INMOTION ROBOT-ASSISTED THERAPY

EVIDENCE-BASED NEUROREHABILITATION
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THE USE OF ROBOTICS FOR NEUROREHABILITATION

AHA Stroke Care Guidelines Recommend Robot-Assisted Therapy for Care in the Inpatient, Outpatient Setting and Chronic Care Settings

American Heart Association Scientific Statement Published in Stroke Miller et al. (2010); 41:2402-2448

Care in the Inpatient Setting  

- “Robot-Assisted UPPER EXTREMITY therapy, however, can improve motor function during the inpatient period after stroke”174 175 176  
- FIM® score improvement 30% greater than control group

Improvement from robot therapy was maintained on a 3 year follow up evaluation  
The InMotion ARM™ Robot Drives Functional Gains in the Inpatient Setting

Care in the Outpatient Setting  

- “Robot-assisted therapy has been shown to improve UPPER EXTREMITY motor function in outpatient and chronic care settings”143

The Inmotion ARM™ Robot Drives Functional Gains in the Outpatient Setting

Care in the Chronic Care Setting  

- Class I Level of Evidence A

INMOTION ROBOTS™

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SIZE OF TREATMENT EFFECT

CLASS I
Benefit >> Risk
Procedure/Treatment SHOULD be performed/administered

CLASS Ila
Benefit >= Risk
Additional studies with focused objectives needed
IT IS REASONABLE to perform procedure/administer treatment

CLASS Iib
Benefit < Risk
Additional studies with broad objectives needed; additional registry data would be helpful
Procedure/Treatment MAY BE CONSIDERED

CLASS III
Risk > Benefit
Procedure/Treatment should NOT be performed/administered SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL

LEVEL A
Multiple populations evaluated
Data derived from multiple randomized clinical trials or meta-analyses

LEVEL B
Limited populations evaluated
Data derived from a single randomized trial or non-randomized studies

Suggested phrases for writing recommendations:
should is recommended
is indicated
is useful/effective/beneficial
may/might be considered
may/might be reasonable
may/might be useful/effective/uncertain
is not recommended
is not indicated
should not
is not useful/effective/beneficial
may be harmful

ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT
THE USE OF ROBOTICS FOR NEUROREHABILITATION

VA/DOD Clinical Practice Guidelines 2010 for The Management of Stroke Rehabilitation Upper Extremity—Department of Veterans Affairs and Department of Defense

RECOMMENDATION:
Robot-assisted movement therapy as an adjunct to conventional therapy in patients with deficits in arm function to improve motor skill at the joints trained.

THE COCHRANE COLLABORATION

“The Cochrane Collaboration provides an international benchmark for the independent assessment and assimilation of scientific evidence” — World Health Organization

OBJECTIVE:
“Assess the effectiveness of robot-assisted arm training to improve ADL’s, arm function, arm muscle strength”

STUDIES ANALYZED:
19 randomized controlled clinical trials

RESULTS:
“Patients who receive electromechanical and robot-assisted arm training after stroke are more likely to improve generic ADL’s and paretic arm function”

(From page 4)

A partial list of some of our clinical partners:

<table>
<thead>
<tr>
<th>Clinical Partner</th>
<th>Location</th>
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<tbody>
<tr>
<td>Frazier Rehabilitation Institute</td>
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<td>Burke Rehabilitation Center</td>
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<td>VA Healthcare System</td>
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<td>Cardinal Hill Hospital</td>
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<td>Rede de Reabilitação Lucy Montoro Hospital</td>
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<td>Chang Gung University</td>
<td>Taiwan</td>
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## Evidence-Based Neurorehabilitation Technology

### InMotion Robotic Therapy

#### Conventional

- Focuses on compensation
- Uses labor intensive manual methods, one therapist per patient
- Treatment protocols not reproducible, vary in duration, intensity and frequency
- Assumes gains in motor function not possible for long term stroke survivors
- Patients have a difficult time adhering to therapy
- Time consuming traditional evaluation, difficult to distinguish true recovery from compensation
- Conventional care cost (expensive)

