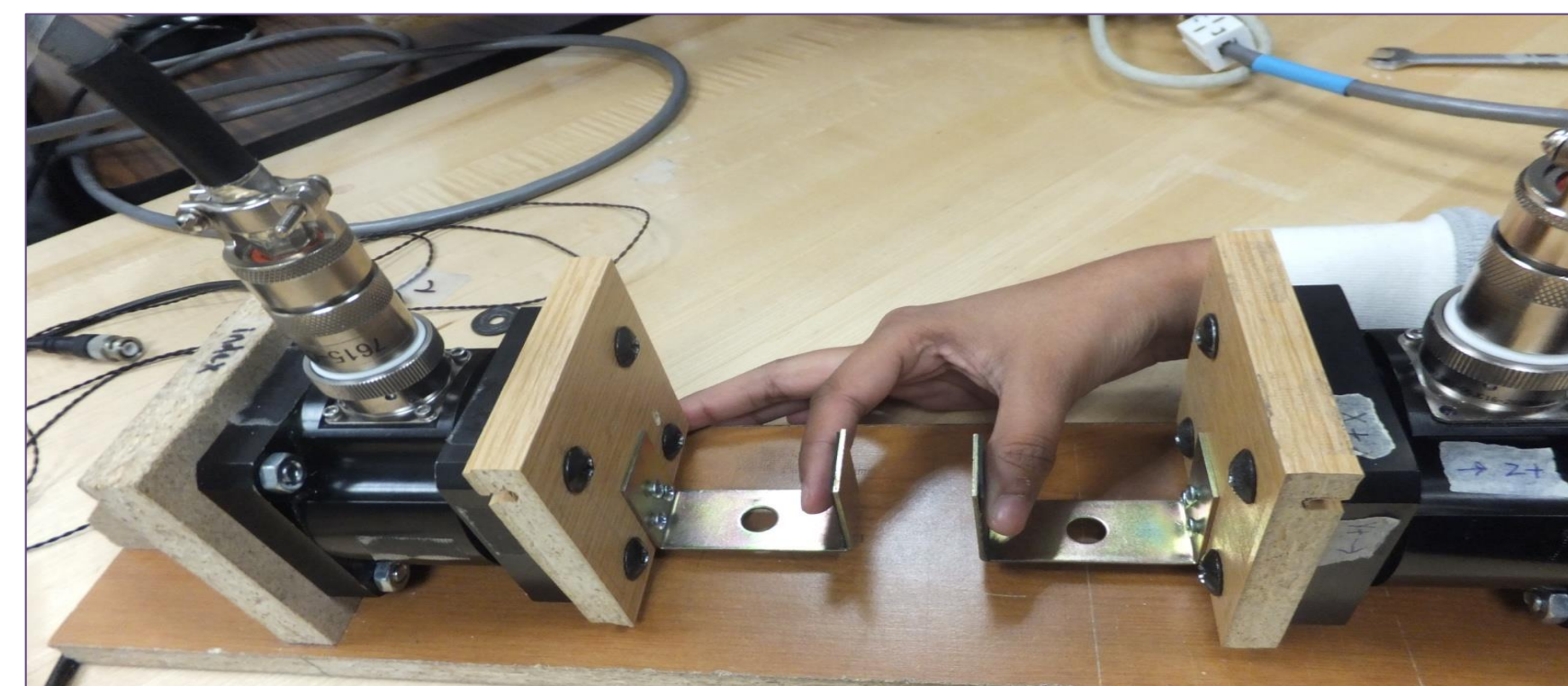


Figure 3: Pinch Grip Device

- Two vibrotactile devices were attached, one to the volar wrist and one to the dorsal wrist



Figures 4 and 5: Vibrotactile Stimulators



- The noise was set at 60% of the subject's sensory threshold found at the beginning of testing.
- Each task was performed five times, once for practice to reduce the learning curve and then four times in four blocks of testing.
 - Blocks one and four had no vibrotactile stimulation
 - Blocks two and three had the subjects perform the hand function tests with vibrotactile stimulation.
- In addition to the four hand function tests, two tactile sensory tests were performed after each block of hand function tasks:
 - The Monofilament Test
 - Sensory threshold
- Separate repeated measure ANOVAs were used to detect the effect of stimulation on BBT Score, NHPT Time, ROM, and Maximum Force of Pinch and Control.

