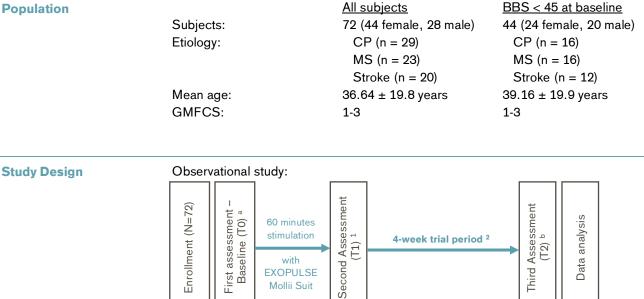
Reference	Hahn, Andreas ¹ ; Moeller, Susan ² ; Schlausch, Arne ³ ; Ekmann, Matilda ⁴ ; de Chelle, Gautier ⁵ ; Westerlund, Marie ⁴ ; Braatz, Frank ⁶ ; Mayr, Winfried ⁷														
	Effects of a full-body electrostimulation garment application in a cohort of subjects with cerebral palsy, multiple sclerosis, and stroke on upper motor neuron syndrome symptoms Biomedical Engineering / Biomedizinische Technik: 2023; 69(1); 49-59. DOI: 10.1515/bmt-2023-0271														
									Products	EXOPULSE Mollii Suit					
									Major Findings	With EXOPULSE Mollii Suit:					
										 → Positive effects on static and dynamic balance, fall risk, mobility, health utility, upper extremity function (for subjects with Berg Balance Score < 45 at baseline) → Overall reduction in spasticity-related pain after 4 weeks (for subjects 					
reporting pain at Baseline) Cerebral Palsy (CP): -35.8% Multiple Sclerosis (MS): -26.5% Stroke: -29.1%															
	Cerebral Palsy (CP): -35.8% → High increase in absolute He Cerebral Palsy (CP): -0.11		lity of Life (Hea	1											
	→ High increase in absolute He	alth Related Qua Multiple Sclerosis	lity of Life (Hea s (MS): -0.18 size, Cohen´s d	alth Utility) Stroke: -0.21											
	 → High increase in absolute He Cerebral Palsy (CP): -0.11 → Functional and clinical impro 	alth Related Qua Multiple Sclerosis vements (effect s CP	lity of Life (Hea s (MS): -0.18 size, Cohen´s d MS	alth Utility) Stroke: -0.21 I)*: Stroke											
	 → High increase in absolute He Cerebral Palsy (CP): -0.11 → Functional and clinical impro Berg Balance Scale (BBS) 	alth Related Qual Multiple Sclerosis wements (effect s CP 1.64	lity of Life (Hea s (MS): -0.18 size, Cohen´s d	alth Utility) Stroke: -0.21 I)*: Stroke 1.28											
	 → High increase in absolute He Cerebral Palsy (CP): -0.11 → Functional and clinical impro Berg Balance Scale (BBS) Functional Gait Assessment 	alth Related Qua Multiple Sclerosis vements (effect s CP	lity of Life (Hea s (MS): -0.18 size, Cohen´s d MS 1.83	alth Utility) Stroke: -0.21 l)*: Stroke											
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	 → High increase in absolute He Cerebral Palsy (CP): -0.11 → Functional and clinical impro Berg Balance Scale (BBS) Functional Gait Assessment 10m walk test 	alth Related Qua Multiple Sclerosis ovements (effect s CP 1.64 1.59 0.76	lity of Life (Hea s (MS): -0.18 size, Cohen's d MS 1.83 1.28 1.07	alth Utility) Stroke: -0.21 1)*: 5troke 1.28 0.89 0.92											
	 → High increase in absolute He Cerebral Palsy (CP): -0.11 → Functional and clinical impro Berg Balance Scale (BBS) Functional Gait Assessment 10m walk test Wolf Motor Function Test 	alth Related Qual Multiple Sclerosis wements (effect s CP 1.64 1.59 0.76 1.00	lity of Life (Hea s (MS): -0.18 size, Cohen's d MS 1.83 1.28 1.07 0.93	alth Utility) Stroke: -0.21 1)*: 1.28 0.89 0.92 0.71											
	 → High increase in absolute He Cerebral Palsy (CP): -0.11 → Functional and clinical impro Berg Balance Scale (BBS) Functional Gait Assessment 10m walk test Wolf Motor Function Test Timed Up and Go EQ 5D 5L Pain (Subscale of EQ 5D 5L) 	alth Related Qual Multiple Sclerosis vements (effect s CP 1.64 1.59 0.76 1.00 0.29 0.50 1.28	lity of Life (Hea s (MS): -0.18 size, Cohen's d MS 1.83 1.28 1.07 0.93 0.83 1.11 0.78	alth Utility) Stroke: -0.21 1)*: 5troke 1.28 0.89 0.92 0.71 0.78 1.26 0.78											
	High increase in absolute He Cerebral Palsy (CP): -0.11 > Functional and clinical impro Berg Balance Scale (BBS) Functional Gait Assessment 10m walk test Wolf Motor Function Test Timed Up and Go EQ 5D 5L Pain (Subscale of EQ 5D 5L) * Small effect size < 0.3; medium of the significant improvi	alth Related Qual Multiple Sclerosis vements (effect s CP 1.64 1.59 0.76 1.00 0.29 0.50 1.28	lity of Life (Hea s (MS): -0.18 size, Cohen's d 1.83 1.28 1.07 0.93 0.83 1.11 0.78 0.8; large effect s BS) USE Mollii Suit	alth Utility) Stroke: -0.21 5troke 1.28 0.89 0.92 0.71 0.78 1.26 0.78											

*Significant change: **: p<0.01, ***: p<0.001*

Baseline EXOPULSE Mollii Suit

Population



EXOPULSE Mollii Suit

^aThe suit (without stimulation); In case any aid (primarily orthotics) was used by participants during daily living, they were worn also during all assessments.