#### InMotion Interactive Robotic Therapy

- Focuses on reducing impairment — translating motor skill to improve function
- One therapist may treat multiple patients
- Evidence based treatment protocols — reproducible, quantifiable, high intensity task specific therapy (over 1000 movements per typical session)
- The positive results of InMotion Interactive Robotic Therapy have been shown to be:
  1. Effective at reducing impairment and improving function
  2. Long lasting
  3. Can occur even when started years after the persons’ initial injury
  4. Cost effective
- Injured brain can recover through plasticity based remapping of pathways
- Motivates patients for active participation
- Provides objective feedback during therapy
- INMOTION Eval™ quantifies upper extremity motor control and movement recovery allowing clinicians to distinguish true recovery from compensation. Correlated with traditional evaluation measures
- Better outcomes at lower cost

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1. Extensive bibliography, for more information please contact IMT or visit our website to view the clinical research with INMOTION robots
InMotion Robots are suitable for a broad range of patients, even those with very limited movement. It is the ideal clinical tool for the episode of care across settings.

**SUITABILITY OF INMOTION ROBOTIC THERAPY**

Cerebral Palsy

STROKE

TRAUMATIC BRAIN INJURY
Interactive Motion Technologies (IMT) is the global pioneer and leader in providing effective robotic tools for neurorehabilitation professionals. Developed at the Newman Laboratory for Biomechanics and Human Rehabilitation at the Massachusetts Institute of Technology (MIT), InMotion Robots are the most thoroughly researched technology available in the rehabilitation industry.

InMotion robotic therapy augments each patient's remarkable capability to learn, reacquire and improve motor skills using the brain's own inherent neuroplasticity. InMotion robots' patented Assist as Needed™ technology and evidence-based treatment protocols ensures patients are continuously engaged and able to perform over 1000 movements per interactive therapy session.

By applying the latest research in neuroscience, neurorehabilitation and biomedical engineering, IMT is redefining recovery for neurorehabilitation professionals, patients and their families.

Our mission is to improve function and quality of life to the broadest possible range of neurologic patients.

**Between 1994 and 1998 the MIT-Manus was tested with over 250 Stroke Patients**

| 1989 | MIT-MANUS PROJECT INITIATED |
| 1994 | MIT-MANUS CLINICAL DEBUT |
| 1998 | MIT-MANUS Clinical Debut |
| 2010 | InMotion Robots available for clinical use |
| 2012 | National Health Service UK |

**From 1998-2010, InMotion Robots were tested with over 800 stroke patients in the world’s leading medical research institutions**

| 1994 | Burke Rehabilitation Hospital where it has been in daily operation since 1994. |
| 2010 | MIT-Manus was tested with over 250 Stroke Patients |
| 2012 | InMotion Robots were selected by the National Health Service (NHS) and its National Institute for Health and Clinical Excellence (NICE) to examine the efficacy and effectiveness of robotic therapy in the UK medical system. According to NHS this is the largest ever stroke rehabilitation study in the British Healthcare System |

**3 CORE DESIGN PRINCIPLES**

- Backdriveable Robotic Hardware
- Impedance Control Assist-as-needed™
- Modular Rehabilitation System

Today the American Heart Association, American Stroke Association and the Department of Veterans Affairs all include robot-assisted therapy in their stroke rehabilitation guidelines for moderate to severe patients with upper extremity disability.
Dan Parkinson PT, MBA Director of Rehabilitation, Braintree Rehabilitation Hospital, Braintree, MA

“Braintree believes that their investment in InMotion and other rehab technology has made a favorable impact on the hospital. “It is hard to attribute any specific initiative to inpatient volume growth, however Braintree believes evidence-based technology has helped to increase admissions of neurologic patients for both inpatient and outpatient programs”, says Parkinson. “Technology has also helped with our therapist recruitment and retention. Our clinical staff is excited about contributing to the development of clinical applications for rehab technology. Braintree is proud that we can offer patients such innovative treatment.”
Clinical research designed to measure the intensity of therapy needed to augment neuroplasticity shows at least 400 repetitions are required. InMotion Robots are designed to deliver over 1000 repetitions in a typical therapy session.
LONG LASTING IMPROVEMENTS

Patients from an early clinical study were recalled up to three years later, and those patients who received interactive robotic therapy sustained their improvement over those who did not. Moreover, subsequent follow-up studies re-examining these patients also confirmed the findings.


IMPROVEMENT CAN OCCUR EVEN SEVERAL YEARS POST ONSET OF INJURY

A multi-center VA study of 127 patients with long-term severe to moderate upper-limb impairment from a stroke that occurred at least 6 months before enrollment (average time of 4.7 years, 33% with multiple strokes) found that “the improvements… provide evidence of potential long-term benefits of rehabilitation and challenge the widely held clinical belief that gains in motor function are not possible for long term stroke survivors.”


