Product Information Locomotion Therapy

LokoHelp
The Way To Walk

Product Information Locomotion Therapy

WOODWAY LokoStation

For more than 20 years, treadmill therapy has established itself as a successful, evidence-based therapeutic means for gait recovery and rehabilitation after stroke, after spinal and head injuries, and after infant cerebral palsy. Studies show that treadmill therapy with body weight support is superior to conventional walking, since the number of repetitions of standing- and swinging-leg cycles is generally greater. This means that in the long term, clear improvement of walking ability is to be expected.

WOODWAY LokoStation

Continuously Variable Patient Body Weight Support

With the LokoStation, partial body weight support of the patient is made possible. It allows for weight support to be controlled in a continuously variable manner by means of the therapist using a crank (minimal exertion necessary!) and can be readjusted at any time.

2-Point Suspension

The LokoStation's 2-point suspension ensures optimal rotational stability for the patient. Asymmetrical support is possible through direct adjustment of cable length. Fixing of the patient's center of mass is possible using elastic bands on the railings.

Dynamic Body Weight Support

In addition to static body weight support, the LokoStation also allows dynamic body weight support. With dynamic weight support, the previously set support weight provides for uniform support during the entire gait cycle, since the support weight of the vertical movement of the centre of mass is always tracked. This special form of dynamic weight support has the advantage that for the safety of the patient, vertical movement is limited using upper and lower stops. The patient can thus move within a defined area without falling, and is thereby guided precisely and in complete safety.

High Level of Patient Safety

The LokoStation ensures a high degree of safety when used with patients. It not only gives the patient a tremendous sense of security during treadmill training, but also supports the therapist during therapy. The patient harness reliably prevents falls. The walking surface of the treadmill is outfitted with an additional safety brake which prevents unwanted movement of the walking surface during preparation of the patient.

Access to the Patient from All Sides

The entire structure is designed with the special requirement of locomotion therapy in mind – to be able to reach the patient from all sides – and allows absolutely unhindered work with the patient and thereby the correction of body and joint position. Furthermore, this design allows the use of a mirror within the field of view of the patient. Seats mounted on the side of the treadmill are individually adjustable and enable a comfortable seating position for the therapist during manual therapy.

Wheelchair Ramp

The LokoStation is equipped with a wheelchair ramp, which enables comfortable loading of the patient onto the walking surface while still seated in a wheelchair. Longer wheelchair ramps and platforms for horizontal loading onto the treadmill are optionally available, according to space available.

No Additional Equipment Required - Low Cost of Operation

The LokoStation is a purely mechanical system which functions without additional equipment and/or electrical power or complex control routines and is thus ideal for use in physical therapy. Use is uncomplicated and operation costs are correspondingly low.

LokoStation – Technical Data

		LokoStation for PPS 55 / PPS 70
Standard features	*Body Weight Support System*	Static and dynamic
	Suspension Points	2-point suspension
	Weight Support	Symmetric and asymmetric support
	Therapist's Seat	2 side seats – adjustable height and may be set horizontally to the walking surface
	Wheelchair Ramp	Wheelchair ramp with handrails, 177 cm long Inclination ~13° = approx. 23%
	Front Handrail	Foldable crossbar
	Hip Joint / Pelvis Stabilisation	2 elastic bands with quick-release fastener for stabilisation of the patient's hips
	Patient Harness	1 harness included, selectable size
	Weight Indicators	2 weight indicators for the left and right sides of the body in dynamic mode
	Max. Patient Weight	160 kg
	Max. Body Weight Support	Static 160 kg Dynamic 2 x 38 kg
	Access to the Patient	From all sides
	Dimensions L x W x H	LokoStation 55: 377 x 149 x 278 cm Loko Station 70: 377 x 164 x 278 cm
	Weight	Approx. 450 kg (without treadmill surface)

