Rehab-Robotics

Hand of Hope

For hand rehabilitation

Over 17 Million people worldwide suffer a stroke each year

A stroke is the largest cause of a disability with half of all survivors being left with an impairment of the hand and arm leading to an inability to execute their activities of daily living.

Consequently a patient can lose motivation and hope which is key to their rehabilitation, especially when the greatest recovery can be see in the first days and weeks after a stroke.

Hand of Hope

Lets introduce you to the Hand of Hope, an award winning, state-of-the-art sEMG driven robotic hand rehabilitation device that combines advances in robotics and neuroscience to enable stroke survivors to restore movement to their paralysed hands.

Neuroplasticity

The brain has a unique ability to reorganise itself by forming new neural connections throughout our lifetime. Neuroplasticity allows the neurons in the brain to compensate and adjust their response to new activities and situations after strokes or brain injuries.
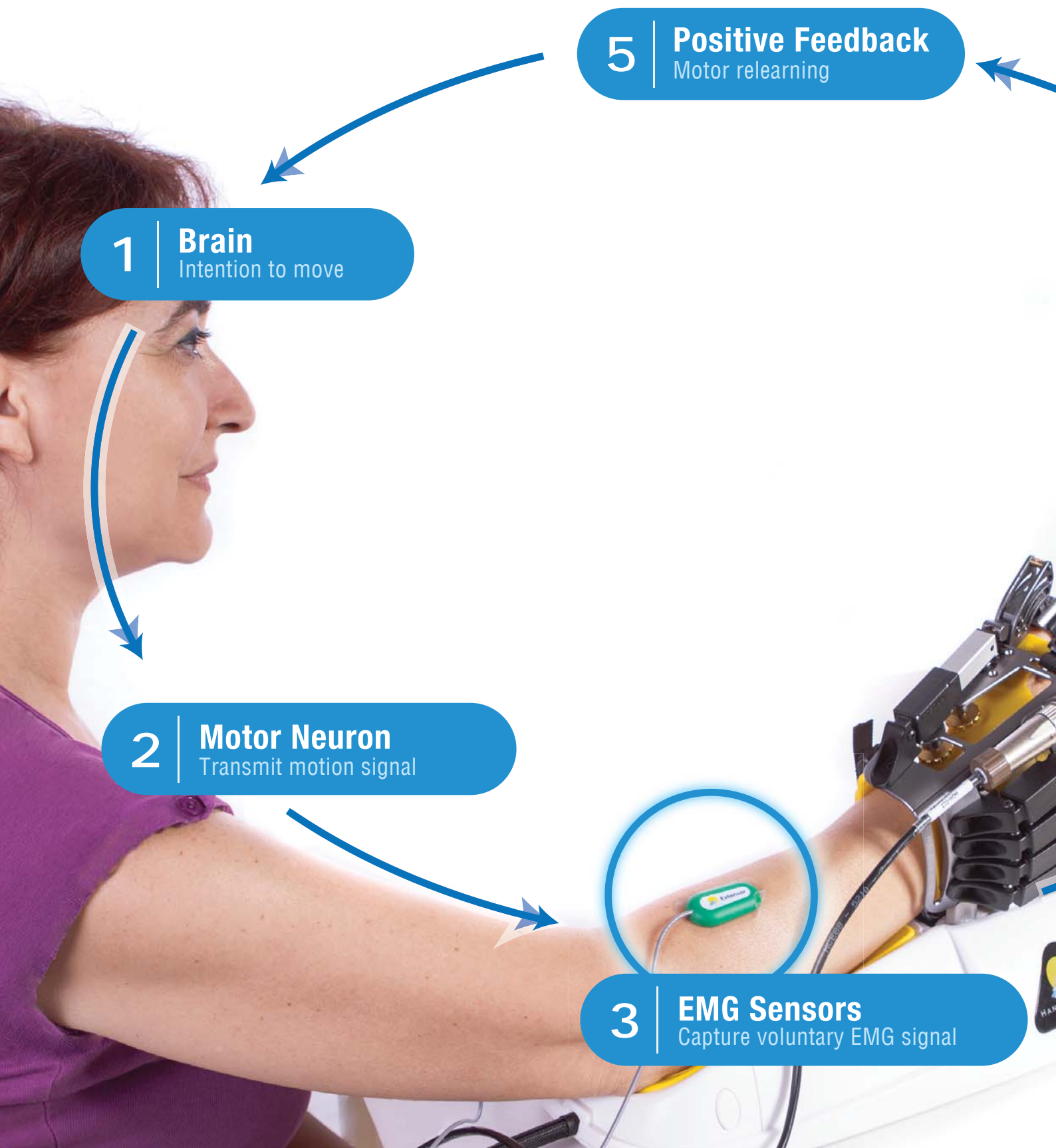
Highly intensive repetition of activities has shown to promote a reconnection of pathways leading to neuromuscular rehabilitation of the hand and forearm that may help patients regain hand mobility through motor relearning.