Patients, who had suffered a single unilateral stroke one to five years earlier and who were demonstrated to be in a “stable phase,” showed significant improvement after receiving robotic therapy three times a week for six weeks. These findings also suggest that such patients have potential for further recovery which conventional therapy has been unable to tap into.


“Thanks to the InMotion Arm Robot, I am now able to use my left arm to hold my granddaughter on my lap to read to her. I’m more balanced and have greater endurance when I walk. After the first robotic session, I was able to lift my left foot up to my buttock.”

David Karchem, stroke patient and volunteer, Rancho Los Amigos Rehabilitation Hospital
EVIDENCE-BASED NEUROREHABILITATION TECHNOLOGY

PUBLISHED RESEARCH USING INMOTION ROBOTS

LOWE-EXTREMITIES


IMT in close collaboration with the Newman laboratory for biomechanics and human rehabilitation at MIT has developed the “ANKLEBOT”. The technology uses patented Assist-as-Needed™ technology and the initial results are quite encouraging.

Lee Hyunglae, Ho Patrick “Multivariable Static Ankle Mechanical Impedance with Relaxed Muscles,” Journal of biomechanics (44) 2011

CEREBRAL PALSY

IMPROVEMENT IN COORDINATION AND FUNCTION

12 children aged 5-12 with Cerebral Palsy and upper-limb hemiplegia received robotic therapy twice a week for 8 weeks. The children showed significant improvement in total Quality of Upper Extremity Skills Test (QUEST) and Fugl-Meyer Assessment Scores.

A questionnaire administered to the children’s parents also showed significant improvement in how the children used the paretic arm during functional tasks at home.


“A child’s brain is much more plastic than an adults brain, so if adults can make gains perhaps children with CP can make even larger gains”.

In our initial studies we saw gains that were completely unexpected!

Blythedale Children’s hospital

Chief medical officer – Dr. Joelle Mast
Blythedale Children’s hospital

Please see Dr. Joelle Mast in this video:
Robotics Helps Tappan Girl Move Again

By Randi Weiner

To her mother, her special-education teacher and her therapists, watching 8-year-old Heather Matthew use both hands to cut out magazine pictures and glue them onto paper is like watching a miracle unfold.

Heather’s left side has been paralyzed since she was an infant. About 18 months ago, she qualified for an experimental program at Blythedale Children’s Hospital in Valhalla using MIT-created robots to move her left arm in a circle hundreds of times to see if it would help return movement to her left side.

The results have been outstanding, said Donna Matthews of Tappan, Heather’s mother. Two days before her First Communion in May, Heather raised her left arm as high as her ear – the first time she had done since she was 17 months old.

“I think she’s really come a long way in the last two years,” said Eleanor Lacovetta, who has been Heather’s occupational therapist for three years and was helping her with the cut-and-paste project yesterday at her Rockland Board of Cooperative Education Services summer school class.

“Her fine motor skills have really improved. Now, when she’s engaged in a cutting activity, she’s stabilizing the paper with her left hand and bringing it to the cutting edge and helping guide the paper to the scissors. She was never able to do this before,” Lacovetta said.

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Dan Fink — President and CEO, Riley’s Children’s Hospital — INDIANA
http://www.youtube.com/watch?v=YJ7HcMqdDw

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Krebs, HI, et al., “Robot-assisted task-specific training in cerebral palsy,” *Developmental Medicine and Child Neurology*, 51 (Suppl. 4)


Published research using Inmotion robots

stroke


PUBLISHED RESEARCH USING INMOTION ROBOTS

STROKE (CONT.)


PUBLISHED RESEARCH USING INMOTION ROBOTS

STROKE (CONT.)


UPPER-EXTREMITY


PUBLISHED RESEARCH USING INMOTION ROBOTS

UPPER-EXTREMITIES (CONT.)


LOWER-EXTREMITIES


CEREBRAL PALSY


CHILDREN


SPINAL CORD INJURY

Improvement in Strength and Function

A pilot study of two patients with incomplete spinal injuries, level C4-6, that had occurred greater than two years ago, was conducted at Burke Rehabilitation Hospital. Patients received treatment on the InMotion ARM™ robot for 18 sessions over 6 weeks with one arm followed by 18 sessions over 6 weeks with the other arm. Patients showed changes greater than 10% in Fugl-Meyer Scores and 20% in the Motor Power Scales. The study also showed that while one arm was treated, both arms showed comparable improvement.


