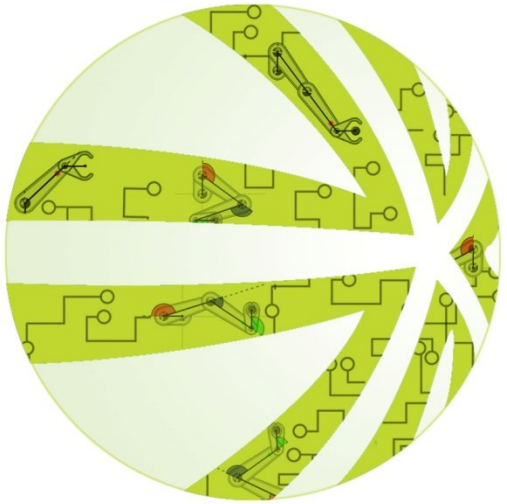


IISART

INTERNATIONAL INDUSTRY SOCIETY IN
ADVANCED REHABILITATION TECHNOLOGY

Examples for New Technologies

Contents

1

ROBOTICS

Lower Extremities

EXOSKELETONS

Lower Extremities

System 4 Pro

Biodex Medical Systems

Key Points

- Over 5,600 Peer Reviewed Citations in Support
- Objective Data
- Documented Progress, Need and Outcomes
- Research, Rehabilitation, Testing and Training
- 5 Modes of Operation, Passive, Isometric, Isokinetic, Isotonic and Reactive Eccentrics
- Capable of delivering concentric and eccentric contractions in 4 modes

System 4 Pro (Biodex Medical Systems, Shirley, New York, USA)

Lokomat®Pro

Hocoma

Key Points

- Adjustable exoskeleton for a physiologic gait pattern
- Assist-As-Needed support for optimal training challenge
- Augmented Performance Feedback for increased patient participation
- FreeD Module for balance activation and weight shift

Lokomat®Pro (Hocoma, Zurich)

Mehrholz et al., *Electromechanical-assisted training for walking after stroke*, Cochrane Database (2013)

Lokomat®Pro

Lokomat®Pro training (Landeskrankenhaus Hochzirl)

Erigo®Pro

Hocoma

Key Points

- Early and safe mobilization of severely impaired patients even in acute care
- Progressive verticalization up to 90°
- Cyclic leg movements 8-80 steps/min
- Cyclic leg loading (up to 50 kg) allows enhanced cardiovascular output
- Improved orthostatic tolerance through Functional Electrical Stimulation (FES)
- Sensorimotor stimulation improves patient awareness

Erigo®Pro (CHUV, Lausanne)

Yoshida et al., *Cardiovascular response of individuals with spinal cord injury to dynamic functional electrical stimulation under orthostatic stress*, IEEE Trans Neural Syst Rehabil Eng (2013)

Erigo®Pro

Erigo®Pro patient training
(Landeskrankenhaus Hochzirl)

END-EFFECTORS

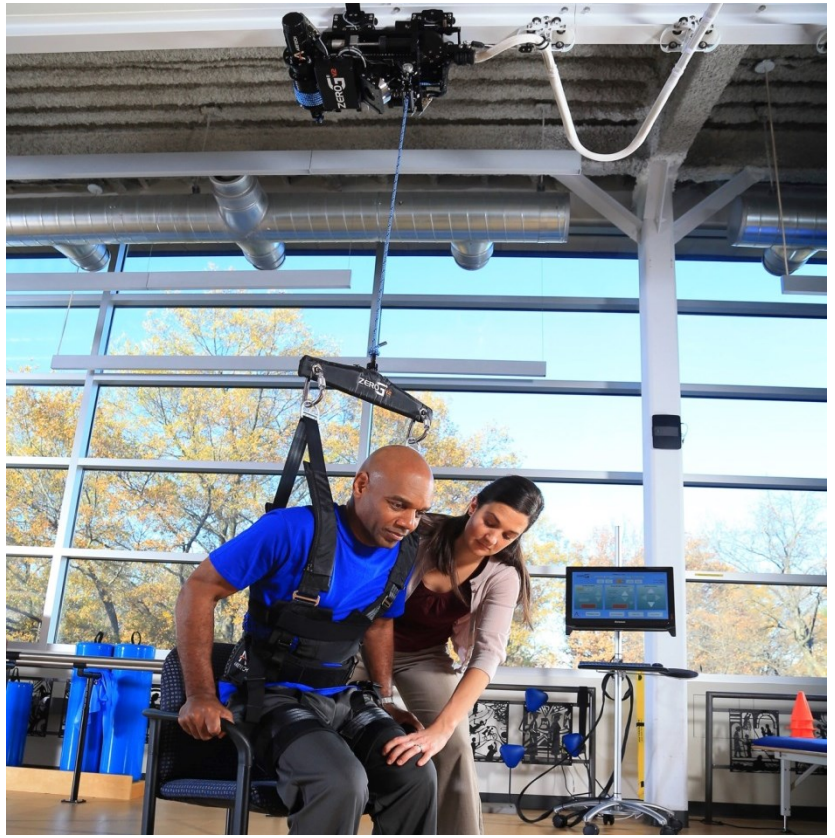
Lower Extremities

ZeroG® Gait and Balance System

Aretech

Key Points

- Dynamic body-weight support compensates for weakness & poor coordination
- Robot tracks movements along a ceiling track
- Interactive games and balance training with biofeedback
- Lowers the risk of injury to patient & therapist
- Practice functional activities safely
- Monitor & track functional progress



ZeroG (Aretech, Ashburn, VA USA)

Hidler, et al. *J Rehabil Res Dev.* (2011) 48(4):287-98.

