

# ACADEMY OF SPINAL CORD INJURY PROFESSIONALS



## An Efficacy Study of a Robotic Hand Device for People with Cervical Spinal Cord Injury

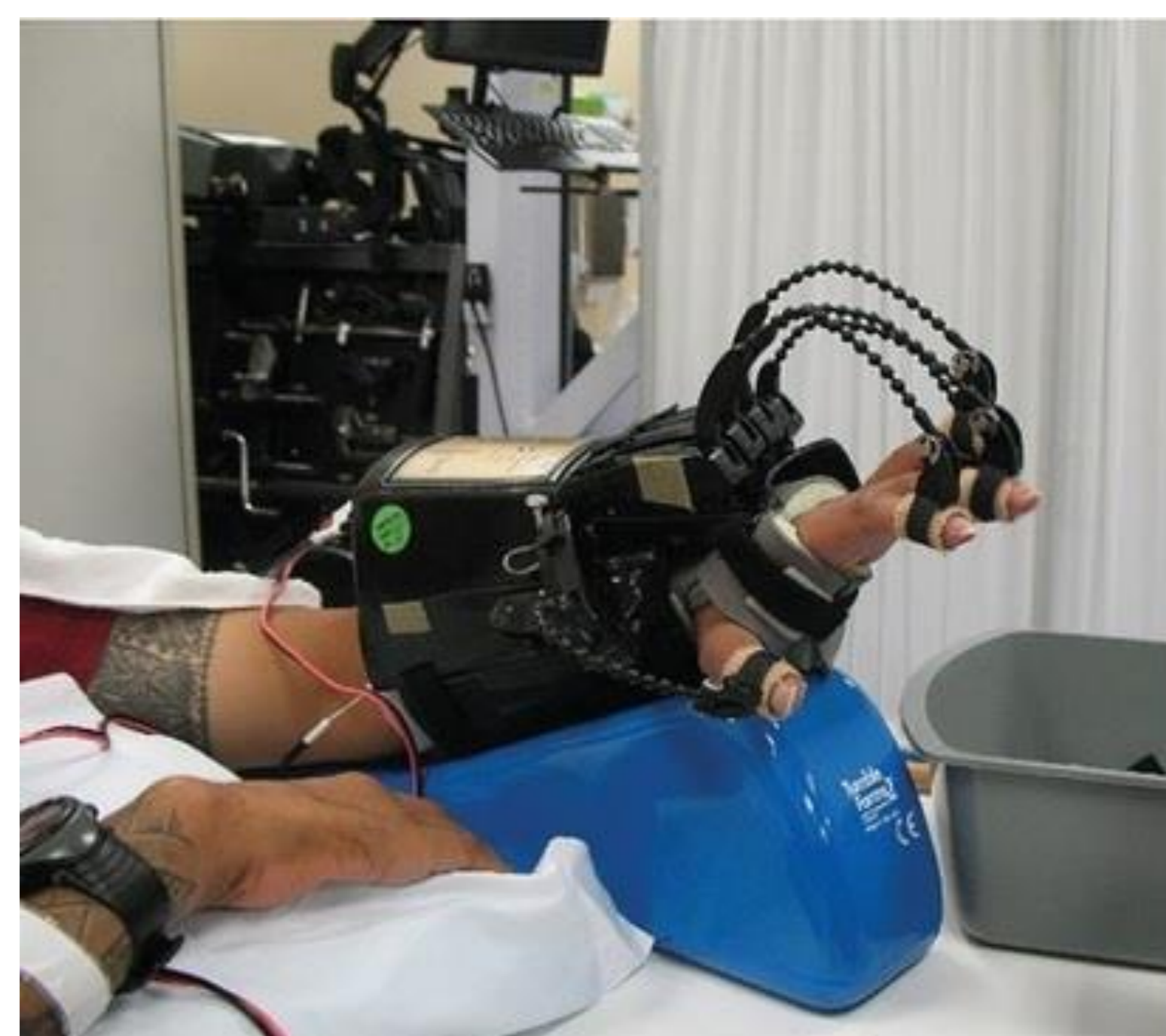
Tommy Yu, M.D.<sup>1,2</sup>, Steven Scott, M.D.<sup>1,2</sup>, Kevin White, M.D.<sup>1,2</sup>, Wanda Van Harlinger, OTR/L<sup>1</sup>, Yasmin Gonzalez, OTR/L<sup>1</sup>, Imelda Llanos, MS, OTR/L<sup>1</sup>

<sup>1</sup>James A. Haley Veterans' Hospital, Tampa, Florida, <sup>2</sup>University of South Florida Morsani College of Medicine, Tampa, Florida



### Background

- About 50% of people with tetraplegia view hand/arm functions as the most important factor in their quality of life.
- FES Hand Glove 200 (Robotix Hand Therapy Inc. Colorado Springs, CO) was developed and previously proven safe to use among SCI population.