MULTIPLE SCLEROSIS (MS)

A pilot study of two MS patients at the West Haven VA Medical Center has shown that treatment with the InMotion AnkleBot twice a week for twelve total sessions resulted in significant improvement in torque production at the ankle and movement accuracy. Although the training did not include gait activities the researchers noted carry over improvement in gait function when measured through six-minute walk tests.


PARKINSONS


BOOK CHAPTERS

Dietz, Volker; Nef, Tobias; Rymer, William Zev (Eds.) 2012, “Neurorehabilitation Technology” Chapter 8 Forging Mens et Manus: The MIT Experience in Upper Extremity Robotic Therapy


Krebs, H.I., Hogan, N., “Robotic Rehabilitation Therapy,” Editor, Metin Akay, Wiley Encyclopedia of Biomedical Engineering, 2006


“Advances in robotics and an increased understanding of the latent neurologic potential for stroke recovery led to our initiation of this multicenter, randomized, controlled trial, called the Veterans Affairs (VA) Robotic-Assisted Upper-Limb Neurorehabilitation in Stroke Patients study, to determine whether a rehabilitation protocol using the MIT–Manus robotic system (Interactive Motion Technologies), as compared with a program based on conventional rehabilitative techniques or usual care, could improve functioning and quality of life of stroke survivors with long-term upper-limb deficits.”

**COST OF ROBOTIC INTERVENTION**

- Personnel Time
- Capital cost of robot system (3 modules)
- Financing costs
- Annual maintenance contract
- 5 year-life span for robotic system
- Facility overhead

Average per patient additional cost of therapy

- Robot Therapy $5,152
- ICT $7,382
- Usual Care $0

**TOTAL COST OVER 36 WEEKS**

Therapy + all other healthcare utilization

- Robot $17,831 (other healthcare $12,679)
- ICT $19,746 (other healthcare $12,364)
- Usual Care $19,098 (other healthcare $19,098)

**Conclusion:** “The added cost of delivering robot or intensive comparison therapy was recuperated by lower healthcare use costs compared with those in the usual care group”

Important results for ACO/ bundled payment models proposed under healthcare reform
### EVIDENCE-BASED THERAPY PROTOCOLS

- Consistent with principles of motor learning
- Simple clinical integration
- Easy to use “Click and go” protocols
- Intuitive user interface
- Ensures over 1000 repetitions are completed in a therapy session
- In session performance feedback

### INPATIENT SETTING

- 5x/week, 1 hour per day in adjunct to Conventional Physical Therapy and Occupational Therapy
- Maximizes functional recovery*

### CLINICAL OUTCOMES FROM A RANDOMIZED CONTROLLED CLINICAL TRIAL

<table>
<thead>
<tr>
<th>GROUP</th>
<th>FIM MOTOR</th>
<th>FIM COGNITION</th>
<th>MOTOR POWER</th>
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<tr>
<td>CONTROL</td>
<td>19.5</td>
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<tr>
<td>INMOTION ROBOT</td>
<td>25</td>
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### A 31 POINT CHANGE IN FIM® SCORE FOR THE ROBOT TREATED GROUP

* Robot training enhanced motor outcome in patients with stroke maintained over 3 years.

INMOTION ROBOTIC THERAPY PROTOCOLS

OUTPATIENT SETTING
- 3x/week, 1 hour per day
- At least 18 sessions

MEASURED CLINICAL OUTCOMES VA-ROBOTICS – RCT
Impairment
- Fugl Meyer

Function
- Wolf Motor Function

Quality of Life
- Stroke Impact Scale

InMotion Robotic Therapy Superior to Conventional Therapy in ALL Clinical Outcomes.
INMOTION EVAL™ — WORLDS FIRST INTELLIGENT EVALUATION SYSTEM

- Quantifies upper extremity motor control and movement recovery
- Establishes a baseline and measures progress to
  - Determine medical necessity
  - Justify continuation of treatment based upon measurable gains
- Measures effectiveness of treatment intervention (robotic and other)
- Five evaluation tests
- Takes about 20 minutes
- Robot generates 4 evaluation reports
- Uses technology to objectively measure motor control more consistently, reliably and efficiently then a human-administered clinical scales.
- First step towards a unified, automated measure of the outcomes
- Robot records kinematic and kinetic elements of upper extremity movement. (Position, Direction, Area, Time, Force)
- Robot calculates 13 evidence-based measures of motor control that are highly correlated with Fugl-Meyer, Motor Power and NIH Stroke Scale performance.
- Performance translates to function.