Options		LokoStation for PPS 55 / PPS 70
	Weight Indicators	2 digital weight displays for static body support
	Platform for Wheelchair Ramp	Flat platform 50 cm long for extension of the slanted wheelchair ramp
	Long Wheelchair Ramp	Wheelchair ramp with handrails, 206 cm long Inclination ~10° = approx. 17.6%
	Patient Harness	VENUS model Sizes S, M, L, XL
	Children's Harness	VENUS model Sizes "WILLI" and "TIGER"
	Harness Attachment	Elastic band with 2 carabiner hooks for attachment of the patient harness to the front crossbar
	Height Reduction	Height reduction (for ceilings lower than 2.85 m)
	LokoHelp® Gait Trainer	LH 300M and LH 400M

WOODWAY Treadmill (see separate prospectus / data sheet)

Slat-Belt Technology
The WOODWAY treadmill and its proven, unique slat-belt technology. Hitch- and slip-free acceleration of the treadmill starting from 0.0 km/hr. The treadmill cycle is absolutely homogeneous, smoothly controllable and can be started for the patient without any startling hitches or jerks.

Display
The treadmill's data display shows walking parameters such as speed, distance covered, elapsed time, inclination, pulse, and calories burned. An overview of the data is shown on a pivoting display.

WOODWAY User System (WUS)
As an alternative to the data monitor, the WOODWAY User System is available, with an easy-to-use and intelligently-built program module for display of walking parameters as well as control of the treadmill. All functions may be controlled using an LCD touchscreen. Manual operation, 18 preset programs, medical test cycles, capacity for saving up to 200 individual programs, pulse monitoring with all programs, automatic pulse-based control, treadmill setup.

Operation
Speed can be controlled or the treadmill stopped using the portable control pad.

Safety
Two emergency stop switches ensure the safety of the patient. A magnetic switch, attached to the patient using a cord, automatically stops the treadmill upon interruption. A large portable emergency stop switch can be used by the patient as well as the therapist to stop the treadmill at any time.

Specifications
PPS Series treadmills for use with the LokoStation are available with a usable walking surface of 157 x 55 cm (optional 70 cm width). The PPS Series offers a maximum speed of up to 24 km/hr. Inclination of up to 20% and device display units such as the data monitor or WUS (described above) are optionally available.

Options
The PPS treadmill, used in conjunction with the LokoStation, can be equipped with additional options according to the special needs of the patient or therapy program.

PPS Series Treadmills used in conjunction with LokoStation

		PPS 55ortho LOKO* PPS 70ortho LOKO*	PPS 55med LOKO PPS 70med LOKO	PPS 55plus LOKO PPS 70plus LOKO
Standard features	*Usable Walking Surface*	157 x 55 cm / 157 x 70 cm	157 x 55 cm / 157 x 70 cm	157 x 55 cm / 157 x 70 cm
	Speed *Inclination*	0 - 20 km/h no inclination	0 - 20 km/h 0 - 20%	0 - 24 km/h 0 - 20%
	Supplemental Safety Brake	incl.	incl.	incl.
	Reverse Mode	0 - 10 km/h (Controlled via PC)	no reverse mode	0 - 10 km/h (Controlled via PC or WUS)
	Pulse Measurement	POLAR chest band	POLAR chest band	POLAR chest band
	Display	no display	Data monitor (on handrail)	WUS (on handrail)
	Operation	Handrail-mounted control pad, operation by PC via serial interface	Handrail-mounted control pad, operation by PC via serial interface	Handrail-mounted control pad, WUS, operation by PC via serial interface
	Handrails	No handrails**	Height- and width-adjustable handrails	Height- and width-adjustable handrails

Options	*Handrails*	Height- and width-adjustable handrails	incl.	incl.
	Inclination	0 - 20%	incl. (0 – 20%)	incl. (0 – 20%)
	Higher Speed	0 - 24 km/h	0 - 24 km/h	incl. (0 – 24 km/h)
	Display	Data monitor or WUS mounted on handrails or as external unit	WUS on handrails or as external unit	WUS as external unit
	Reverse Mode	incl. (0 - 10 km/h)	0 - 10 km/hr (Controlled via PC)	incl. (0 - 10 km/h)
	Reverse Mode, Operated without PC	with WUS only	with WUS only	incl.
	Elevated Handrail	for especially tall patients, necessary for LokoHelp LH 400M	for especially tall patients, necessary for LokoHelp LH 400M	for especially tall patients, necessary for LokoHelp LH 400M

*The PPS Ortho LOKO model serves as the base device to be supplemented according to the needs of the client with a modular system of options. **required

LokoHelp® Gait Trainer

The LokoHelp Gait Trainer was developed to relieve therapists of the labour-intensive task of guiding the patient's legs during locomotion therapy and to provide more efficient treadmill therapy for severely affected patients. It not only provides physical relief to the therapist, but also improves gait symmetry and the quality of therapy for the patient. Since therapy can only be carried out by a therapist, it greatly reduces the personal exertion required to work with severely affected patients.