How the Hand of Hope works

The Hand of Hope is a therapeutic device that may help patients regain hand mobility through motor relearning, the patient self-initiates movement through voluntary EMG signals that indicates an intention to move.

5 | **Positive Feedback**
Motor relearning

1 | **Brain**
Intention to move

2 | **Motor Neuron**
Transmit motion signal

3 | **EMG Sensors**
Capture voluntary EMG signal

1. Intention to Move
The Hand of Hope detects the patient's intention for hand motion using voluntary EMG signals commanded by the brain

2. Motion Signal
The Device processes these signals and delivers them to the hand brace

3. Perform Movement
The Hand brace provides an assistive function for hand motion
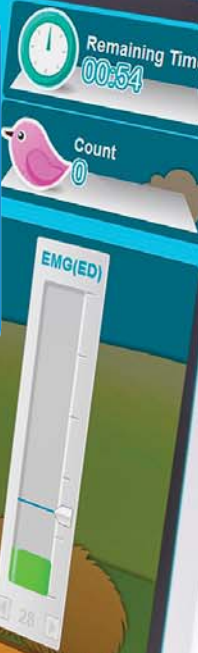
4. Positive Feedback
The Patient relearns hand function through positive feedback

5. Interactive
Real-time interactive games enhance the training outcomes

4 | EMG + HOH
The HOH responds to the user's desire to move the hand through a real time interactive EMG signal displayed on the bar

EMG(PL)

50

Remaining Time
00:54

Count
0

EMG(ED)

28

Open!

R

Hand of Hope basics

The hand brace is worn on the impaired hand with 2 surface sensors attached to the extensor and flexor muscles of the forearm to detect the surface electromyographic signals (sEMG) for active participation during exercise.

Intended Use

The Hand of Hope therapy device is intended for use in patients that require hand and forearm rehabilitation. Potential goals for the use of HOH could be, but not limited to the following:

- Motor learning via interactive use of the biofeedback system
- Help initiation of the voluntary muscle contraction and voluntary movement
- Maintain voluntary muscle contraction and the voluntary movement
- Control of abnormal muscle activity

Indications

- Decreased muscular activity after Stroke, Spinal Cord Injury, Hand / Finger injury
- Difficulty to self-initiate, control or maintain voluntary muscle movement,
- Impaired coordination of voluntary movement of the upper limb