FIVE EVALUATION TESTS — EFFICIENT

1. Circle tests – Set of 4 trials, total 20 circles
2. Point-to-Point 80 Movements towards a target
3. Playback Static – stabilization, isometric hold
4. Round Dynamic – Movement against resistance, isotonic
5. InMotion Maximum Force (optional feature)

THE INMOTION ROBOT CALCULATES 13 NEW MEASURES OF MOTOR CONTROL AND MOVEMENT RECOVERY

CIRCLE TESTS

InMotion Circle Size™ measures the size of the circle which indicates the patient’s range of motor coordination. To perform a functional extremity task: dressing, bathing, feeding etc. A patient must plan, sequence, and time movements over a broad range or area.

InMotion Joint Independence™ measures the patient’s ability to freely coordinate their arm purposefully in all directions. Joint independence is required for functional tasks: placing an arm in a sleeve, grooming hair, giving a hug, etc.

PLAYBACK STATIC

InMotion Stabilization™ measures a patient’s ability to employ shoulder and elbow muscles to stabilize position when external force is applied. Upper extremity weight bearing requires the shoulder and elbow muscles to co-contract to maintain a position. Shoulder and elbow stabilization is essential for resting on an elbow, pushing up from a chair, opening a door, automatic reactions such as protective extension, etc.
**Evidence-based neurorehabilitation technology**

**InMotion Maximum Force** *(optional feature)*

InMotion Maximum Force measures maximum strength a patient can exert in shoulder flexion, extension, adduction, and abduction.

The four shoulder tests: shoulder flexion/extension and shoulder adduction/abduction measure the patient’s ability to generate a maximum force.

Applying forces with shoulder muscle groups is essential for functional independence. Examples include using a hammer, opening a can, push up from a chair, stabilizing balance with a cane, giving a hug, cutting food, etc.

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**Interactive Motion Technologies**

Redefining Recovery™
According to the American Heart Association, the Department of Veterans Affairs and the latest Cochrane Report, upper extremity robot-assisted therapy can make a modest but significant clinical impact in the functional outcomes (FIM®) of stroke patients in the inpatient and outpatient settings.

**EVIDENCE-BASED NEUROREHABILITATION TECHNOLOGY**

Drawing circles with the InMotion Robot is part of the clinical evaluation protocols included in the InMotion Eval™ software.

The following are circles drawn by a chronic stroke patient. On the Left is the admission plot and on the right is the discharge plot following 6 weeks of InMotion Therapy.

(The robot does not provide assistance during evaluation)

**WHAT IMPROVEMENTS IN FUNCTIONAL ABILITIES DO PATIENTS OR THERAPISTS REPORT?**

Examples of new abilities using affected affected arm following robot assist-as-needed™ therapy:

- Put on a shirt or jacket
- Hold a shopping bag
- Push open a door
- Pick up a laundry basket
- Turn on a light switch
- Do household chores
- Pick up a cup of coffee
- Put a leash on a dog

By applying the latest research in neuroscience, neurorehabilitation and biomedical engineering, IMT is Redefining Recovery for neurorehabilitation professionals, patients and their families.

Our mission is to improve function and quality of life to the broadest possible range of neurologic patients.
Clinical application case: InMotion WRIST™

**ROBOTIC WRIST THERAPY**

**Chronic stroke patient before therapy**—patient can’t extend the left wrist

**Does NOT qualify for Constraint-Induced Movement Therapy**

After wrist therapy with the InMotion WRIST™—patient can now reach all targets

**Qualifies for Constraint-Induced Movement Therapy**

**ROBOTIC WRIST THERAPY**

severely impaired patient

**CIMT**

mildly impaired patient
IMT’s modular, “gym-of-robots” systems approach to neurorehabilitation is the only system designed to optimize the use of robotics for neurorehabilitation in a manner that is consistent with the latest clinical research and neuroscience, taking into account the latest understandings on motor learning interference and motor memory consolidation. For instance, training planar and vertical (anti-gravity) movements in alternate days leads to significant functional improvements. By measuring patient kinematic and kinetic data objectively, IMT’s robots have shown that for severe to moderate brain injury the effectiveness of therapy is optimized by allowing the robots to focus on reducing impairment and allowing the therapist to assist on translating the gains in impairment into function.