LokoHelp is patented worldwide and is based on the "end effector" principle (this means that support is provided to the feet and the patient actively controls the knee and hip joints). Locomotion therapy using the LokoHelp not only saves the therapist from great physical stresses, but also reduces the personal effort required. With the LokoHelp, climbing is possible using the treadmill, facilitating the hip extension and dorsal muscle strength necessary for successful locomotion therapy (depends on the availability of this function on the treadmill).

Active knee and hip extension, active impact on the foot sole and postural control are possible and improve treatment results. The synchronised speed of the treadmill and LokoHelp is protected at all times within the servo drive using a master & slave circuit. With this design, LokoHelp enables consistent and symmetric leg guidance.

LokoHelp can be easily removed from the treadmill, thus allowing multifunctional use of the treadmill with body weight support.

Comparison of Locomotion Therapy

<u>without</u> the LokoHelp® gait trainer

<u>with</u> the LokoHelp® gait trainer

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CASE STUDY

Gait training with the newly developed 'LokoHelp'-system is feasible for non-ambulatory patients after stroke, spinal cord and brain injury. A feasibility study

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Abstract

Primary objective: To evaluate the feasibility of using a newly developed electromechanical gait device (LokoHelp) for locomotion training in neurological patients with impaired walking ability with respect to training effects and patients' and therapists' efforts and discomfort.

Methods and procedures: Design: Case series. Setting: A neurological rehabilitation centre for children, adolescents and young adults. Subjects: Six patients with impaired walking function: two after stroke, two after spinal cord injury and two after brain injury. Intervention: Twenty additional training sessions on a treadmill fitted with a newly developed electromechanical gait device and body weight support (BWS), performed over a study-period of 6 weeks.

Main outcomes and results: Patients' progress was assessed with the following instruments: the Functional Ambulation Category FAC (walking ability), the 10-metre walk test (gait velocity), the Motricity Index (lower limb strength), the Berg Balance Scale (postural capacity), the modified Ashworth Scale (spasticity) and the Rivermead Mobility Index (activity). After each therapy session, therapists completed a form, thereby indicating whether manual assistance was necessary and, if so, how much physical effort was expended and how much discomfort was experienced during the therapy session. The therapists also indicated on the form information about the patient's effort and discomfort. No severe adverse events were observed during the locomotion training with the LokoHelp device. Patients improved with regard to Functional Ambulation Category (FAC) (from mean 0.7, SD = 1.6, to mean 2.5, SD = 2.1, $p = 0.048$), Motricity Index (from mean 94 points, SD = 50, to mean 111, SD = 52, $p = 0.086$), Berg Balance Scale (BBS) (from mean 20 points, SD = 23 to mean 25, SD = 23, $p = 0.168$) and Rivermead Mobility Index (RMI) (from mean 5 points, SD = 4, to mean 7, SD = 5, $p = 0.033$). Therapists required a low level of effort to carry out the training and seldom experienced discomfort. Patients described their effort during training as being low-to-exhausting. They rarely experienced discomfort, which was mostly related to difficulties with the BWS-System. Training intensity had to be adjusted in one patient who complained of knee pain.

Conclusions: Locomotion training with the newly developed 'LokoHelp'-system is feasible in severely affected patients after brain injury, stroke and spinal cord injury. In addition,theour results indicate that the described alternative method of gait training may decrease the exertion needed by therapists to carry out the training.