ZeroG®

Functional Training with Dynamic Body-Weight Support

ZeroG®-Lite

Aretech

Treadmill-Based Gait Training System

- Practice functional gait training safely
- Incline & reverse to walk up/down slopes
- Modulate intensity with dynamic body-weight support
- Lowers risk of injury to patient and therapist
- Orthopedic rehabilitation
- Improve cardiovascular function
- Monitor and track functional progress
- Ramp and wheelchair landing

ZeroG-Lite (Aretech, Ashburn, VA USA)

ZeroG®-Lite

Treadmill-Based Gait Training System

1

ROBOTICS

Upper Extremities

EXOSKELETONS

Upper Extremities

Armeo®Power

Hocoma

Key Points

- Early rehabilitation training for severely affected patients
- Extensive 3D workspace (6 actuated dof)
- Assist-As-Needed support automatically adapts to patient's capabilities
- Augmented Performance Feedback increases motivation and trains activities of daily living
- Assessment Tools for objective analysis of patient's progress

Armeo®Power (Hocoma, Zurich)

Klamroth-Marganska et al., *Three-Dimensional, Task-Specific Robot Therapy Of The Arm After Stroke: A Multicentre, Parallel-Group Randomised Trial*, Lancet Neurol. (2014)

Armeo®Power

Armeo®Power Product Demo
(Hocoma, Zurich)

System 4 Pro

Biodex Medical systems

Key Points

- Visual Biofeedback
- Torque ranges from .5 ft-lbs to 500 ft-lbs
- Speed ranges from .25 deg/sec to 500 deg/sec
- Analog Output Signal Ranges from 100 – 2000hz
- Proproception mode incorporating Joint Position Sense and Kinesthesia testing and training
- Export Utility Software

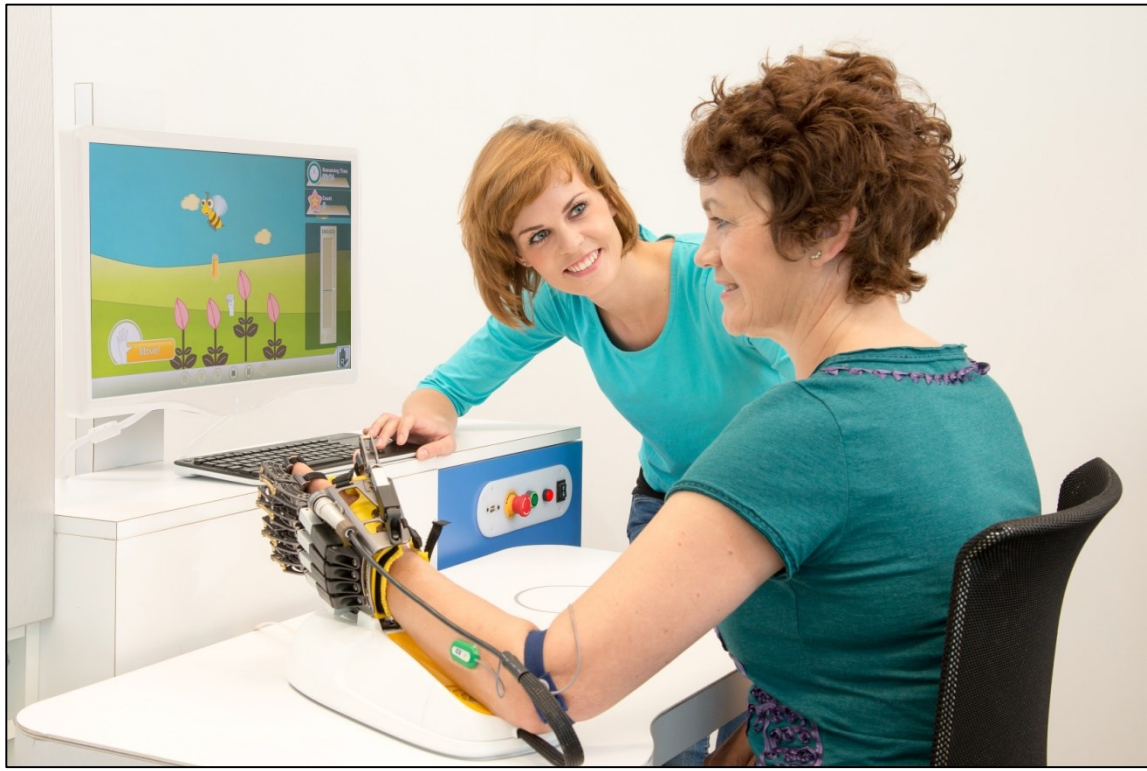
System 4 Pro (Biodex Medical Systems, Shirley, New York, USA)

Hand of Hope

Rehab-Robotics Company

Key Points

- 1st EMG-driven hand exoskeleton
- Active and Assistive device
- Hand and arm training
- Adjustable length for each finger
- Light, compact and portable
- Interactive games
- Easy-to-use interface
- Automatic report availability