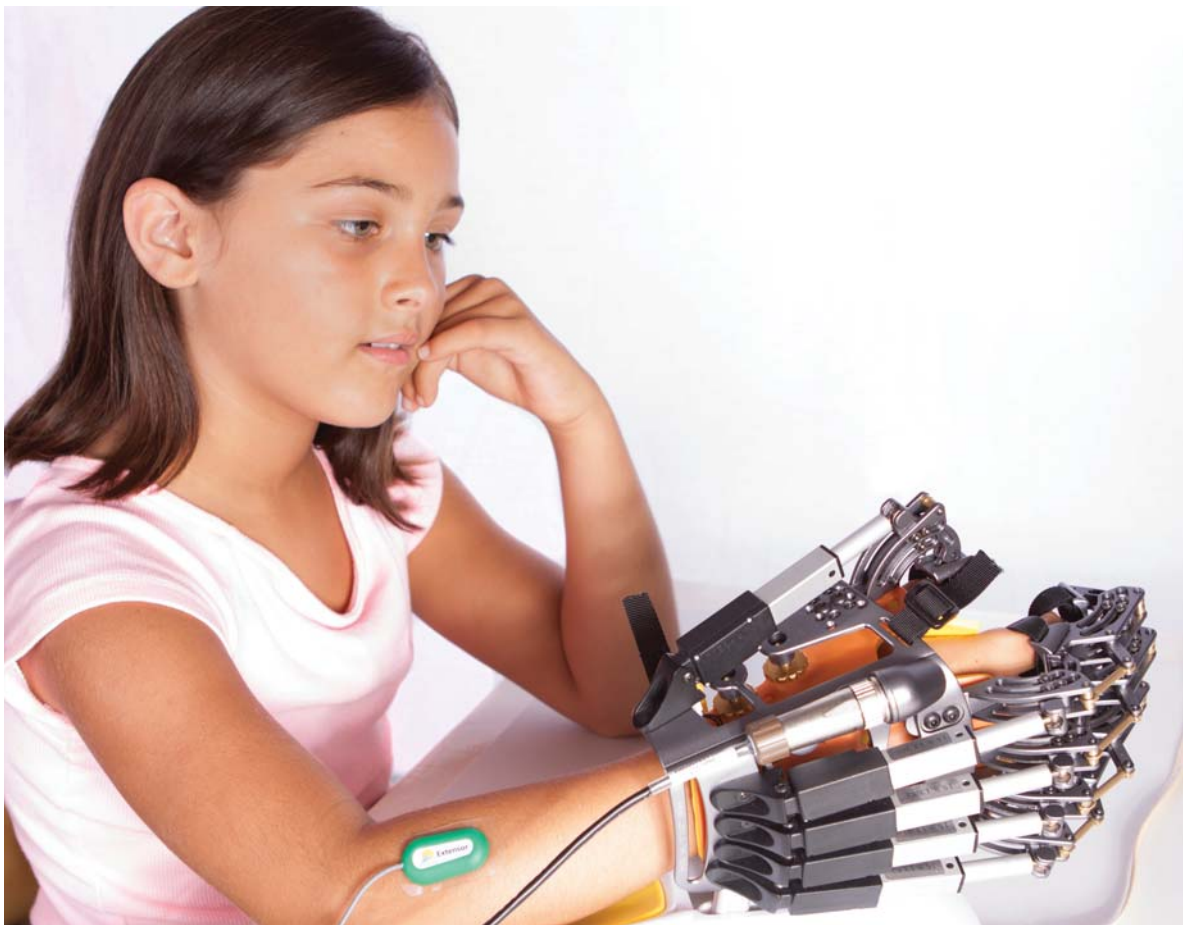## Hand of Hope is used to facilitate

- Initiation of voluntary muscle contraction
- Motor control and coordination