^bUse of the suit for 60 minutes daily or every other day during the entire trial period and no change of lifestyle, routine or other applied medical interventions, e.g., physical therapy, should be made during their participation in the study.

For six outcome measures the recorded data were stratified by etiology (CP, MS, Stroke) and a Berg Balance Score <45 at baseline. The results of the pain subscale of EQ 5D 5L were stratified by etiology (CP, MS, Stroke) and subjects reporting pain at baseline. The effect sizes (Cohen's d) were classified as "large" if $d \ge 0.8$.

Results												
Body Functions & Structure				Activity	Activity					Participation	Environment	
Pain	Spasticity		Psychologi cal function	Genera Health	l Activit		Mobi Safet	lity & sy	ADL	S	Preference, Satisfaction , QoL	Health Economics
Category		Outcomes Results for EXOPULSE Mollii Suit vs. Baseline							Sig.*			
					Baseline (T0)	60 m (T1)		4 wee (T2		Effect (T2 vs		T2 vs. T0
Pain		Pain (Subscale of	le of	СР	2.79	2.22	2	1.7	9	1.28	}	***
	EQ 5D 5L)		MS	3.06	2.00	C	2.2	5	0.78	}	**	
				troke	2.58	1.83	3	1.8	3	0.78	\$	*
Activity		Wolf Motor		СР	53.1	56.1	1	59.	1	1.00)	***
		Function Test		MS	64.2	71.7	7	71.	7	0.93	}	*
			S	troke	28.6	30.6	6	38.	3	0.71		+

Ottobock | Effects of a full-body electrostimulation garment application in a cohort of subjects with cerebral palsy, multiple sclerosis, and stroke on upper motor neuron syndrome symptoms

Category Mobility & Safety	Outcomes	Results for EXOPULSE Mollii Suit vs. Baseline				Sig.*	
			Baseline (T0)	60 min (T1)	4 weeks (T2)	Effect size (T2 vs. T0)	T2 vs. T0
	Functional Gait	СР	11.0	15.5	16.6	1.59	***
	Assessment	MS	11.3	16.7	18.3	1.28	**
		Stroke	14.17	16.5	19.0	0.89	+
	10m walk test [m/s]	СР	0.96	1.0	1.1	0.76	+
		MS	0.66	0.76	0.8	1.07	***
		Stroke	0.57	0.67	0.76	0.92	**
	Berg Balance Scale	СР	31.0	36.3	39.1	1.64	***
		MS	27.8	34.1	38.1	1.83	***
		Stroke	34.7	40.8	41.6	1.28	**
	Timed Up and Go [s]	CP	26.4	22.0	23.2	0.29	*
		MS	29.7	23.3	21.3	0.83	***
		Stroke	36.0	25.7	22.3	0.78	**
Participation, QoL	EQ 5D 5L (Health Utility)	СР	0.76	0.87	0.87	0.5	*
		MS	0.55	0.77	0.73	1.11	**
		Stroke	0.54	0.66	0.75	1.26	*

* no difference (0), positive trend (+), negative trend (-), significant (*: p<0.5, **: p<0.01, ***: p<0.001), not applicable (n.a.)

Effect size Cohen's d: Small effect size < 0.3; medium effect size = 0.3-0.8; large effect size > 0.8

Author's Conclusion	"Individualized multi-site transcutaneous electrical stimulation seems to increase ambulation-related skills in subjects with upper motor neuron syndrome stemming from infantile cerebral palsy, multiple sclerosis and stroke. These results obtained with an improved full-body electrostimulation garment show encouraging effects on static and dynamic balance, fall risk and mobility. Upper extremity improvement may be observed as well as an overall increase in health utility and a reduction in spasticity- related pain. Effects are immediate (after one hour of stimulation) as well as sustained (1 month of application) with stimulation applied for 60 minutes daily or every other day. Outcomes being sensitive to such improvements could be identified. The results may improve the quality of individual trial fittings as well as inform controlled trials that are most clearly warranted in this context." (Hahn et al. 2023)							
Author's Affiliation(s)	 ¹Ottobock Healthcare Products GmbH, Brehmstrasse 16, AT-1110 Vienna. (Corresponding author) ²Academy, Otto Bock HealthCare Deutschland GmbH, Duderstadt, Germany. ³Clinical Research & Services Otto Bock HealthCare Deutschland GmbH, Duderstadt, Germany. ⁴Clinical Research, Exoneural Network AB, Danderyd, Sweden. ⁵Médecin MPR Centre de Santé ROSSETTI, Nice, France. ⁶Private Hochschule Göttingen, Göttingen, Germany. 							
	⁷ Medical University Vienna, Vienna, Austria.							

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