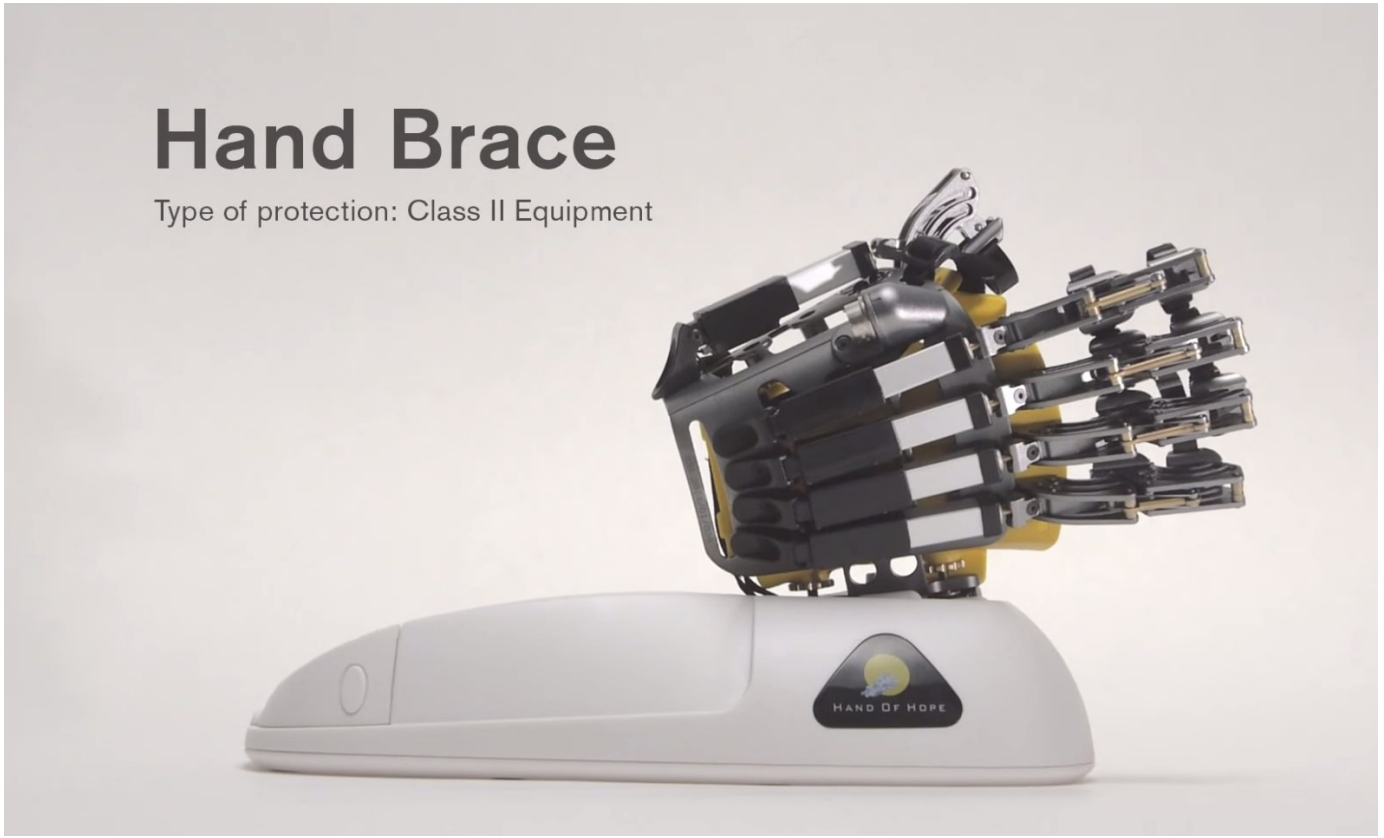


Hand of Hope (Rehab-Robotics Company, Hong Kong)

The effects of post-stroke upper-limb training with an electromyography (EMG)-driven hand robot

X.L. Hu, K.Y. Tong X.J. Wei, W. Rong, E.A. Susanto, S.K. Ho Journal of Electromyography and Kinesiology 23 (2013) 1065–1074

Hand of Hope



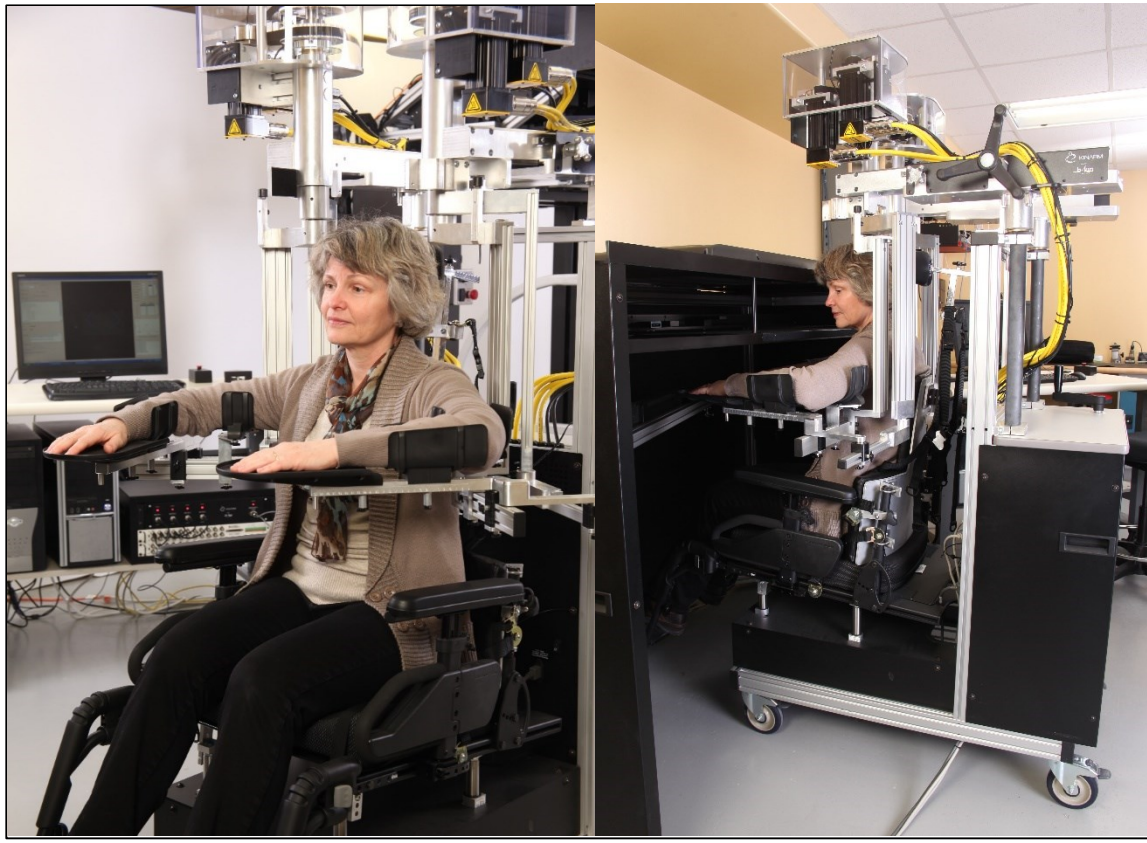
Hand of Hope (Rehab-Robotics, Hong Kong), product demo

KINARM Exoskeleton Lab

BKIN Technologies Ltd

Key Points

- Assessment of range of neurological impairments associated with stroke, spinal cord injury, CP, Parkinson's
- Quantitative and objective measures of brain function and dysfunction through precise measurement of human behaviour
- Supports clinical researchers in the development of novel therapies for improved outcomes



KINARM Exoskeleton Lab (BKIN Technologies Ltd., Canada)

Semrau, J.A. et al. *Robotic identification of kinesthetic deficits after stroke.* Stroke. 44:3414-3421 (2013)

KINARM Exoskeleton Lab

Demonstrates Visually Guided Reaching Task: limb coordination, use of vision, postural stability

END-EFFECTORS

Upper Extremities

Amadeo®

tyromotion

Key Points

- Robot-assisted finger and hand therapy system
- Rehabilitation training for all levels of hand impairment
- Simulation of grasping and individual finger movements
- Force and ROM assessments
- Wide range of therapy applications, e.g. passive (CPM), assistive, active, spasticity and proprioceptive therapy
- Easily adjustable for children and adults

Amadeo® (tyromotion, Graz)

Sale et al., *Recovery of hand function with robot-assisted therapy in acute stroke patients: a randomized-controlled trial.* Int J Rehabilitation Research (2014).