Better outcomes with gravity compensated planar InMotion ARM™ robot.

EVIDENCE-BASED NEUROREHABILITATION TECHNOLOGY

INMOTION ANKLE™ INTERACTIVE THERAPY SYSTEM

Examples of trajectory changes on 10 repetitions of a standard unassisted plantar flexion and dorsiflexion ankle targeting tasks before and after 6 weeks of performance-based training with the InMotion ANKLE™ Robot. Note the improved consistency of responses, increased velocity (steeper slope) and smoother trajectories.

"Ankle Training With a Robotic Device Improves Hemiparetic Gait After a Stroke," Larry W. Forrest-er, Anindo Roy, Hermano Igo Krebs and Richard F. Macko, Neurorehabil Neural Repair published online 29 November 2010

Partial list of Research Partners:

- Bambino Gesu, San Marinella, Italy
- Veterans Administration Hospital, Baltimore, MD (USA)
- Veterans Administration Hospital, Providence, RI (USA)
- Franciscan-Mount Sinai, Hartford, CT (USA)
- North Shore Jewish Long Island, NY (USA)
- University Sao Paulo, Sao Carlos, Brazil

MORE DETAIL:

The InMotion ANKLE™ can deliver a continuous net torque of ~23 Nm in dorsiplantarflexion and 15 Nm in eversion-inversion.

The robot can estimate ankle angles with an error less than 1° in both planes of movement (maximum 1.5°) over a wide range of movement (60° in dorsiplantarflexion and 40° in eversion-inversion) and can measure ankle torques with an error less than 1 N·m.

It has low friction (0.744 N·m) and inertia (0.8 kg per actuator for a total of 1.6 kg at the foot) to maximize the backdriveability.

Although the device adds some weight to the leg, a previous study has shown that unilaterally loading the impaired leg with the additional mass of the InMotion ANKLE™ had no detrimental effect on the gait pattern in subjects with chronic hemiparesis (Khanna et al. 2010).
INMOTION ARM™ INTERACTIVE THERAPY SYSTEM

INMOTION ARM™

The InMotion ARM™ Robot is evidence based, intelligent interactive technology that is capable of continuously adapting to and challenging each patient’s ability. This allows the clinician to efficiently deliver optimum intensive sensorimotor therapy to neurologic patients.

Robotic arm with two active degrees of freedom

- Elbow flexion/extension
- Shoulder protraction/retraction
- Shoulder internal/external rotation
- Shoulder flexion/extension
- Shoulder abduction/adduction

The most thoroughly researched device for upper extremity neurorehabilitation

- 800+ patients
- Large multi-site randomized controlled clinical trials
- Easy to use technology allows for high repetition 400-1000 reps/session
- Task specific to reduce impairments in the affected limb(s) focusing on improving patient’s:
  - Range of Motion
  - Coordination
  - Strength
  - Movement Speed
  - Movement Smoothness
- Easy-to-use, grab and go set up
- Direct wheelchair access
- Print patient progress reports directly from the robot

Broad clinical application shown to improve functional outcomes across the continuum of care.¹

Clinical research has shown improved patient outcomes

Stroke
Cerebral Palsy
Traumatic Brain Injury

Today the American Heart Association, American Stroke Association and the Department of Veterans Affairs include robot-assisted therapy in their stroke rehabilitation guidelines for moderate to severe patients with upper extremity disability.

The InMotion HAND™ Robot senses patient forces and assists the patient as needed, continuously adapting to each patient’s abilities allowing the clinician to deliver optimum intensive sensorimotor grasp and release hand therapy.

The InMotion HAND™ is an “add-on” optional module that attaches to the InMotion ARM™ Robot.
**EVIDENCE-BASED NEUROREHABILITATION TECHNOLOGY**

**INMOTION ARM™ INTERACTIVE THERAPY SYSTEM**

**INMOTION ARM™ SOFTWARE**

**Intensive** — 1024 movements per therapy session

Evidence-based treatment protocols.

