

Reference

Hobusch, G. M., Hasenöhr, K., Pieber, K., Schmalz, T., Dana, S., Ambrozy, C., Pohlig, K., Dietl, H., Crevenna, R., von Skrbensky, G., Hofer, C., Auberger, R., Windhager, R.

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A novel mechanotronic orthosis enables symmetrical gait kinematics in a patient with femoral nerve palsy – a case study

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Products

C-Brace

Major Claims

With C-Brace compared to no orthosis:

→ More symmetrical gait pattern

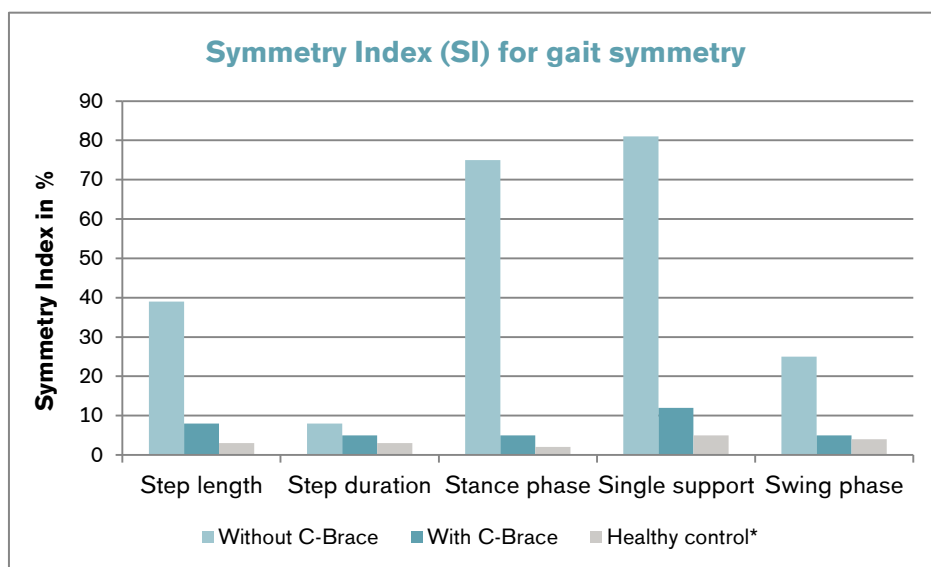
Step length: the difference between the affected and healthy leg changed from 39% without C-Brace to 8% with C-Brace.

Single support: the difference between the affected and healthy leg changed from 81% without C-Brace to 12% with C-Brace.

Opposite foot off: occurred earlier in gait cycle (GC) and changed for the affected leg from 23% GC without C-Brace to 14% GC with C-Brace.

→ Safer gait

The gait pattern changed from an unstable, asymmetrical gait with crutches to a stable and more symmetrical gait without crutches

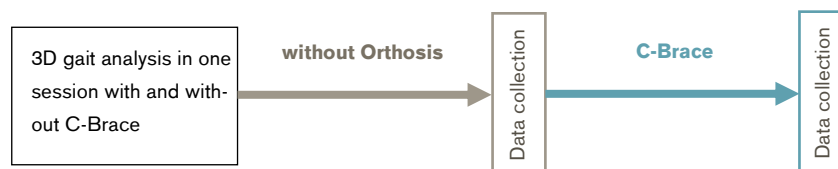


Symmetry Index (SI) is a method of percentage assessment of differences in kinematic parameters for both lower limbs when walking. SI=0% indicates full symmetry; SI=100% indicates asymmetry. *reference data from healthy controls following Błażkiewicz et al. 2014. (Hobusch et al. 2017)

Błażkiewicz, M., Wiszomirska, I., Wit, A. (2014). Comparison of four methods of calculating the symmetry of spatial-temporal parameters of gait. Acta Bioeng Biomech, 16: 29-35.

Population	Subject:	1 female
	Age:	37 years
	Underlying condition:	permanent high-grade axonal lesion of the femoral nerve due to an intraoperative three-in-one femoral nerve block after accidental rupture of the cruciate ligament of the right knee in 2005
	Clinical presentation:	muscle strength grade 0-1 of hip flexors, muscle strength grade 0-1 of knee extensors, hypaesthesia, and neuropathic pain
	Developmental dysfunctions:	chronic complex regional pain syndrome (CRPS) II, mild foot flexor weakness, and flaccid paralysis of adductor muscles
	Previous orthosis:	knee stabilization with residual function of vastus lateralis muscle, and walking with crutches
	Gait pattern:	unstable and asymmetrical
	Secondary diseases, due to altered gait pattern:	pain in lower back, cervical spine, and sacroiliac region

Study Design Case study, comparative design:

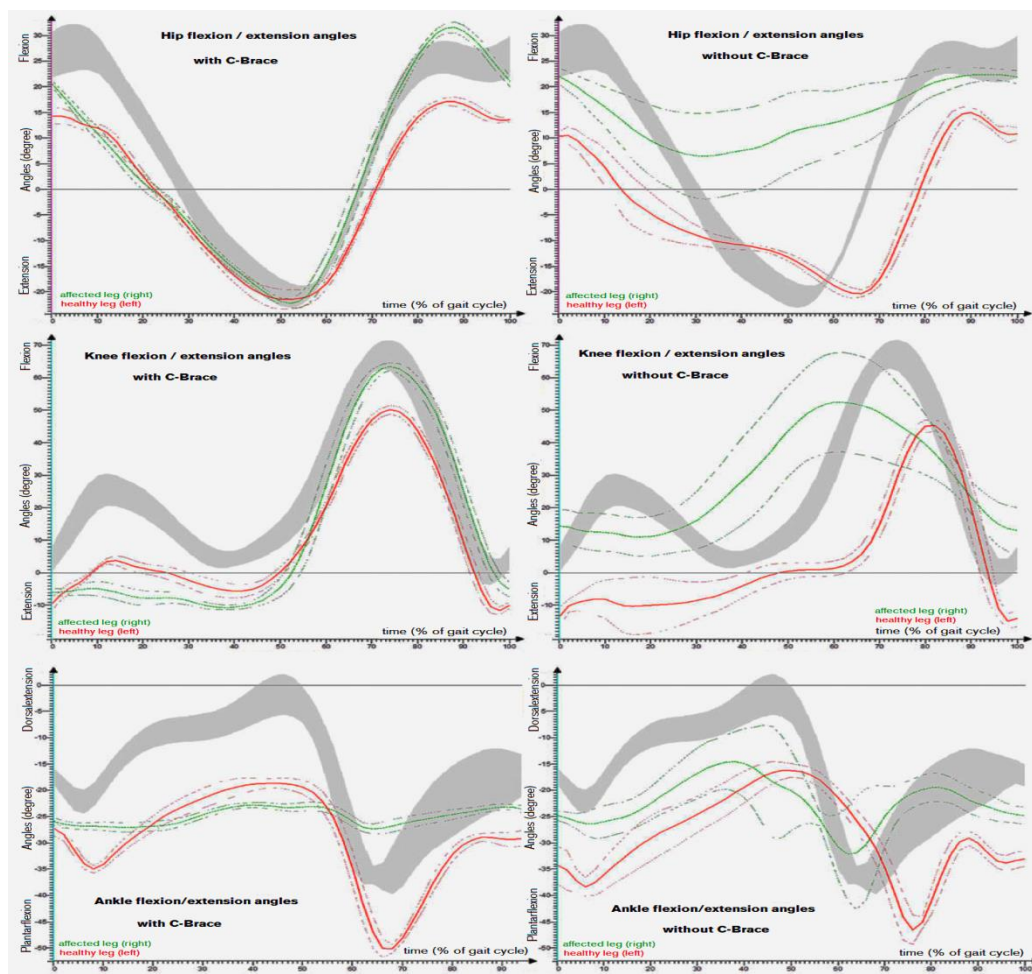


Results

Functions and Activities						Participation
Biomechanics – Static measures	Biomechanics – Gait analysis	X-Ray	EMG	Functional tests	Clinical effects	Satisfaction
Category	Outcomes	Results for C-Brace			Diff.*	
Biomechanics –	Walking speed	With C-Brace enhanced walking speed (1.2 ± 0.09 m/s, n.a. reported as 100% more than without C-Brace).				
Gait analysis	Cadence	With C-Brace enhanced cadence (100 ± 6 steps/min, n.a. reported as 60% more than without C-Brace)				
	Stride length	With C-Brace enhanced stride length (1.4 ± 0.004 m, reported as 30% more than without C-Brace).				
	Step length		affected leg (right side)	healthy leg (left side)	n.a.	
		without C-Brace #39%	0.46 ± 0.036 m	0.64 ± 0.033 m		
		with C-Brace #8%	0.74 ± 0.031 m	0.68 ± 0.021 m		
	Single support		affected leg (right side)	healthy leg (left side)	n.a.	
		without C-Brace #81%	0.44 ± 0.027 s	0.80 ± 0.13 s		
		with C-Brace #12%	0.41 ± 0.02 s	0.46 ± 0.015 s		

Category	Outcomes	Results for C-Brace			Diff.*
Opposite foot off	in % of gait cycle	affected leg (right side)	healthy leg (left side)	n.a.	
		without C-Brace	22.9 ± 3.77 %		10.5 ± 2.25 %
		with C-Brace	14.1 ± 1.35 %		13.4 ± 0.88 %
Use of walking aids	without C-Brace: unable to walk without crutches. with C-Brace: able to walk, ascend and descend slopes as well as stairs without crutches.				

Time charts of flexion / extension during one gait cycle in the hip (top), knee (middle), and ankle joint (bottom). The movement patterns in the hip and knee with C-Brace nearly matched those of the healthy leg.



* no difference (0), positive trend (+), negative trend (-), significant (++/--), not applicable (n.a.)

difference between the impaired (right) leg and the healthy (left) leg in percentages (%)

Author's Conclusion

"The usage of SSCOs seems a very good option in patients with neuromuscular insufficiency of the quadriceps muscle in a broad range of musculo-skeletal disorders. The subjective sensation of improved mobility in daily life and walking comfort could be objectively confirmed by the ability to walk without crutches and by harmonization of the gait patterns in hip and knee. They could also be a considered mobility device after limb salvage surgery, which may even have an impact on preoperative decision making." (Hobusch et al. 2018)

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