Keywords: *Gait rehabilitation, brain injury, spinal cord injury, stroke, exercise, physiotherapy*

Introduction

Restoration of walking ability is a major goal in the rehabilitation of patients with acquired brain and spinal cord injury [1, 2]. Accordingly, therapeutic efforts should be primarily aimed at restoring independent walking ability, with or without walking aids. Modern therapeutic approaches are goal-directed (i.e. training is the task itself) and largely rely on the principles of repetition and massed practice [3]. These task-oriented training regimes

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Studies which include usage of LokoHelp®

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Improved walking ability and reduced therapeutic stress with an electromechanical gait device.

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OBJECTIVE: To evaluate the effectiveness of repetitive locomotor training using a newly developed electromechanical gait device compared with treadmill training/gait training with respect to patient's ambulatory motor outcome, necessary personnel resources, and discomfort experienced by therapists and patients.

METHODS: Randomized, controlled, cross-over trial. Sixteen non-ambulatory patients after stroke, severe brain or spinal cord injury sequentially received 2 kinds of gait training. Study intervention A: 20 treatments of locomotor training with an electromechanical gait device; control intervention B: 20 treatments of locomotor training with treadmill or task-oriented gait training. The primary variable was walking ability (Functional Ambulation Category). Secondary variables included gait velocity, Motricity-Index, Rivermead-Mobility-Index, number of therapists needed, and discomfort and effort of patients and therapists during training.

RESULTS: Gait ability and the other motor outcome related parameters improved for all patients, but without significant difference between intervention types. However, during intervention A, significantly fewer therapists were needed, and they reported less discomfort and a lower level of effort during training sessions.

CONCLUSION: Locomotor training with or without an electromechanical gait trainer leads to improved gait ability; however, using the electromechanical gait trainer requires less therapeutic assistance, and therapist discomfort is reduced.

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Research Report

Kinematic, Muscular, and Metabolic Responses During Exoskeletal-, Elliptical-, or Therapist-Assisted Stepping in People With Incomplete Spinal Cord Injury

T. George Hornby, Catherine R. Kinnaird, Carey L. Holleran, Miriam R. Rafferty, Kelly S. Rodriguez, Julie B. Cain

Background. Robotic-assisted locomotor training has demonstrated some efficacy in individuals with neurological injury and is slowly gaining clinical acceptance. Both exoskeletal devices, which control individual joint movements, and elliptical devices, which control endpoint trajectories, have been utilized with specific patient populations and are available commercially. No studies have directly compared training efficacy or patient performance during stepping between devices.

Objective. The purpose of this study was to evaluate kinematic, electromyographic (EMG), and metabolic responses during elliptical- and exoskeletal-assisted stepping in individuals with incomplete spinal cord injury (SCI) compared with therapist-assisted stepping.

Design. A prospective, cross-sectional, repeated-measures design was used.

Methods. Participants with incomplete SCI (n=11) performed 3 separate bouts of exoskeletal-, elliptical-, or therapist-assisted stepping. Unilateral hip and knee sagittal-plane kinematics, lower-limb EMG recordings, and oxygen consumption were compared across stepping conditions and with control participants (n=10) during treadmill stepping.

Results. Exoskeletal stepping kinematics closely approximated normal gait patterns, whereas significantly greater hip and knee flexion postures were observed during elliptical-assisted stepping. Measures of kinematic variability indicated consistent patterns in control participants and during exoskeletal-assisted stepping, whereas therapist- and elliptical-assisted stepping kinematics were more variable. Despite specific differences, EMG patterns generally were similar across stepping conditions in the participants with SCI. In contrast, oxygen consumption was consistently greater during therapist-assisted stepping.

Limitations. Limitations included a small sample size, lack of ability to evaluate kinetics during stepping, unilateral EMG recordings, and sagittal-plane kinematics.

Conclusions. Despite specific differences in kinematics and EMG activity, metabolic activity was similar during stepping in each robotic device. Understanding potential differences and similarities in stepping performance with robotic assistance may be important in delivery of repeated locomotor training using robotic or therapist assistance and for consumers of robotic devices.

