

Reference

Daisuke Imoto^a, Satoshi Hirano^b, Yushi Ozawa^a, Motonari Ohashi^c, Akihito Uno^c, Takashi Yamamoto^b, Yohei Otakag^b.

Rehabilitation program using a computer-controlled knee-ankle-foot orthosis for a patient with incomplete spinal cord injury: A case report

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Products

C-Brace

Major Findings

With a bilateral C-Brace fitting and a structured rehabilitation program:

- **Independent walking capability with C-Brace was achieved.**
- Structured rehab program led to improved balance, walking ability, stair negotiation and reduced fear of falling:
 - Berg Balance Scale (BBS) improved by **54.2%** (+13 points)
 - Comfortable walking speed increased by **59.6%** (+0.34 m/s)
 - Maximum walking speed increased by **15.8%** (+0.15 m/s)
 - Six-minute walking distance increased by **15.5%** (+39 m)
 - Stair Assessment Index (SAI) increased by **200%** (+8 points)
 - Falls Efficacy Scale-International (FES-I) improved by **23.2%** (-13 points)

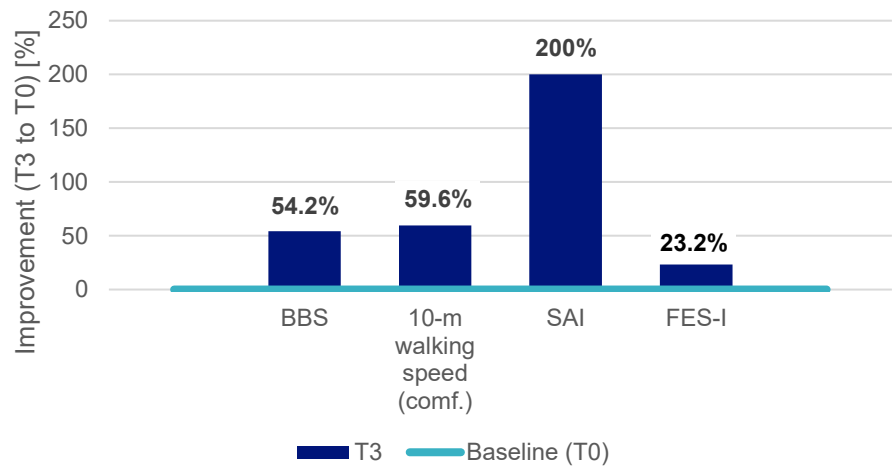


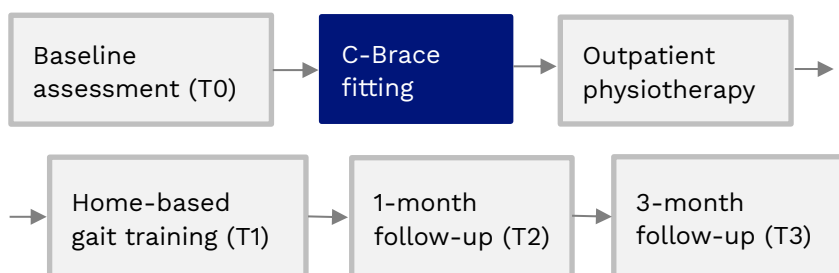
Figure 1. Percentage improvements are shown relative to baseline for the outcomes of Ber Balance Scale (BBS), 10-m walking speed (comf. = comfortable), Stair Assessment Index (SAI), Falls Efficacy Scale International (FES-I).

- **The structured rehabilitation program, progressive gait training, and appropriate orthotic alignment supported successful bilateral C-Brace use.**
- 3-month period, 11 outpatient physiotherapy sessions (545 min total), including swing-phase training (150 min), outdoor gait training (125 min), stepper training (60 min), ramp training (60 min), stair training (45 min), orthotic adjustments (35 min), straight overground gait training (30 min), overground gait training except straight (20 min), stance phase training (10 min), others (10 min) resulting in independent ambulation with bilateral C-Braces.

Population	Subjects:	1 adult male (53 years old)
	Previous Orthosis:	Bilateral ankle-foot orthoses (AFOs)
	Previous Additional Walking Aids:	Bilateral Lofstrand crutches for ambulation, Wheelchair for longer distances
	Diagnosis:	Chronic traumatic incomplete spinal cord injury (iSCI), AIS Grade C, Neurological level: L1 at initial rehabilitation, T12 at discharge
	Injury Cause:	Workplace accident resulting in burst fractures of T12 and L1, Open fracture of the right tibia and fibula
	Time since injury:	Approximately 3 years

Study Design

Case report:



Outpatient rehabilitation program including customized bilateral C-Brace fitting.

Outpatient physiotherapy was provided for 40–60 minutes per session, 11 sessions were applied.

Independent ambulation with the C-Brace was achieved.

Results

Functions and Activities						Participation	Environment
Biomechanics – Static Measurement	Biomechanics – Gait analysis	X-Rays	EMG	Functional tests	Clinical effects	Satisfaction	Health Economics

Category	Outcomes	Results for C-Brace at T3 vs. T0
Functional tests	Berg Balance Scale (BBS)	Improved by 54.2% (+13 points), from 24 to 37 points. Improved postural stability and balance.
	10-m Walking Speed (comfortable)	Improved by 59.6% (+0.34 m/s), from 0.57 to 0.91 m/s.
	10-m Walking Speed (maximum)	Improved by 15.8% (+0.15 m/s), from 0.95 to 1.10 m/s.
	6-Minute Walking Distance (6MWD)	Improved by 15.5% (+39 m), from 252 m to 291 m.
	Hill Assessment Index (HAI)	No change (7 points throughout the study period).
	Stair Assessment Index (SAI)	Improved from 4 to 12 points (+8 points).
Clinical effects	Falls Efficacy Scale-International (FES-I)	Improved by 23.2% (–13 points), from 56 to 43 points, indicating reduced fear of falling.

Author's Conclusion

“The benefits of the C-Brace may not be immediate, requiring a certain amount of training. Clinicians need to set up the brace and provide thorough explanations to patients about the functional properties of the brace to maximize its benefits.” (Imoto et al., 2026)

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