

Introduction

- **Frailty and gait impairment** in older adults are associated with increased morbidity and reduced independence.
- Exoskeleton-assisted gait training has shown safety and functional benefits in clinical studies.
- Conventional exoskeleton devices are limited by weight, bulkiness, and cost.
- A lightweight (<1 kg) soft-frame elastic exo-suit was developed to overcome these limitations.

A practical solution for real-world mobility support

■ This study aim to

- evaluate the effects of a lightweight exo-suit on physical function and mobility in older adults.

Methods

■ Study Design & Participants

- Prospective pre–post study
- Community-dwelling older adults (n=20)
 - Healthy individuals (n=12)
 - Gait impairment (n=8/ TKRA, THRA, Hip fracture, ...)

■ Outcome Measures

- **Strength**
 - 30-second chair stand test (30CST)
- **Gait**
 - 10-meter walk test (10mWT)
 - Timed Up and Go test (TUGT)
- **Cardiopulmonary Endurance**
 - 6-minute walk test (6MWT)
- **Functional tasks**
 - Lifting low, Short carry, Stair climbing



Fig 1. Functional assessments with exo-suit: (A) 30-second chair stand test, (B) Timed up and go test, (C) 6-minute walk test, (D) Stair climbing task, (E) Short carry task, (F) Lifting low task.

Results

■ Comparison of physical function before and after wearing an Exo-suit (All participants)

- 30CST ↑ 14.5 → 20.3 counts (p<0.001)
- TUGT ↓ 10.0 → 9.0 sec (p<0.01)
- 6MWT ↑ 393 → 429 meters (p<0.01)
- Lifting ↓ 17.8 → 13.7 sec (p<0.001)
- Carry ↓ 27.0 → 21.2 sec (p<0.001)
- Stair climbing ↓ 19.7 → 16.2 sec (p<0.05)

Table 1. Comparison of physical function before and after wearing an Exo-suit in all participants

Variables	Baseline	After wearing Exo-suit	p-value
30-sec CST (times)	14.5±5.4	20.3±4.7	< 0.001
10mWT (sec)	10.6±5.2	9.1±3.1	< 0.01
TUGT (sec)	10.0±4.1	9.0±3.3	< 0.01
Overall stability index	0.87±0.59	0.67±0.26	0.15
Lifting low (sec)	17.8±5.3	13.7±2.4	< 0.001
Short carry (sec)	27.0±7.6	21.2±4.8	< 0.001
Stair climbing (sec)			
Ascending	9.2±5.9	8.0±4.5	< 0.05
Descending	10.5±8.5	8.1±4.2	< 0.05
Total	19.7±14.2	16.2±8.6	< 0.05
6mWT (m)	393.0±113.7	429.0±102.7	< 0.01

CST, chair stand test; 10mWT, 10-meter walking test; TUGT, timed up and go test; 6mWT, 6-minute walk test.

■ Gait impairment group (subgroup analysis)

- 30CST ↑ 11.5 → 18.3 counts (p<0.05)
- TUGT ↓ 12.7 → 10.7 sec (p<0.05)
- 6MWT ↑ 314 → 375 m (p<0.05)
- Stair climbing ↓ 30.7 → 19.9 sec (p<0.05)

Table 2. Comparison of physical function before and after wearing an Exo-suit in participant with gait impairment

Variables	Baseline	After wearing Exo-suit	p-value
30-sec CST (times)	11.5±6.4	18.3±3.1	< 0.05
10mWT (sec)	13.7±8.8	10.4±4.9	< 0.05
TUGT (sec)	12.7±6.7	10.7±5.5	< 0.05
Overall stability index	0.95±0.87	0.57±0.28	0.46
Lifting low (sec)	22.0±6.8	14.3±1.3	< 0.05
Short carry (sec)	32.2±10.4	23.4±4.5	< 0.05
Stair climbing (sec)			
Ascending	14.0±8.8	10.2±5.7	< 0.05
Descending	16.8±13.0	9.7±5.8	< 0.05
Total	30.7±21.7	19.9±11.4	< 0.05
6mWT (m)	314.3±136.0	375.5±126.5	< 0.05

CST, chair stand test; 10mWT, 10-meter walking test; TUGT, timed up and go test; 6mWT, 6-minute walk test.

➔ Improves strength, mobility, and real-world functional performance !

Conclusion

- **The exo-suit** improved physical function, gait performance, and functional task ability in older adults.
- Greater benefits were observed in individuals with gait impairment.
- This device may serve as a practical assistive solution for enhancing mobility in real-world settings.

Key Message

This device may serve as a practical assistive solution for real-world mobility support