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Electromechanical Gait Therapy / "End Effector" Principle vs. Robot Guided Gait Therapy / Exoskeleton Principle

The LokoHelp is an electromechanical gait trainer based on the "end effector" principle. In "end effector" gait training, mechanical support of the stand- and swinging-leg cycle is accomplished by using the feet as the last link of the kinematic chain. Movements in the hip and knee joints are actively controlled by the patient. The patient's hip and knee joints as well as ventral and dorsal thigh muscles are accessible from all sides during LokoHelp training. For this reason, if necessary, additional manual support by the therapist on the hip and knee joints is possible at all times.

Robot-controlled gait trainers are usually based on the "exoskeleton" principle. Guidance and/or support of the sequence of movements in the hip and knee joints during walking is provided to the patient. Additionally, foot joint movements are passively supported using elastic bands. Manual therapeutic correction of the movement sequence is not possible due to the entire design principle.

Fundamentally, hip extension and weighting of the base of the foot are seen as dominant factors leading to spinally generated locomotor activity (1). In contrast with "exoskeleton" gait trainers, the LokoHelp gait trainer enables maximal extension of the hips as well as a well-aligned weighting of the lower extremities.

A Cochrane study of the efficacy of gait trainers by Mehrholz and others (2) concluded that one in four patients lacking gait ability after stroke regained their ability to walk after using a gait trainer. The efficacy of "end effector" and "exoskeleton" gait trainers is not equivalent, however (3, 4).
A comparative review of these two systems has shown that significantly more stroke patients regain walking ability through the use of "end effector" devices than do those who undergo training with robot-assisted "exoskeleton" devices (5). For patients with spinal paralysis, the efficacy of both types of gait trainers is similar (6).

Active hip and knee movements controlled by the patient, such as facilitated by the LokoHelp gait training, appear to be more effective than robot-assisted hip and knee movements for the achievement of independent walking ability among stroke patients (5).

For the ability to walk on the ground independently, not only are standing and swinging leg movements necessary, but also postural control. During LokoHelp training, the torso and pelvis of the patient are not rigidly fixed. Thus additional postural requirements can be identified and trained through appropriate exercises.

The question of whether robot-controlled "exoskeleton" gait trainers can improve the walking movement patterns of ambulatory stroke patients has not been positively confirmed. Studies which have compared treadmill therapy with manual therapeutic support – provided only on an as-needed basis – with robot-guided "exoskeleton" gait trainers for ambulatory stroke patients have shown that gait movement quality is clearly improved by using treadmill therapy (7, 8). This means that hip and knee movements controlled independently by the patient are more favourable for the optimisation of the gait movement sequence than movement sequences optimised using a gait robot (9).

Technical instruction and therapeutic procedures are quickly learned with the LokoHelp gait trainer. Likewise patient set-up time with the LokoHelp is considerably shorter than with robot-guided "exoskeleton" systems, which substantially increases the net therapy time and thus the number of repetitions of standing and swinging leg movements during a therapy session.

Acquisition and maintenance costs are considerably lower for the LokoHelp gait trainer when compared with other complex gait trainers.

Electromechanical Gait Therapy / "End Effector" Principle vs. Robot Guided Gait Therapy / Exoskeleton Principle

Through the quick and easy disassembly of the LokoHelp gait trainer, the treadmill can be used multifunctionally along with the body weight support system for a wide variety of treadmill applications. Possible training modes include speed, endurance, and cardiovascular training (with or without body weight support) as well as inclination of the treadmill surface for the training of climbing gait, thereby strengthening the leg muscles both concentrically as well as eccentrically.

Inclination of the treadmill surface is also possible in conjunction with the LokoHelp gait trainer, thereby enabling the training of climbing gait and the desired strengthening of the leg muscles.

Training with the LokoHelp gait trainer can help non-ambulatory patients achieve independent walking ability, and improves walking safety, stride length and walking endurance. Clinical observations show that LokoHelp training leads to a reduction in spasticity as well as improved mobility in the hip and knee joints, improved flexibility of shortened muscles, improved strength in hip, knee, and calf muscles as well as torso extensors. Amongst severely affected patients, torso and head control as well as (independent) patient transfers are improved. Improved strength and mobility also lead to an increase in the motivation to engage in movement, thereby improving the training tolerance of the patient.

