

# PILOT STUDY OF GAIT SYMMETRY EFFECTS FOLLOWING HIP FRACTURE REHABILITATION

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## INTRODUCTION

The impact of hip fracture in our country is substantial, with more than 350,000 persons over age 65 predicted to fracture a hip in the United States during the coming year [1]. Early rehabilitation has been shown to reduce hospital length of stay, however, these patients have significant muscular atrophy and weakness on the side of fracture that can persist for months after fracture with mobility deficits remaining for a number of years [2]. While exercise programs have been shown to improve physical function in patients with total hip replacement surgery, these programs require patients to travel to centers for participation since direct supervision is needed [3]. Studies of home-based exercise programs post hip replacement surgery have reported increases in walking speed, however, none have included more detailed information about gait parameters and symmetry.

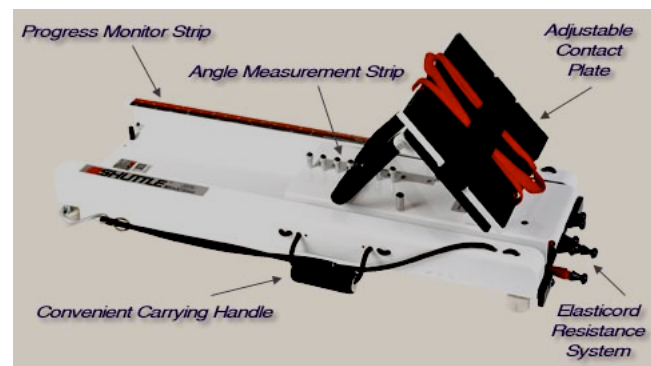
The purpose of this pilot study was to investigate the effects of a 16-week home-based exercise program, beginning 2 months post hip fracture on lower extremity function as shown in the 6-minute walk and gait parameters. The hypothesis was that this moderate intensity home exercise intervention would improve gait function in older adults post hip fracture.

## METHODS

Four participants met the following inclusion criteria for this pilot study: 1) diagnosis of hip fracture (ICD-0 codes 820.0 to 820.9); 2) age 65 or older; 3) living in the community at time of fracture; 4) hospitalization within 4 days of the fracture; 5) successful fixation (partial or total hip replacement or open reduction internal fixation) of a hip fracture; 6) non-pathological fracture; 7)

minimal trauma fracture; and 8) ambulating without human assistance pre-fracture.

After informed consent, the four participants were tested before and after a 16-week home-based physical therapy program beginning two months post hip fracture (after traditional rehabilitation had ended). The exercise training program included lower extremity strengthening with a mini shuttle (see figure) and cardiovascular conditioning. For the aerobic component, the goal intensity of the training was 65% to 75% of age-predicted maximal heart rate. The resistive component targeted strengthening for the bilateral hip extensors hip abductor, knee extensor, and plantar flexor muscle groups.



**Figure 1.** Resistance Training Device (Shuttle Systems, Glacier WA)

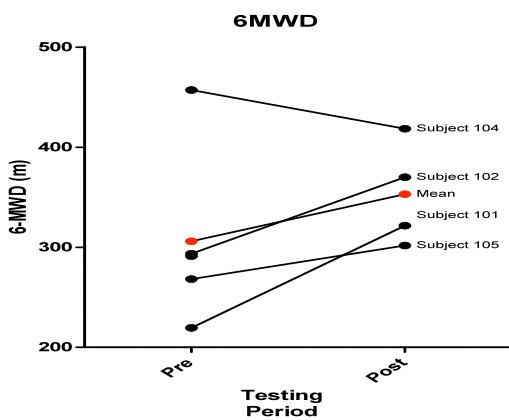
Before and after the 16-week exercise program, data were collected for the 6-minute walk distance. Gait parameters were also collected for three trials at walking preferred speed using a GaitRite® gait mat (CIR Systems, Havertown, PA) to measure selected spatio-temporal parameters. A symmetry index (SI) was used to quantify fracture and nonfracture percent stance symmetry in gait [4]:

$$SI = \frac{V_{fracture} - V_{nonfracture}}{\frac{1}{2}(V_{fracture} + V_{nonfracture})} \times 100$$

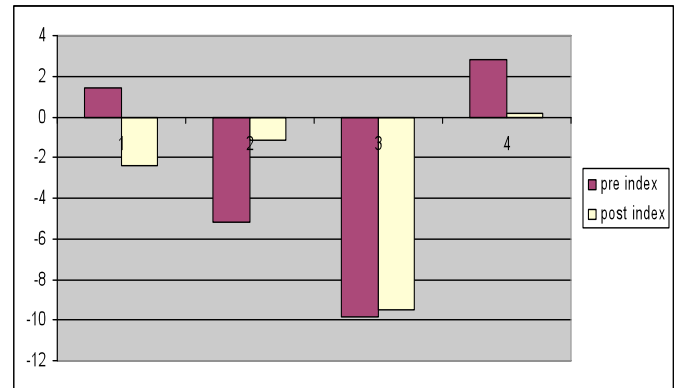
Where  $V_f$  is fracture side percent stance and  $V_n$  is nonfracture side percent stance. A symmetry index equaling zero corresponds to perfect symmetry.

## RESULTS AND DISCUSSION

The 6 minute walk distance increased in three of the four subjects following training as shown in Figure 2. Gait parameters results for each subject are shown in Table 1. Velocity and cadence increased for three of the four subjects. Symmetry was improved in three of the four subjects following training (Figure 3).



**Figure 2.** Six minute walk distances for each subject before and after the 16 week training intervention.



**Figure 3.** Symmetry index for each subject where zero represents perfect symmetry.

## CONCLUSIONS

This pilot study demonstrated that a moderate intensity home exercise intervention improved gait function as shown in three of the four older adults post hip fracture tested. This pilot data provides a basis for future investigation into effective intervention for individuals post hip fracture.

## REFERENCES

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Subject	Velocity (cm/s)		Cadence (steps/m)		Double Support (%)		Stride Length (cm)		Symmetry Index	
	pre	post	pre	post	Pre	Post	pre	post	pre	post
101	60.9	88.7	95.7	113.5	37.5	30.9	76.0	94.0	1.5	-2.4
102	90.4	110.2	123.0	124.5	37.5	27.7	88.5	106.0	-5.2	-1.2
104	112.5	111.8	111.0	110.0	31	31.5	123.3	122.3	-9.8	-9.5
105	79.0	91.7	97.0	102.0	33.8	30.1	98.0	108.0	2.8	0.2

**Table 1:** Gait parameters for each subject during preferred speed walking trials (mean of three trials).