- Muscle relaxation
- Motivation
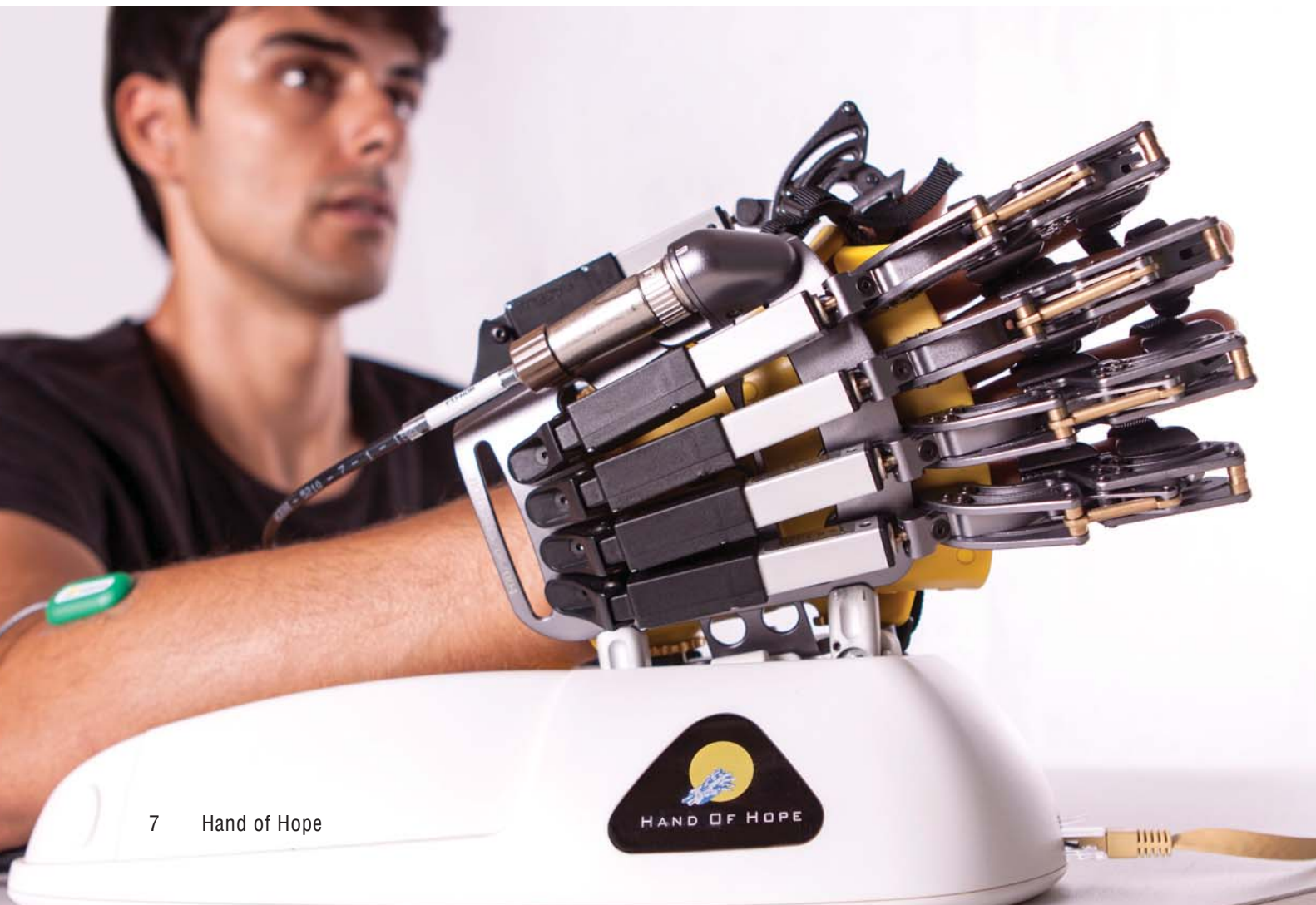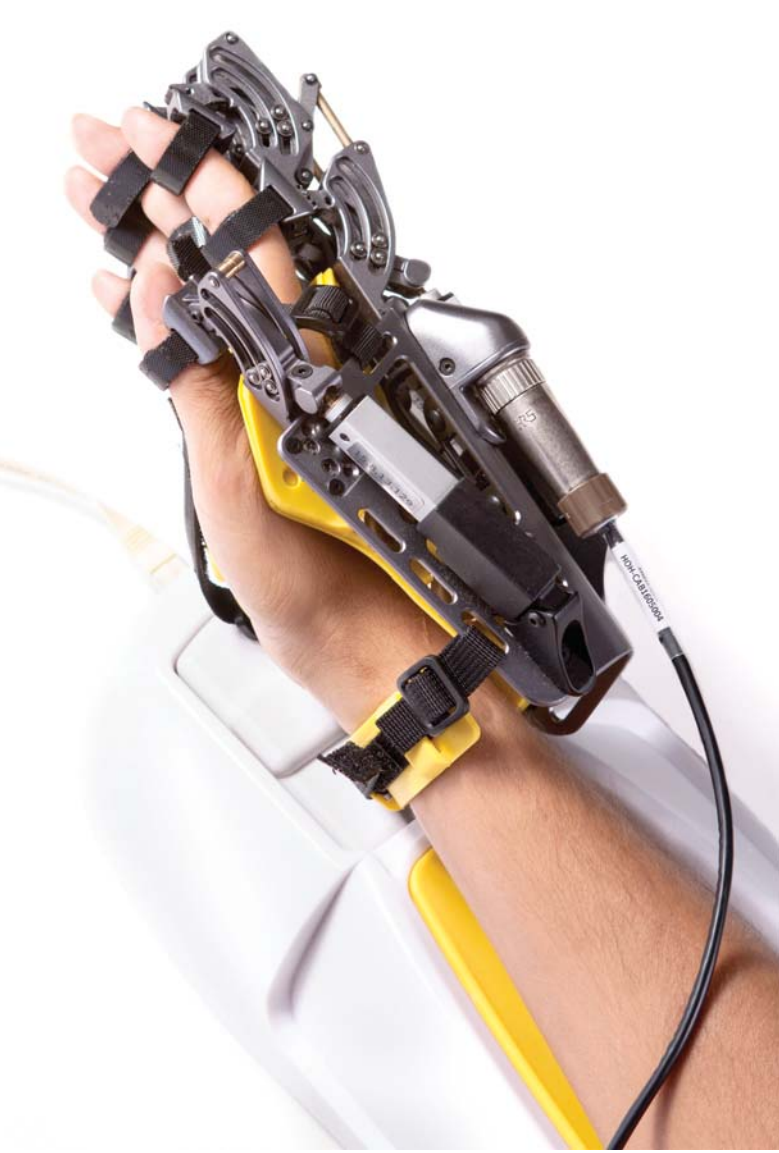- Control of abnormal muscle activity