Amadeo®

Amadeo® product video: https://www.youtube.com/watch?v=KA37ws_6-XM

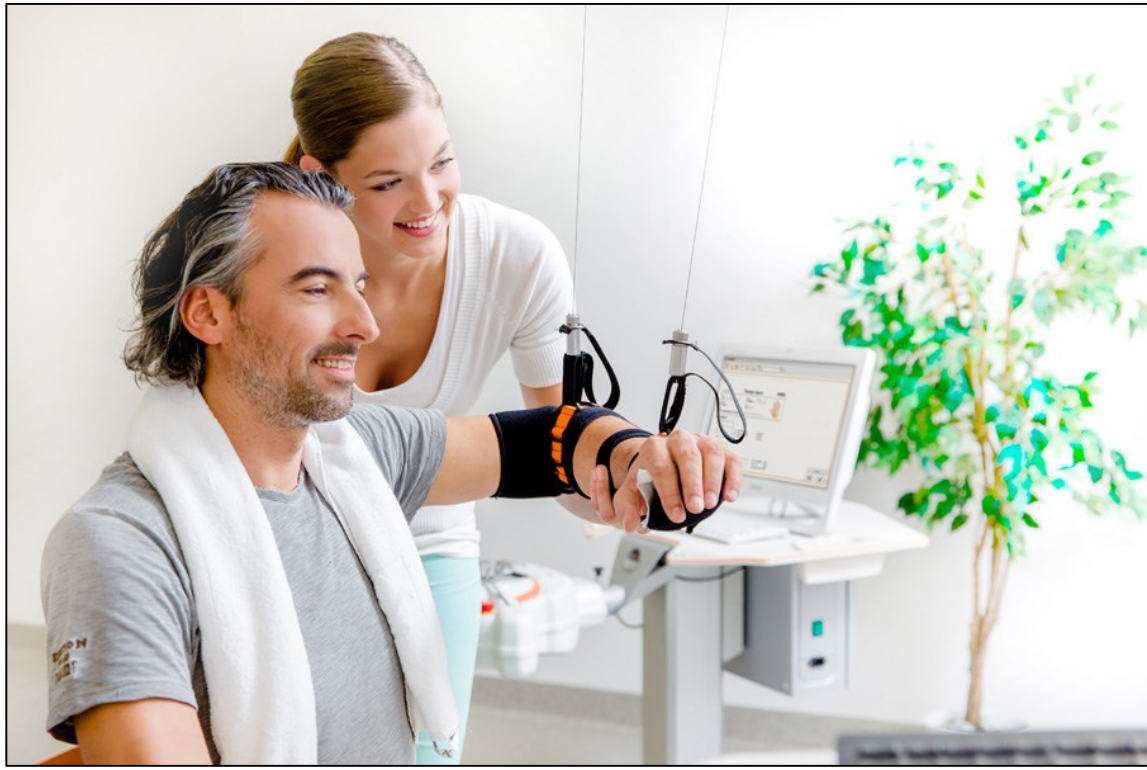
Amadeo® - Craig Hospital uses interactive technology for hand rehabilitation : https://www.youtube.com/watch?v=Z_rk__2IreA

Diego®

tyromotion

Key Points

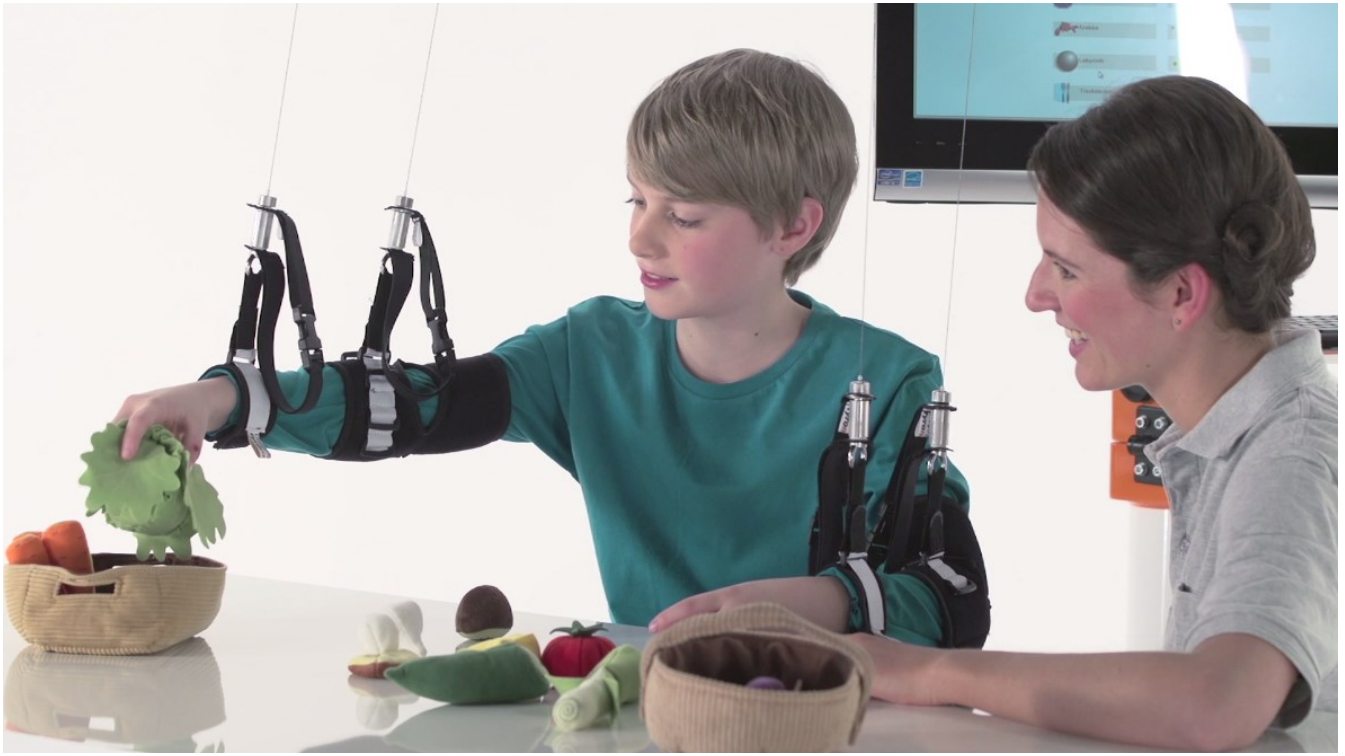
- Robot-assisted arm and shoulder therapy system
- Intelligent gravity compensation (IGC) to assist-as needed for functional reaching training
- Bilateral, unilateral and symmetric arm training
- 3D bio-feedback
- Individual applications for children and adults
- Task-oriented training with real objects