Therapy protocols allowing clinicians to customize treatment.

Therapeutic exercise Games for:
- Motor planning
- Eye-hand coordination
- Attention, visual field deficits/neglect
- Massed practice

Performance feedback metrics

**INMOTION EVAL™**

Quantifies upper extremity motor control and movement recovery allowing clinicians to distinguish true recovery from compensation

Establishes a baseline and measures progress to:
- Determine medical necessity
- Justify continuation of treatment based upon measurable gains

Quantifiable measures for:
- Shoulder stabilization
- Smoothness of Arm movement
- Arms ability to move against resistance
- Mean and Maximum arm speed
- Arm Reaching error
- Joint independence

Correlated with traditional assessment scales: Fugl-meyer, Motor-Power and NIH stroke scale performance*

**MAXIMUM SHOULDER FORCE**

Optional InMotion Eval module.

Allows clinicians to measure a patient’s ability to generate maximum shoulder flexion/extension, adduction/abduction force.

**Custom Designed Technology**

6 degree-of-freedom force-torque sensor monolithic aluminum device containing analog and digital electronics systems. Module attaches to the InMotion ARM™ Robot.

**To see how Interactive Motion Technologies is redefining recovery™ visit www.interactive-motion.com or call 617.926.4800**

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EVIDENCE-BASED NEUROREHABILITATION TECHNOLOGY
Enhancing Neurorecovery

The InMotion WRIST™ is capable of lifting even a severely impaired neurologic patient’s hand against gravity, overcoming most forms of hypertonicity.

The InMotion WRIST™ accommodates the range of motion of a normal wrist in everyday tasks.

- Flexion/Extension 60°/60°
- Abduction/Adduction 30°/45°
- Pronation/Supination 70°/70°

Clinicians may use the InMotion WRIST™ as a stand-alone treatment option, or it may be used in addition to the InMotion ARM™ to offer progressive modular robotic neurorehabilitation. It may also be used to carry patients to qualify for CIMT.

Independent clinical trials have shown progressive, modular robotic neurorehabilitation to be more effective at reducing impairment and improving function even in severely impaired chronic patients.

Clinical research has shown improved patient outcomes

Stroke
Cerebral Palsy
Traumatic Brain Injury

Today the American Heart Association, American Stroke Association and the Department of Veterans Affairs include robot-assisted therapy in their stroke rehabilitation guidelines for moderate to severe patients with upper extremity disability.
Overview of a typical InMotion WRIST™ robotic therapy session:

1. Therapist selects appropriate treatment protocol
2. Robot prompts patient to initiate movement
3. Patient initiates or attempts movement
4. Robot senses patient movement and provides continuous adaptive real-time assist-as-needed™ support ensuring movement is completed successfully.
5. Robot provides performance feedback to both patient and therapist
6. Therapist determines next treatment protocol

SYSTEM COMPONENTS

INMOTION WRIST™ HARDWARE

Robotic wrist with 3 active degrees-of-freedom
Universal design for fast and easy patient setup
- Adjustable-height robot and workstation
- Adults and small-body people may use the same device

INMOTION WRIST™ SOFTWARE

Intensive — 1024 movements per therapy session
Evidence-based treatment protocols.
25 different therapy protocols allowing clinicians to customize treatment for adults and children
Therapeutic exercise Games for:
- Motor planning
- Eye-hand coordination
- Attention, visual field deficits/neglect
- Massed practice

Performance feedback metrics

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1 Extensive bibliography, for more information please contact IMT or visit our website.
CEREBRAL PALSY

Clinical research studies with Interactive Motion Technologies’ (IMT) advanced robotic systems are helping children with cerebral palsy and other neurological diseases reduce impairment and improve function.1

“The new robotics therapy program is retraining children’s brain and nervous pathways so they can live a more normal physical life then ever before. Just 10 or 20 years ago they were non-existent now they are in place, here now at Rileys childrens hospital”

Dan Fink — President and CEO, Riley’s Children’s Hospital

“A child’s brain is much more plastic than an adults brain, so if adults can make gains perhaps children with CP can make even larger gains. In our initial studies we saw gains that were completely unexpected! “I think there is tremendous hope for cerebral palsy”

Dr. Joelle Mast — Chief Medical Officer, Blythedale Children’s Hospital

To learn how you can start redefining recovery at your facility, visit www.interactive-motion.com or call 617.926.4800.