Children

Robotic rehabilitation in children has many constraints in comparison to adult rehabilitation, these constraints range from the size of the child's hand to the interactive interface design. The Hand of Hope has been successfully applied for use with children, the small hand brace insert allows them to fit securely and enjoy the full range of the interactive games.

Suitable to address neurologic/orthopedic problems of pediatric patients.

7   Hand of Hope

Training Modes

Different training modes allow the therapist to customise the level of assistance that the Hand of Hope provides. The difficulty level of each mode can be adjusted according to the user's need.

Continuous Passive Motion

Movements are passively repeated over time. Two CPM patterns are available for training: hand opening & grasping.

EMG Biofeedback Training

Trigger & Go

The HOH will assist the user in completing the hand motion once the signal is detected above a pre-set sEMG threshold level.

Trigger & Maintain

The HOH will assist the user in completing the hand motion once the signal is detected above a pre-set sEMG threshold level.

Hand Opening Training

An sEMG threshold level can be set by moving the horizontal line in the vertically displayed EMG signal bar on the screen. Thereafter the set EMG threshold level is used as a visual biofeedback displayed on the screen. The patient will need to exceed this threshold level in order to run modes of Trigger & Go and Trigger & Maintain.

Open & Grasp Training

Both opening and grasping are performed according to detected EMG threshold. The movement is controlled completely by voluntary muscle contraction.

Training mode is

Trigger & Go

Grasping Training

The EMG threshold level can be manually changed depending on the clinician's observations by moving the horizontal line in the EMG signal bar up and down.
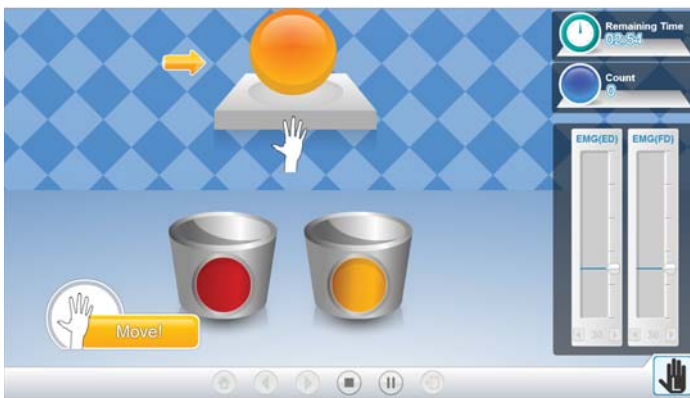
User can select two different training modes:

1. Trigger & Go
2. Trigger & Maintain

For Hand Opening Desperate Bee

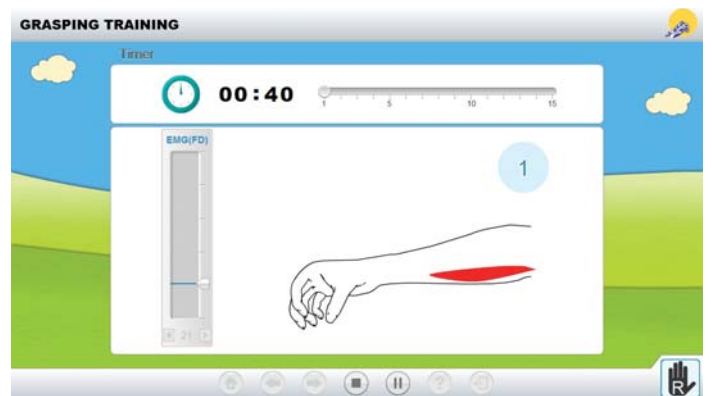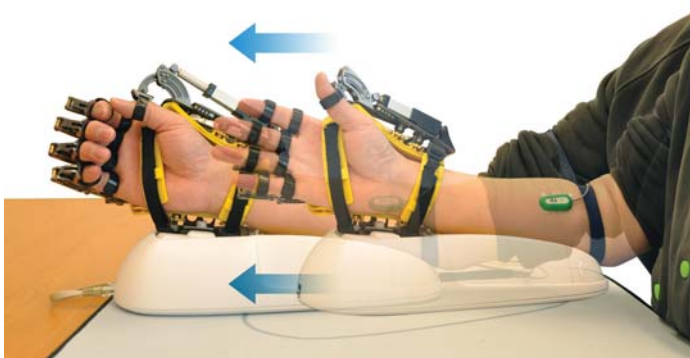**For Hand Opening** Hungry Bird