Diego® (tyromotion, Graz)

Mehrholz et al., *Electromechanical and robot-assisted arm training for improving generic activities of daily living, arm function, and arm muscle strenght afters troke (Review),* The Cochrane Library (2012)

Diego®



Diego® product video: https://www.youtube.com/watch?v=Ng5GyGIdrMk

KINARM End-Point Lab

BKIN Technologies ltd

Key Points

- Assessment of range of neurological impairments associated with mTBI, sport concussion, TIA, MS, Alzheimer's
- Quantitative and objective measures of brain function and dysfunction through precise measurement of human behaviour
- Supports clinical researchers in the development of novel therapies for improved outcomes

KINARM End-Point Lab (BKIN Technologies Ltd., Canada)

Lowrey, C.R., et al. *A Novel Robotic Task for Assessing Impairments in Bimanual Coordination Post-Stroke,* Int J Phys Med Rehabil 2014, S3. (2014)

KINARM End-Point Lab

Demonstrates Object Hit Test: a rapid bi-manual task that assesses assymetries in spatial awareness and use of upper limbs.

2

NON-ACTUATOR DEVICES

Lower Extremities

Unweighting System and Gait Trainer 3

Biodex Medical Systems

Key Points

- Dynamic partial weight bearing support system
- Adjustable harness with multiple lifting points for a comfortable, no slip patient experience.
- Ability to move overground without use of a treadmill
- Instrumented deck treadmill
- Visual biofeedback
- 0 deg/sec starting speed
- Documentation of gait compared to normative data

Unweighing System and Gait Trainer 3 (Biodex Medical Systems, Shirley, New York, USA)

KineAssist-MX

HDT Global

Key Points

- Driven by patient intent
- Reinforces neurological pathways *and* muscular systems
- Helps muscles relearn and reconnect through feedback and *self initiation*
- Transparent interaction with therapist
- Patients exercise at their own pace and with their own gait patterns
- Challenge-based training allows patients to *safely* learn from their mistakes and exceed their current capabilities

KineAssist-MX, HDT Global, Fredericksburg, VA USA

Patton J, Lewis E, Crombie G, Peshkin M, Colgate E, Santos J, Makhlin A, and Brown DA: A novel robotic device to enhance balance and mobility training post-stroke. Topics in Stroke Rehabilitation 15.2: 131-9. 2008

KineAssist-MX

Short Video Description

2

NON-ACTUATOR DEVICES

Upper Extremities

Armeo®Spring

Hocoma

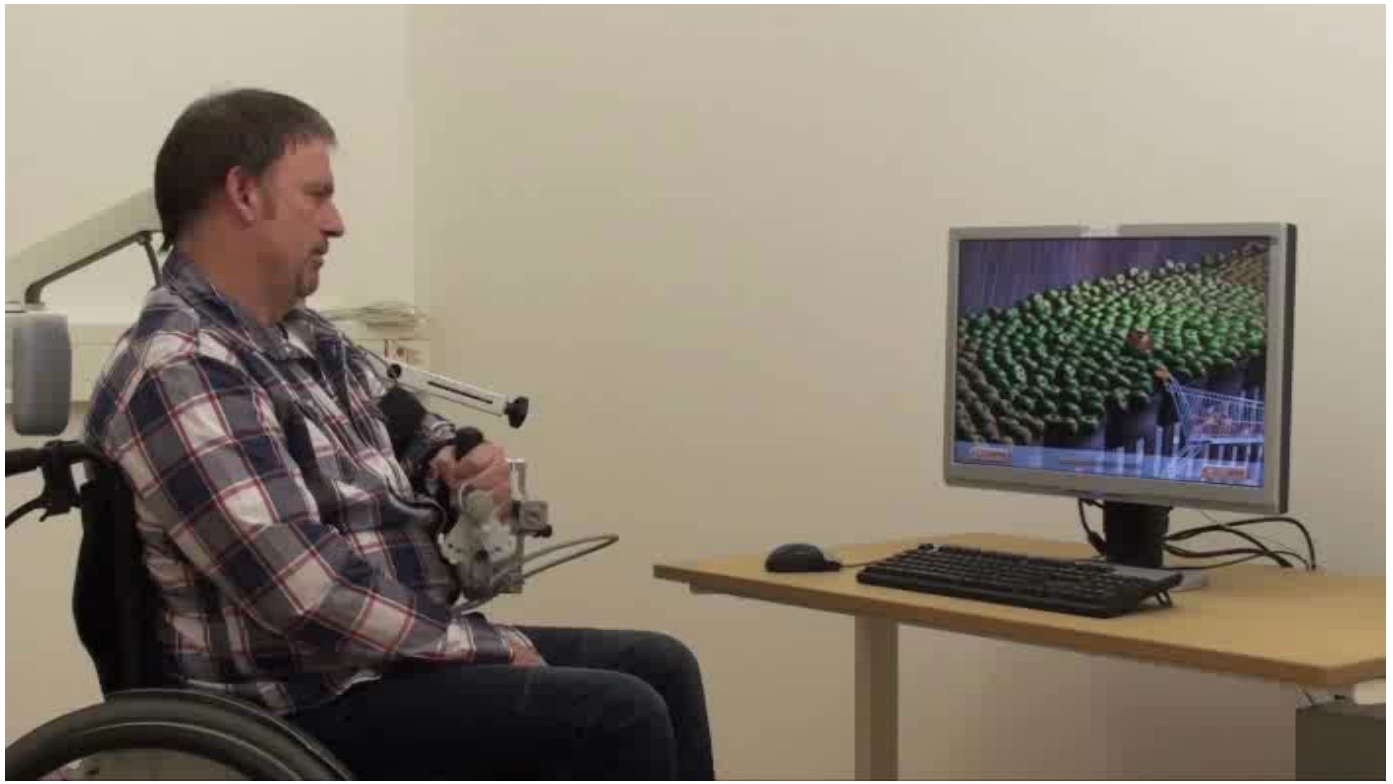
Key Points

- Simultaneous arm and hand therapy in an extensive 3D workspace
- Arm orthosis with integrated weight compensation mechanism
- Augmented Performance Feedback for motivational training of activities of daily living
- Assessment Tools for objective analysis of patient progress