RESULTS

- The subthreshold noise significantly enhanced three of the hand function tasks
 - BBT Score
 - NHPT Time
 - Maximum Pinch Force

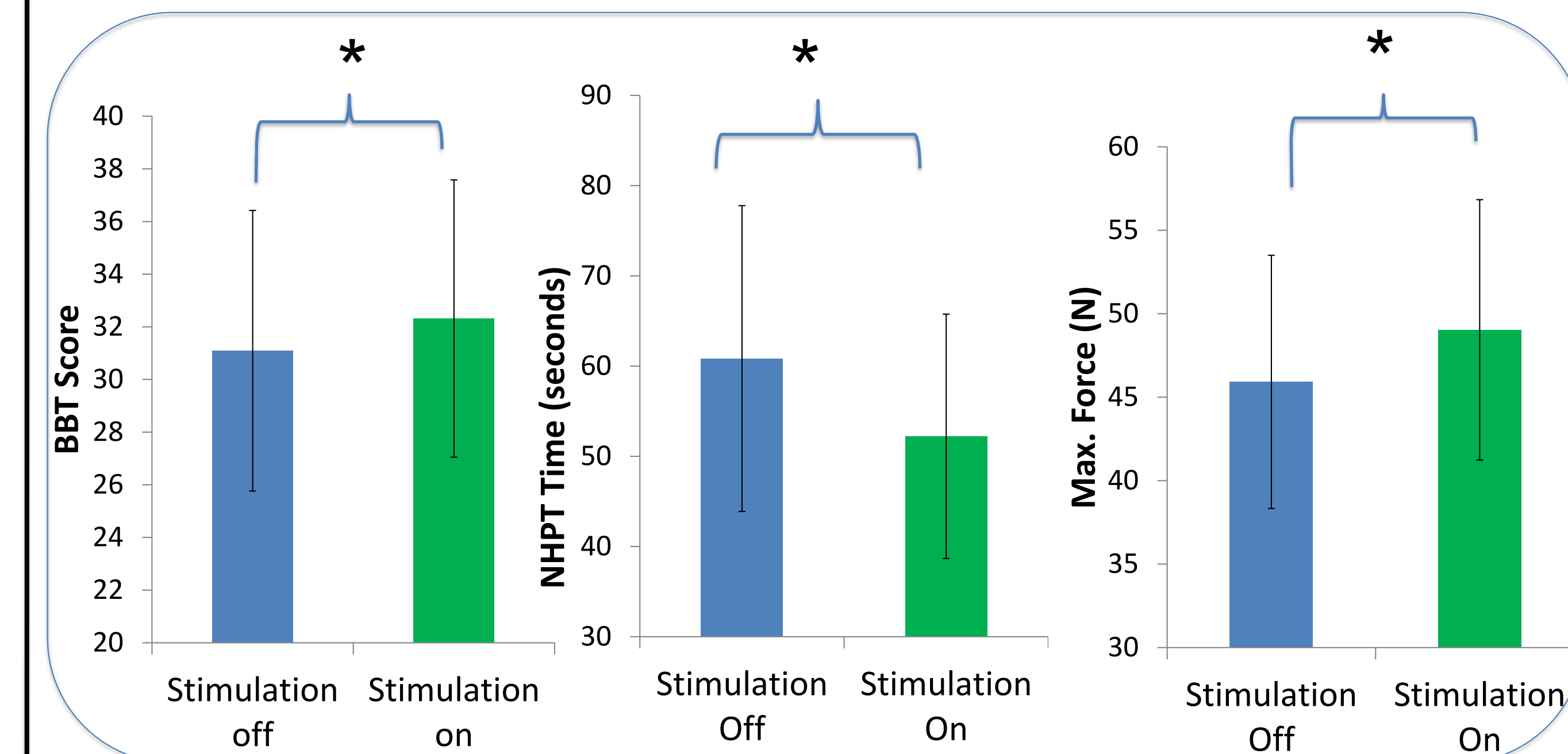


Figure 6: Average BBT Score without noise (mean ± SE) 31 ± 5 With noise (mean ± SE) 32 ± 5

Figure 7: Average NHPT Time without noise 60 ± 17 With noise 52 ± 14

Figure 8: Average Maximum force without noise 46 ± 8 With noise 49 ± 8

- The two sensory measurements, the monofilament test and sensory threshold, showed no enhancement with noise

CONCLUSION

- The main finding of this study is that the three of the hand functions improved with remote sub threshold noise applied to the wrist.
- The remote effect prevents the assistive device from interfering with object manipulation hand function.
- This study holds potential for a sensory prosthesis to complement rehabilitation therapies and improve functional outcomes and quality of life for stroke survivors

REFERENCES

1. Go et al., *Circulation*, 2014, 128:155-163
2. Enders et al., *Journal NeuroEng Rehab*, 10:105, 2013

ACKNOWLEDGEMENTS

The authors would like to thank the American Heart Association Postdoctoral Fellowship 12POST12090039 and UWM SURF