For Hand Opening & Grasping Ball & Basket

For Hand Grasping UFO Catcher

Training Mode Open & Grasp Training

Training Mode Grasp Training

Training Mode Arm Training

Training Mode Hand Training

Interactive Games

The Hand of Hope's real-time interactive games play an important part in the rehabilitation process and will enhance the training outcomes and help to motivate the patient, increasing the patient's interaction with the therapist
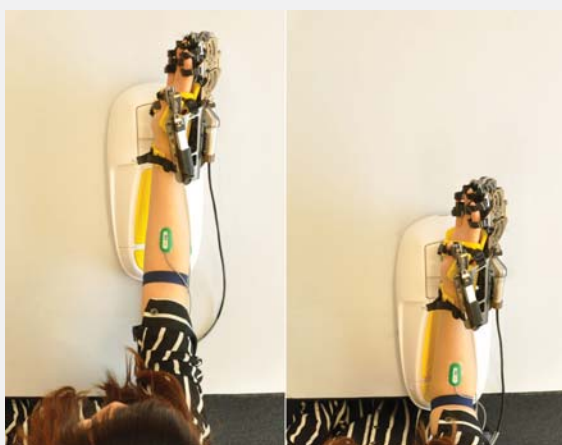
Hand & Arm Training in ONE

Many of the current rehabilitation devices focus primarily on larger joints, e.g. the elbow and the shoulder. Only some focus on hand/wrist training. Overall, these devices rarely work on a complete upper limb movement.

Impairment of the upper limb depends primarily on the loss of hand function and finger dexterity, which is why restoring both distal and proximal motor functions is essential to the completion of daily tasks.

Hand of Hope

Hand of Hope addresses these shortcomings by providing complete upper limb training with coordinated hand and arm movements. It combines executed movements with active control of the Forearm Support.

Arm Training

At later stages of the recovery process, users can train their arm using the Tracking Forearm Support. Levels 3 and 4 of the interactive games require the user to extend their elbow and shoulder to complete game missions.

Training Sessions

Patients may not want their sessions on the interactive games, they can instead use the Training Sessions mode that displays their generated EMG signal, the motion of the hand that they need to move and the muscle group used.

Forearm Support

We use a Forearm Support which not only provides the patient with a comfortable training experience and position but it also acts as a training tool for the elbow, shoulder and to improve eye hand coordination.

Patient Database

Individual patient settings and training details are stored and can be recalled at anytime. Graphical results can be generated and reviewed quickly for data analysis.

Our Principles

The harder you try, the more you're motivated, the more alert you are, the better the potential outcome.

If you're intensely focused on the task and really trying to master something for an important reason, the change experienced will be greater.

Our Approach

Our approach to rehabilitation is that the patient needs to be actively involved, they drive their rehabilitation forward and see the personal gains that can be made using the Hand of Hope.

In active mode we use the EMG sensors and calibrate the robotic hand to the patient's very own signals, that allows the patient who has an intention to move to send a signal direct to the Hand of Hope and it will open or grasp for them.

Why Robotics?

Robotics are becoming more and more common in the enhancement of traditional post-stroke therapies because they provide consistent & precise treatment over longer periods of time.

They can be programmed to perform in different functional modes allowing the therapist varying options in their approach to rehabilitation. Robots can measure and record a range of behaviors in parallel with therapeutic applications which helps to evaluate and track a patient's progress.

Features of the Device

The Hand of Hope is packed full of features to aid and accelerate the rehabilitation process of Patients from the early stages of their injury to achieve their recovery goals.

