Research Development in Physical and Rehabilitation Medicine

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Our Mission

To develop studies that can objectively evaluate and improve the impact of new technologies not only in clinical functioning, but also in the understanding of mechanisms involved in clinical improvement.
Our Research Tracks

New Interventions in Rehabilitation
Shockwave Therapy
Neuromodulation Techniques

Biomarkers
Brain Plasticity
Functional Scales
Pain

Assistive Technology
Wheelchairs
Exoskeletons
Shockwave Therapy

Osteoarthritis is a common chronic, progressive, non-curable musculoskeletal condition causing pain and functional alterations in a number of persons. Shockwave therapy should improve pain, functioning and quality of life, minimizing therapeutic toxicity.

Ongoing / Published Studies

- The efficacy of focal shockwave therapy in patients with primary knee osteoarthritis.
- The effect of radial shockwave therapy in treating upper limb functional impairments due to stroke.
- Study of the efficacy of radial shockwave therapy in treating pain induced by knee osteoarthritis.

Neuromodulation Techniques
In collaborations with Prof. Felipe Fregni; Harvard Medical School

• Non-invasive brain stimulation
  - Transcranial Direct Current Stimulation (tDCS)
  - Transcranial Magnetic Stimulation (TMS)
  - Transcranial Pulsed Current Stimulation (tPCS)

• Peripheral Nerve Stimulation
  - Median Nerve Stimulation (MNS)
New Interventions in Rehabilitation

Neuromodulation Techniques

• Non-invasive brain stimulation
  - Transcranial Magnetic Stimulation (TMS)

**Level A** (definite efficacy):
- analgesic effect of high-frequency (HF) rTMS of the primary motor cortex (M1) contralateral to the *pain*

**Level B** (probable efficacy):
- low-frequency (LF)-rTMS of contralesional M1 in chronic motor stroke.
  (Lefaucheur JP, et al., 2014)

**Study:** “The Effects of TMS on Post Stroke Depression”
Neuromodulation Techniques

- Non-invasive brain stimulation
  - Transcranial Direct Current Stimulation (tDCS)

“Transcranial Direct Current Stimulation Combined with Aerobic Exercise to Optimize Analgesic Responses in Fibromyalgia: A Randomized Placebo-Controlled Clinical Trial.” Frontiers in Human Neuroscience, 2016.

The next step is to promote it in domiciliary care.
Biomarkers

Neurophysiological Biomarkers: assists in understanding the mechanism of disability, brain plasticity, recovery process and to guide neuromodulations therapies.

Neurophysiologic predictors of motor function in stroke
Biomarkers

Neurophysiologic studies during robot training using NIRS + EEG

Currently used for the study: “Association of tDCS with Lokomat for Treatment of Patients with Incomplete SCI”

Next step is to study its use for Stroke, TBI and Prosthetic training.

Adapted from Dutta et al. 2015
Biomarkers

Immunological Markers for Pain

Serum levels of pro-inflammatory cytokines, differentiating people with chronic pain and healthy controls, and fibromyalgia and knee osteoarthritis.

Published / Ongoing Studies

“Serum levels of proinflammatory cytokines in painful knee osteoarthritis and sensitization”. Int J Inflam, 2015.

Biomarkers

Physical Examination of Pain

Combining pressure pain thresholds and serologic markers.

Published / Ongoing Studies

Biomarkers

Functional Neuroimaging of Pain

Functional neuroimaging of morphometric brain analysis from Magnetic Resonance Imaging (Voxel-Based Morphometry), differentiating people with chronic pain and healthy controls.

Published / Ongoing Studies

“Association between experimental pain biomarkers and serologic markers in patients with different degrees of painful knee osteoarthritis.” Arthritis Rheumatol. 2014
Data Sets and Technologies to assess disability

- Motion Analysis Laboratory
- Robotic assessment of upper limb motor function
- ISCoS International SCI Data Sets
  - Shared data sets enable us to collect internationally comparable data to identify SCI patients, their injuries, treatment approaches and resources allocated to rehabilitation.
Wheelchairs

Wheelchairs are the most common mobility aid, yet only 5% to 15% of people who need it have access to one in developing countries.

Wheelchair models and wheelchair services should meet the need of their users and their environments, increasing access to AT.

Published / Ongoing Studies

- μLeve Development Process and Economic Evaluation
- Wheelchair Services Development in a Rehabilitation Network
Assistive Technology

Exoskeleton

Current Exoskeleton Projects are not appropriate for persons with limited trunk control. Providing trunk support and stability, one can enable independent walk for more individuals. The multidisciplinary approach to this project involves doctors, users, caregivers and engineering teams.

Published / Ongoing Studies

- *Trunk and Lower Limb Exoskeleton for Independent and Stable Walk* (ETMICAЕ). Supported by CNPq and the Center for Advanced Rehabilitation Studies (NAP NEAR | USP).
WE REALLY HOPE TO TURN THIS OPPORTUNITY INTO STRONG COLLABORATION

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