Armeo®Spring (Therapiezentrum am Goethe, Osnabrück)

Colomer et al., *Efficacy Of Armeo®Spring During The Chronic Phase Of Stroke. Study In Mild To Moderate Cases Of Hemiparesis*, Neurologia (2013)

Armeo®Spring



Armeo®Spring patient training
(Rehaklinik Zihlschlacht)

Armeo®Boom

Hocoma

Key Points

- Arm Weight Support with low inertia for unrestricted and most physiological movements
- Augmented Performance Feedback with functional exercises and entertaining games for patient
- Assessment Tools to record patient performance

Armeo®Boom (Hocoma, Zurich)

Prange et al., *The Effect Of Arm Support Combined With Rehabilitation Games On Upper-Extremity Function In Subacute Stroke: A Randomized Controlled Trial*, Neurorehabil Neural Repair (2014)

Armeo®Boom

Armeo®Boom Product Demo
(Hocoma, Zurich)

Balance System SD

Biodex Medical Systems

Key Points

- Documented outcome against age based normative data
- Visual and audio Biofeedback
- Static and Dynamic modes
- 12 levels of stability in Dynamic mode
- 5 testing and 6 training modes
- Patient Data Collection Software Utilities

Balance System SD (Biodex Medical Systems, Shirley, New York, USA)

3

FUNCTIONAL ELECTRICAL STIMULATION

RehaStim2

Hasomed

Key Points

- 8 channel stimulator for NMES of paralyzed muscles
- Programmable to generate own FES patterns
- Sequence Mode with 50 pre installed programmes
- External Switch for manual triggering
- Science Mode© protocol for scientific application and PC control
- Used in world wide scientific projects

RehaStim2 (Hasomed, Magdeburg/Germany)

McLachlan AJ et al., *Changes in pulmonary function measures following a passive abdominal functional electrical stimulation training program*. The Journal of Spinal Cord Medicine. 2013, 36(2):97-103

RehaMove

Hasomed

Key Points

- Combination of FES and motor assisted movement therap
- Effective arm and leg treatment for neurological diseases with functional impairments
- Synchonized electrical pulses per communication interface
- Appropriate as home therapy

RehaMove (Hasomed, Magdeburg/Germany)

Kuhn D et al., *Four weeks of functional electrical stimulated cycling after spinal cord injury: a clinical cohort study*. Int J Rehabil Res. 2014, 37(3):243-250