Passive mode & Active mode

The Hand of Hope has two modes of rehabilitation, not only does it work in Passive Mode but also in Active Mode providing the patient with an exciting focused participation.

Readily available information

Individual user settings and training parameters are stored and analysed giving the therapist access to detailed user progress information.

Comfortable training experience

The hand brace and forearm support of the Hand of Hope are designed to provide optimal user comfort.

Easy-to-use

The interactive software is presented with simple animated instructions and icons help guide the patient through their sessions.

The Velcro finger straps make setting up and removing the hand braces effortless to ensure that the patient is comfortable during this process.

Easy-to-carry

The system is compact, lightweight and can be carried around with ease in a provided carry-case that only weighs 14kg.

Cleaning

The Hand of Hope is easily kept clean, all surfaces of the hand brace and forearm support can be wiped clean using an alcohol spray or wipes and the inserts can be removed and cleaned separately.

Hand of Hope Specification

Model	Small	Medium	Large
Dimensions (W x L x H)	160x250x120mm	160x250x120mm	180x250x120mm
Weight	700g	700g	800g
Internal Platform Range	88-100 mm	100-115 mm	115-130 mm
Dimension of Forearm Support (W x L x H)	162 x 336 x 69 mm		
Classification	Class IIA Medical Device		

US Patent No.: 9,532,916

CE 0482

The Hand of Hope System and Packages

Hand of Hope (small-to-medium)

- 1 pair of S-to-M hand braces
- Internal Platform & Strap Pad Set (S & M sizes)
- Advanced Training Software including CPM mode, EMG mode, Patient Database and 5-game Module
- Advanced Forearm Support
- Portable Workstation
- Carrying Case
- Wireless Touch Keyboard
- Cables and Accessories

Hand of Hope (small-to-medium, large)

- 1 pair of large hand braces
- 1 pair of S-to-M hand braces
- Internal Platform & Strap Pad Set (S, M & L sizes)
- Advanced Training Software including CPM mode, EMG mode, Patient Database and 5-game Module
- Advanced Forearm Support
- Portable Workstation
- Carrying Case
- Wireless Touch Keyboad
- Cables and Accessories

Hand of Hope Extension Kit

- Internal Platform & Strap Pad Set (S & M sizes)
- Advanced Training Software including CPM mode, EMG mode, Patient Database and 5-game Module
- Advanced Forearm Support
- Portable Workstation
- Carrying Case
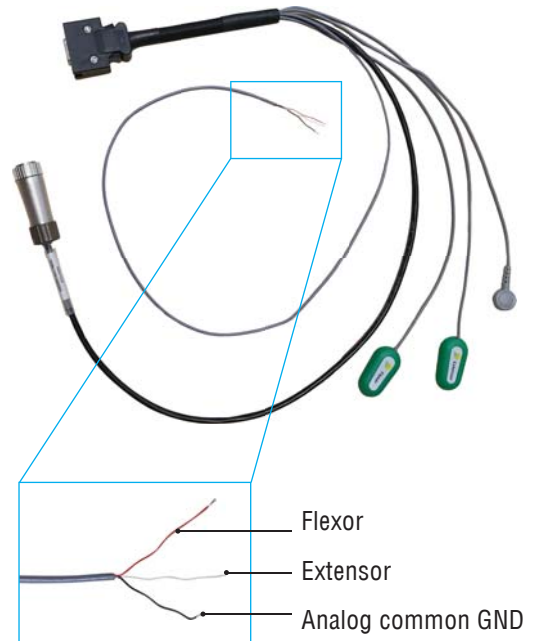- Wireless Touch Keyboard
- Cables and Accessories

* No monitor is provided

Hand of Hope Research Model

What does it do?

