Examples for New Technologies
1. Robotics
2. Non-Actuator Devices
3. Functional Electrical Stimulation (FES)
4. Sensor Technology
5. Virtual Reality
ROBOTICS
Lower Extremities

Examples for new technologies
EXOSKELETONS

Lower Extremities
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

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

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

Examples for new technologies
Hand of Hope

Hand Brace
Type of protection: Class II Equipment

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

Demonstrates Visually Guided Reaching Task: limb coordination, use of vision, postural stability
END-EFFECTORS
Upper Extremities
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)
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=Zrk_21reA
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

Mehrohzu et al., Electromechanical and robot-assisted arm training for improving generic activities of daily living, arm function, and arm muscle strength after stroke (Review), The Cochrane Library (2012)
Diego® product video: https://www.youtube.com/watch?v=Ng5GyGldrMk
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

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

Short Video Description
2

NON-ACTUATOR DEVICES

Upper Extremities
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

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 (Therapiezentrum am Goethe, Osnabrück)
Armeo® Spring

Armeo® Spring patient training
(Rehaklinik Zihlschlacht)
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

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)
RehaMove

Hasomed

Key Points

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


RehaMove (Hasomed, Magdeburg/Germany)
SENSOR TECHNOLOGY

Examples for new technologies
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)
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)
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® product video: https://www.youtube.com/watch?v=JfrwmPdAtPA
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

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

Tymo® product video: https://www.youtube.com/watch?v=laCmvtK6MeD
VIRTUAL REALITY

Examples for new technologies
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 disorders
- D-Flow application development software offering options to create custom research and clinical applications


CAREN (Motekforce Link, Amsterdam)
Examples for new technologies
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

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

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

C-Mill (Motekforce Link, Amsterdam)
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

Dynamic STability And Balance Learning Environment

Examples for new technologies
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

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

Examples for new technologies
International Industry Society in Advanced Rehabilitation Technology (IISART)

General Information
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