### Methods

- This single-arm, prospective efficacy study
- Subjects with traumatic spinal cord injury (SCI) at levels C2-8 and AIS A, B, C and D,  $\geq 1$  month post-SCI, medically stable.
- Intervention – total of 60 minute of passive range of motion (PROM) on the FES Hand Glove 200 4 times per week for 6 weeks.

### Results

Table 1. Characteristics of subjects

Levels of neurological injury (N = 13)					
Levels	C2-4	C5	C6	C7	Unknown
Frequency	3	2	3	2	2
AIS Class					
AIS	A	B	C	D	Unknown
Frequency	6	4	2	1	0

Table 2. Change in ROM

Joints	Change in AROM - Flexion			Change in AROM - Extension		
	Mean (SD)	Median-IQR	P value	Mean-SD	Median-IQR	P value
DIP 2 <sup>nd</sup>	7.3 (11.6)	1.0 (0-14)	0.002	4.3 (8.5)	0 (0-4.3)	0.031
DIP 3 <sup>rd</sup>	9.3 (16.6)	1.0 (0-16.3)	<0.001	0.5 (1.5)	0 (0-0)	0.500
DIP 4 <sup>th</sup>	11.4 (19.8)	2.5 (0-14)	0.004	2.5 (5.6)	0 (0-4.3)	0.031
DIP 5 <sup>th</sup>	8.6 (16.1)	0 (0-10)	0.008	0.9 (3.2)	0 (0-0)	0.500
PIP 1 <sup>st</sup>	8.6 (16.1)	0 (0-10)	0.008	0.9 (3.2)	0 (0-0)	0.500
PIP 2 <sup>nd</sup>	8.0 (8.5)	5.5 (0-16)	<0.001	3.0 (6.4)	0 (0-5.0)	0.031
PIP 3 <sup>rd</sup>	11.2 (17.3)	6.0 (0-13.8)	<0.001	5.3 (10.5)	0 (0-7.3)	0.016
PIP 4 <sup>th</sup>	7.4 (10.4)	4.5 (0-10)	0.002	5.2 (13.8)	0 (0-6.0)	0.016
PIP 5 <sup>th</sup>	11.2 (18.2)	2.5 *(0-20.3)	0.002	2.7 (4.5)	0 (0-5.5)	0.031
MCP1 1 <sup>st</sup>	6.1 (7.6)	4.5 (0-12.0)	0.004	1.5 (3.6)	0 (0-0)	0.025
MCP 2 <sup>nd</sup>	10.4 (11.9)	5.0 (0-15.6)	<0.001	4.4 (9.1)	0 (0-5.0)	0.031
MCP 3 <sup>rd</sup>	6.9 (8.3)	4.0 (0-13.8)	<0.001	9.1 (15.2)	0 (0-21.8)	0.016
MCP 4 <sup>th</sup>	7.9 (10.6)	2.5 (0-15.0)	0.002	5.6 (9.3)	0 (0-16.8)	0.031
MCP 5 <sup>th</sup>	8.4 (13.0)	0.5 (0-20.0)	0.004	4.1 (8.9)	0 (0-1.75)	0.125
Wrist	8.9 (16.5)	1.5 (0-12.3)	0.004	8.4 (11.5)	0.5 (0-17.5)	0.004

Table 3. FIM Outcomes

ADL Task	Percentage of subject with improvement $\geq 1$ (%)
Eating	33
Grooming	33
Upper Body Dressing	50
Lower Body Dressing	42
Toileting	25
Bladder Management	17
Bowel Management	8
Transfers: Bed, Chair, Wheelchair	27
Transfers: Toilet	33
Transfers: Toilet	17
Transfers: Tub, Shower	17
Walk/Wheelchair	8
Stairs	0

### Keys:

<sup>1</sup>DIP: distal interphalangeal joint  
<sup>2</sup>PIP: proximal interphalangeal joint  
<sup>3</sup>MCP: metacarpophalangeal joint  
<sup>4</sup>Statistically significant Adjusting for False Discovery Rate (FDR) with 30 Wilcoxon T Tests

\*Functional Independence Measure (FIM) score provides a measurement of disability and level of assistance required. An increase in the FIM score indicates improvement in function

### Discussion

- The results demonstrated that FES Hand Glove 200 can improve ROM in upper extremities of selected SCI population.
- The FES Hand Glove 200 can further improve functional gains in chronic SCI population.
- Limitation of the study includes uncertainty of the optimal frequency and intensity of the intervention, the study being a single-arm study, differentiating improvement from the device versus purely from participation in upper extremity exercise program.

### Conclusion

- This study supports the efficacy of a 6-week course using FES Hand Glove 200 in traumatic SCI tetraplegic subjects based on the improvement in ROM, strengths, and FIM.

#### Disclaimer:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. There are no conflicts of interest for the authors. His material is the result of work supported with resources and the use of facilities at the James A. Haley Veterans' Hospital. The contents do not represent the views of the Department of Veterans Affairs or the United States Government.