The Hand of Hope Research Model is a special edition designed to perform scientific analysis for research purposes. The model has additional features and components:
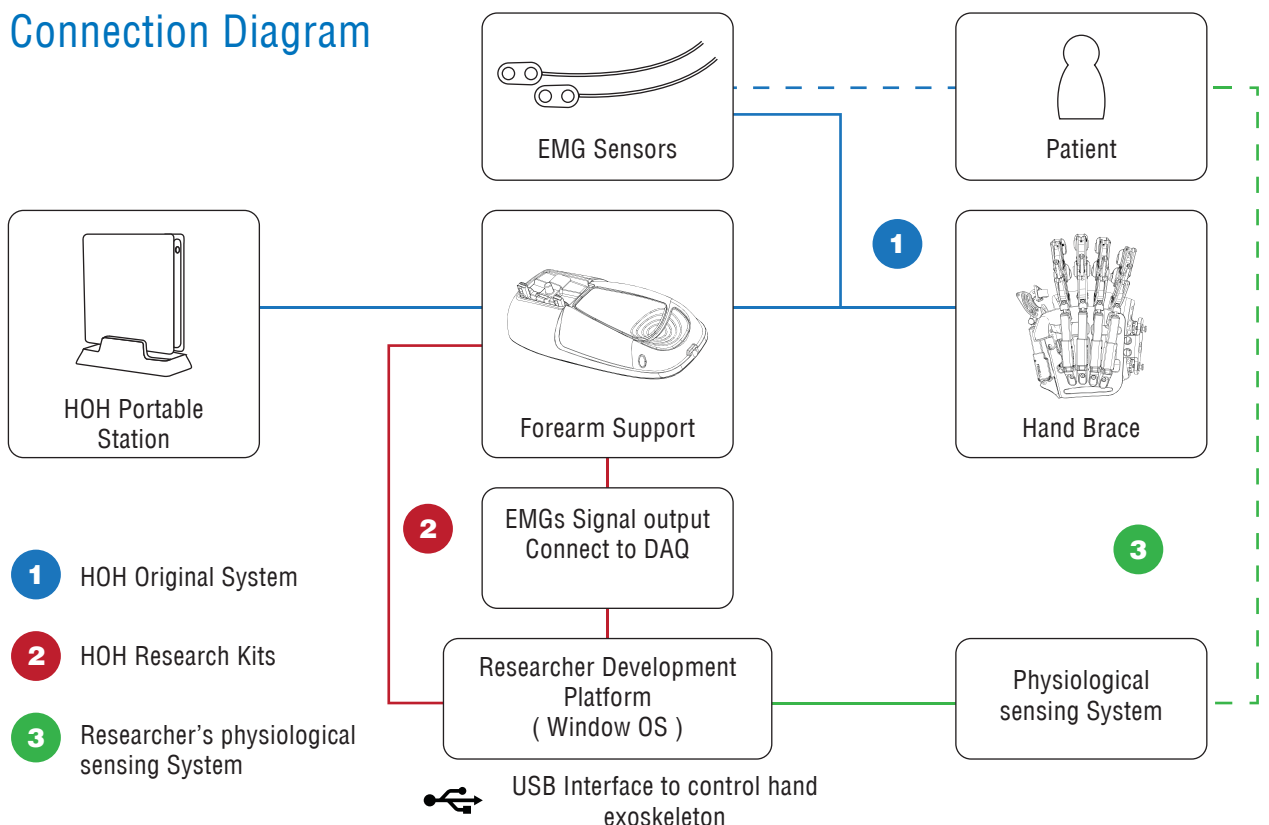
- Allows to combine a variety of physiological sensing technologies such as EEG, Strain Gauge (force), MMG
- Access to real-time EMG signals
- Console software application can be built to control the motion with API
- New algorithms can be programmed and applied

Contents

- Hand of Hope System (s-m)
- Power and USB Adapter
- Power and Sensing cable with 2 EMG signal outputs (pictured)
- Optional: NI Data Acquisition Device (DAQ) Model USB-6216 with USB interface

Flexor
Extensor
Analog common GND

Connection Diagram

EMG Sensors

Patient

HOH Portable Station

Forearm Support

Hand Brace

1 HOH Original System

2 HOH Research Kits

3 Researcher's physiological sensing System

2 EMGs Signal output Connect to DAQ

3 Physiological sensing System

Researcher Development Platform (Window OS)

USB Interface to control hand exoskeleton

Note: When operating the HOH Research Kit, HOH portable station is no longer connected or hosted by the system control. The Research Platform hosts the whole system control.

Rehab-Robotics

Member of Vincent Medical Holdings Limited

We are Rehab-Robotics...

Rehab-Robotics is an award winning company committed to advance technologies in the rehabilitation profession to help patients achieve their maximum recovery outcomes.

We are dedicated to provide the integration of robotics into a patients training activities of daily living, continuous education and professional support.

Rehab-Robotics Company Ltd.

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HAND OF HOPE®