4

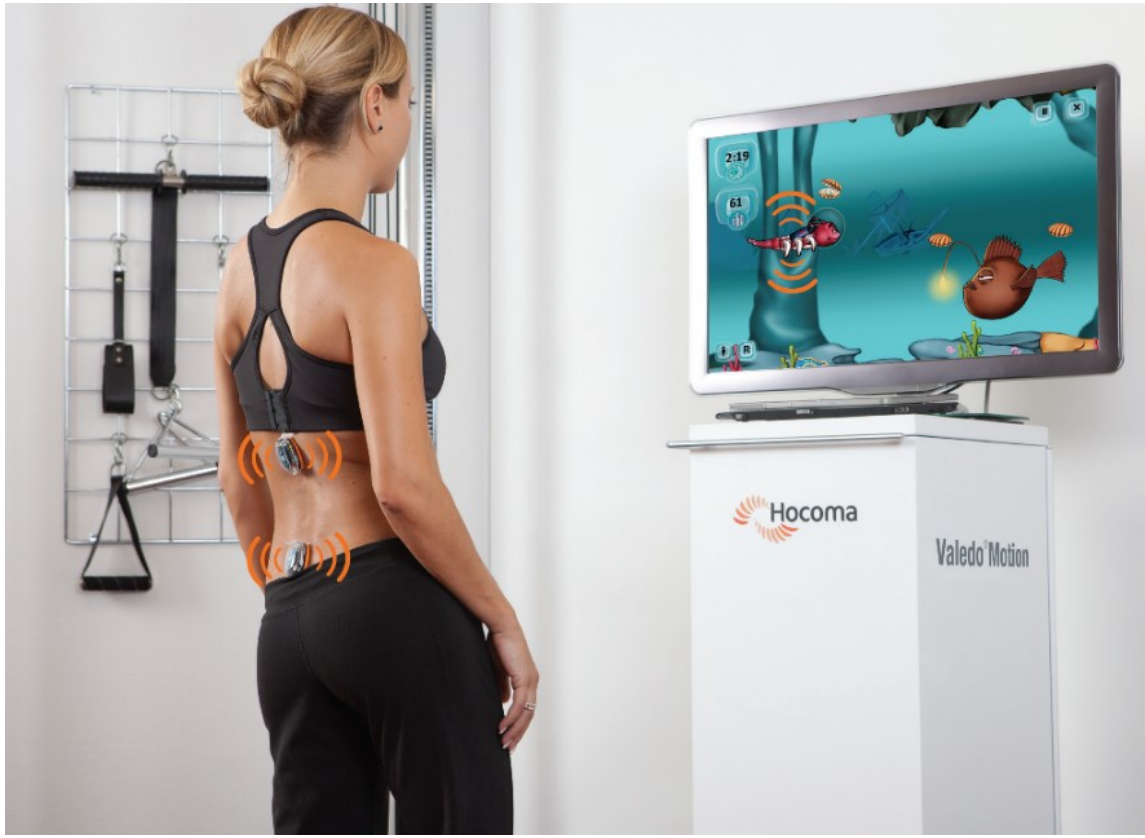
SENSOR TECHNOLOGY

Valedo®Motion

Hocoma

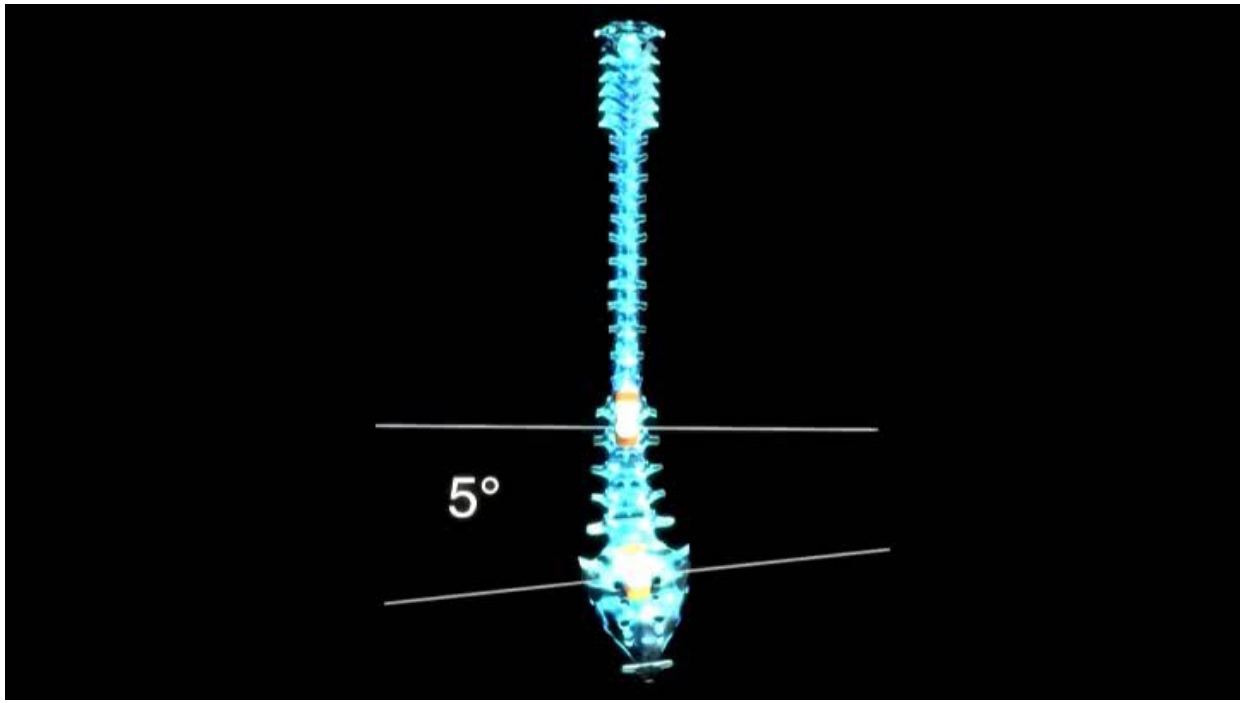
Key Points

- Medical back therapy supporting step-by-step movement learning
- Fun and engaging exercises for extensive training
- Real-Time Feedback improves body movement awareness
- Documentation and evaluation of therapy progress



Valedo®Motion (Hocoma, Zurich)

Valedo®Motion



Valedo®Motion

Valedo®Shape

Hocoma

Key Points

- Rapid recording of the spine (frontal and sagittal planes)
- Visual representation of the spine
- Concise reports of measurements and assessments
- Comparison of measurements with healthy population

Valedo®Shape (Hocoma, Zurich)

Pablo®

tyromotion

Key Points

- Ergonomic sensor handle for inter-active therapy
- Assessment and therapy for strength and mobility:
  - grip force (flexion & extension)
  - functional grips (e.g. pinch grip, key grip)
  - range of motion (ROM) & force control index (FCI)
- Increased application possibilities with additional system components: ball, board, belts, and pads
- Endless exercise options by combining software application, body area, and task

Pablo® (tyromotion, Graz)

Seitz et al., *Monitoring of visuomotor coordination in healthy subjects and patients with stroke and Parkinson's disease: An application study using the PABLO®-device*. International J Neurorehabilitation (2014).

Pablo®

Pablo® product video: https: https://www.youtube.com/watch?v=JfrwmPdAtPA

Tymo®

tyromotion

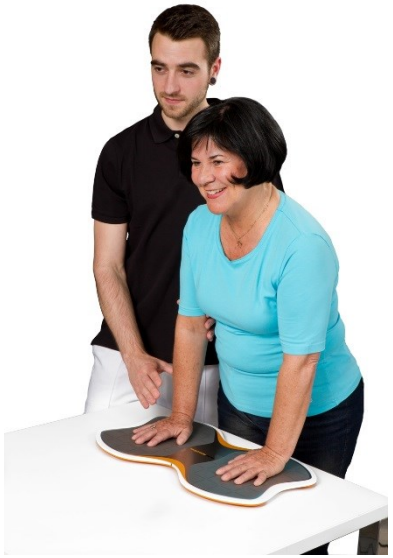
Key Points

- Portable wireless and thin therapy plate
- Assessment and inter-active therapy
  - with real time biofeedback
  - for training of postural control, weight bearing and weight shifting ability, and balance
  - used in various starting positions: supporting, sitting, sit-to-stand, and standing
  - static (force, CoP) & dynamic mode (1D & 2D rolling element)
- Medical device promoting rehabilitation goals

Tymo® (tyromotion, Graz)

Borghese et al., *Computational intelligence and game design for effective at-home stroke rehabilitation.* Games for Health J. (2013)

Tymo®



Tymo® product video: https: https://www.youtube.com/watch?v=laCmvtK6Me0

5

VIRTUAL REALITY

CAREN

Motekforce Link

Key Points

- Computer Assisted Rehabilitation Environment
- Multi-sensory input for advanced rehabilitation protocols
- Interactive and dynamic Virtual Reality providing applied games for rehabilitation of movement discorders
- D-Flow application development software offering options to create custom research and clinical applications

CAREN (Motekforce Link, Amsterdam)

Geijtenbeek et al. (2011). "D-Flow: immersive virtual reality and real-time feedback for rehabilitation". Proceedings of the 10th International Conference on Virtual Reality Continuum and Its Applications in Industry (VRCAI '11). ACM, New York, NY, USA, pp. 201-208.