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Indications and Therapeutic Goals

WOODWAY's locomotion therapy products (slat-belt treadmill, body weight support system and LokoHelp gait trainer) can be successfully used for the following indications and goals:

For impaired walking ability among:

- Patients with spinal paralysis
- Stroke patients
- Patients with traumatic brain injury
- Patients with infant cerebral palsy
- Patients with Parkinson's disease
- Patients with multiple sclerosis
- Patients with Guillain-Barré syndrome and other neurological disorders
- Patients after hip and knee replacement
- Geriatric and orthopaedic patients

For improvement of:

- Walking speed, walking endurance
- Gait symmetry and stride length
- Joint mobility, muscle length
- Cardiovascular function

For spasticity reduction

For research investigations in the field of locomotion therapy

Gait Trainer System Checklist

	LokoHelp	Alternative Product
Has the effectiveness of the gait trainer been demonstrated in research studies?	✓	?
Is the product based on current scientific data regarding the efficacy of "end effector" gait trainers?	✓	?
With the purchase of this product, am I choosing a therapy which promises success at the same time as being cost-effective?	✓	?
Will the equipment be free from potentially long downtimes arising from failure of vulnerable electrical parts?	✓	?
Will costly accessories lacking proven therapeutic usefulness be avoided?	✓	?
Is the gait trainer easy to learn and use, and free from the need to have computer skills?	✓	?
Is the patient prep time short enough that within a therapy session of 20 minutes, the patient can make the 800 - 1000 steps required for successful gait therapy?	✓	?
With this equipment, am I able to maximize the number of therapy sessions possible?	✓	?
Is the physical stress experienced by the therapist low?	✓	?
Is the equipment free of the need for time-consuming calibration?	✓	?
Are acquisition and maintenance costs predictable and relatively low?	✓	?
Is the gait trainer part of a modular therapy solution, with which I can offer gait training to both ambulatory and non-ambulatory patients?	✓	?
Is disassembly of the gait trainer quick and easy, thereby freeing up the treadmill for other uses?	✓	?
During gait training with this equipment, can I simultaneously train postural control, which is essential for the achievement of independent walking?	✓	?

Patient Harness, VENUS Model

The Venus patient harnesses are developed in close, continuous cooperation with physical therapists. The patient harnesses consist of a thorax harness with a washable inner liner and two lined leg loops. High-quality linings make body weight support as comfortable as possible for the patient. Body weight support should occur primarily through the thorax harness. Correct positioning of the harness is thus extremely important. Six fasteners enable good adjustability in the abdominal region as well as along the length of the body. Load-bearing fasteners are made of metal for the highest degree of safety.

The practical quick-release fasteners make putting the harness on the patient's body quite rapid, whether in the lying, sitting, or standing position. The metal rings incorporated into the torso portion allow the attachment of additional elastic bands which may be used for stabilisation of the patient's centre of mass if necessary.

Children's harnesses are constructed in fundamentally the same manner, and likewise offer good adjustability. A high priority was placed on the harness being the lightest weight possible. The harnesses are made with child-appropriate designs with cheerful colours.

All harnesses can also be made according to your custom design wishes.

VENUS for Adults	"WILLI" for Children	"TIGER" for Children
 	 	 

Patient Harness, VENUS Model

[1] Chest size, [2] Waist size, [3] Hip size

Size Table

	VENUS S	VENUS M	VENUS L	VENUS XL	"WILLI"	"TIGER"
Chest (cm)	70 - 82	80 - 108	100 - 124	120 - 138	67 - 75	43 - 65
Waist (cm)	60 - 68	65 - 90	85 - 109	105 - 117		
Hip (cm)	88 - 90	90 - 112	110 - 128	125 - 140		
Maximum Patient Weight	250 kg	250 kg	250 kg	250 kg	80 kg	80 kg

Patient Harness, VENUS Model

Load-bearing buckles made of metal for the highest degree of safety

Highly adjustable for all lengths in the hip, chest, and leg regions

High-quality lining for avoidance of pressure points and pain

Patient Harness, VENUS Model

Two metal rings on the side in order to bring the patient's hips forward, with the help of an elastic band with carabiners (to hold the harness).

Harness attachment

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