CAREN

CAREN

GRAIL

Motekforce Link

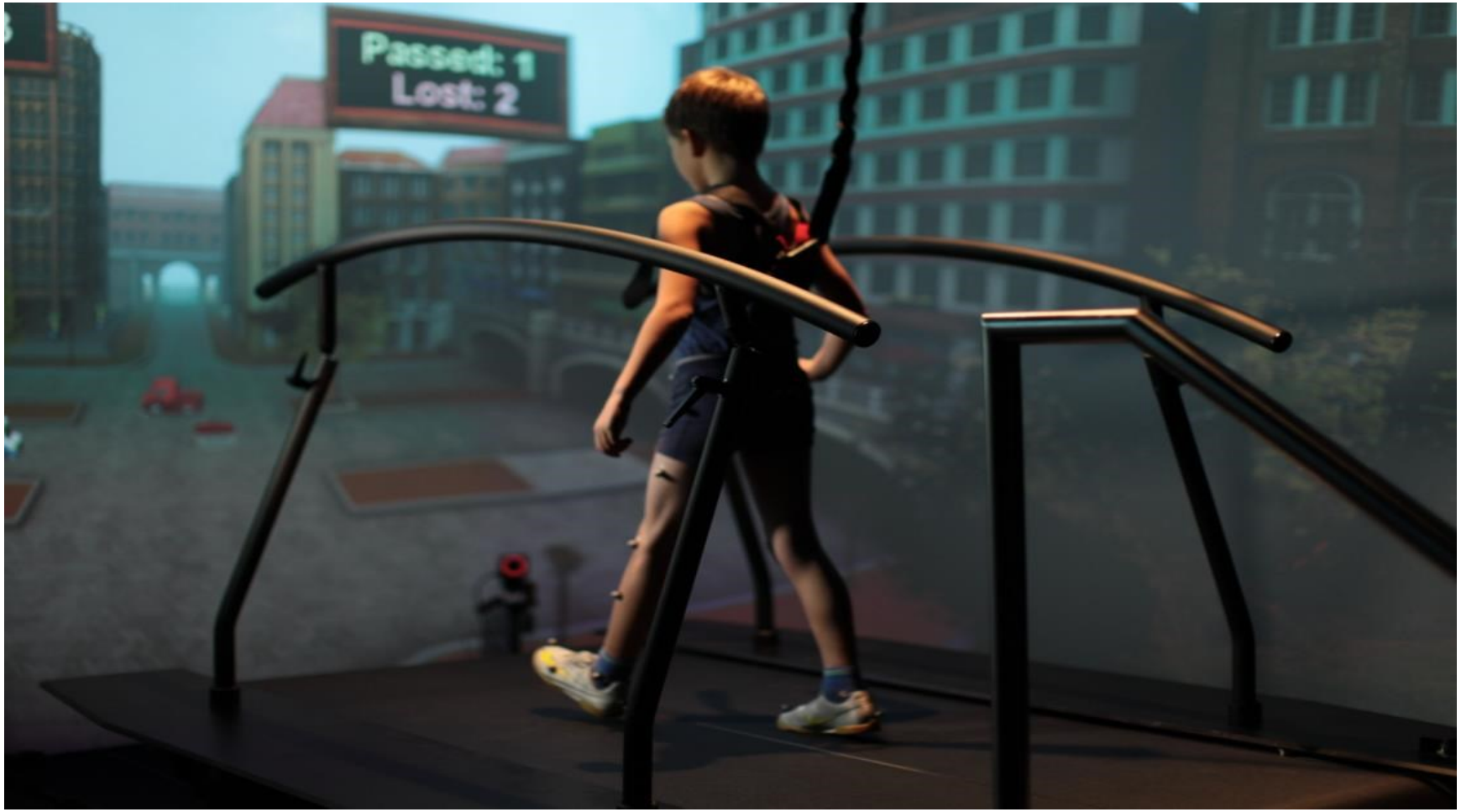
Key Points

- Full 3D gait analysis of multiple cycles within 30 minutes
- All gait parameters available in real-time for monitoring and intervention
- Self-paced mode enables patient to walk at a self selected pace
- Visual, mechanical or cognitive dual tasks for 'functional gait analysis' and gait training

GRAIL (Motekforce Link, Amsterdam)

Van der Krogt et al. *Overground versus self-paced treadmill walking in a virtual environment in children with cerebral palsy*, Gait & Posture (2014)

GRAIL



C-Mill

Motekforce Link

Key Points

- Instrumented treadmill with projection
- Projection of cues relative to gait pattern
- Obstacle avoidance
- Train gait and gait adaptability
- Gait analysis with CueFors software

C-Mill (Motekforce Link, Amsterdam)

Roerdink et al., *Online gait event detection using a large force platform embedded in a treadmill* (2008).

DynSTABLE

Motekforce Link

Key Points

- Dynamic Balance Training and Assessment
- Objective Outcomes to Monitor Progression
- Immersive Virtual Environments Increase Patient Engagement
- Unique Moving Balance Platform

DynSTABLE (Motekforce Link, Netherlands)

Sun(2014). *Effect of Virtual Reality Rehabilitation on Balance Function in Stroke Patients with Hemiplegia.*

DynSTABLE

Dynamic STability And Balance Learing Environment

VirtualRehab

Virtualware Group

Key Points

- CE certified and clinically validated cloud-based physiotherapy videogame platform
- Incorporates motion capture technology
- Variety of engaging 3D styled games exercising different motor functions
- OnPremises version for clinical use and SaaS version for in-home TeleRehabilitation
- Used to treat Neurodegenerative diseases, Neuromuscular and Neurovascular disorders and to help improve mobility for the elderly

VirtualRehab (Virtualware Group, Bilbao, Spain)

Murie Fernandez et al., *VirtualReality Games combined with normal rehabilitation are an effective alternative in Multiple Sclerosis patients* (2014)

VirtualRehab

VirtualRehab

Contact

International Industry Society in Advanced Rehabilitation Technology (IISART)

General Information

info@iisartonline.org

www.iisartonline.org