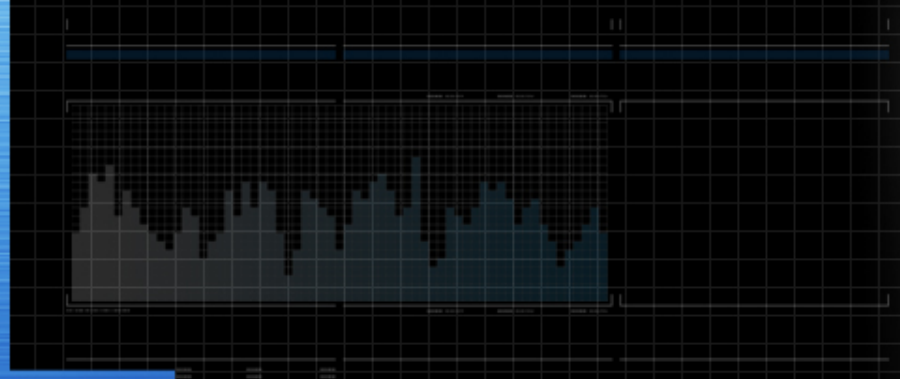
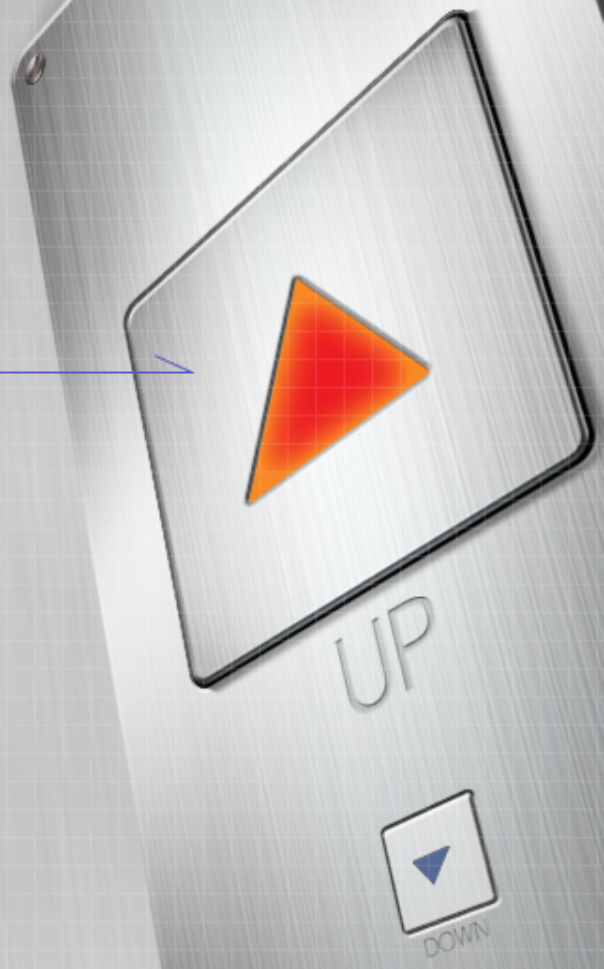
IN THE NAME OF GOD
THE CREATOR
THE SUSTAINER

By Dr. Hooman Mahmoudi

- Consultant Physiatrist: Shiraz Central Hospital, Shiraz, Iran
- Clinical Dirrector: Dr. Mahmoudi’s Acquired Brain Injury Rehabilitaiton Center, Shiraz, Iran
- Research Consultant: Elite Scientists’ Institute for Advanced Hybrid Technologies, Tehran, Iran

NEW TECHNOLOGIES AND TECHNIQUES IN STROKE REHABILITATION





Frequently Asked Questions:

- Does rehabilitation help in chronic stages?

RECENT TECHNOLOGIES & APPROACHES IN STROKE REHABILITATION

- Intensive Task-Specific Approach
- Non-invasive brain stimulation
- Rehabilitation in Virtual Reality environment (VR)
- Robotic Rehabilitation

INTENSIVE TASK – SPECIFIC APPROACH

Intensive Task-Specific Approach

- It is vs. exercise based approach
- Use tasks instead of exercises
- Dexterity comes with the functional task
- Repetition is the key
- Exercise still emphasized
- Evidence: Strong (Level 1a)

NON-INVASIVE BRAIN STIMULATION

Non-invasive brain stimulation

- Includes:
  - Transcranial Magnetic Stimulation (TMS)
    - A Pioneer: Alvaro Pascual Lenone: Neurologist
  - Transcranial Direct Current Stimulation (tDCS)
    - A Pioneer: Felipe Fregni: Neurologist
- Induces brain plasticity
- Could be effective any time after stroke

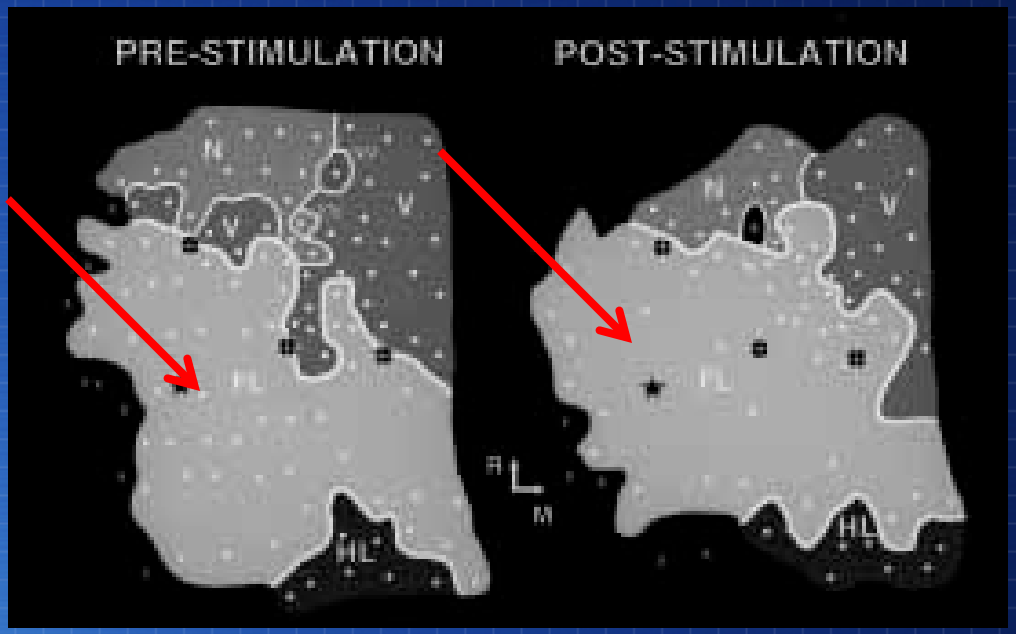
Mechanisms of action

- Activation of parallel motor circuits from contralateral M1, bilateral PMA, bilateral SMA, etc.
- Shifting of the weight of the cortico-cortical and cortico-subcortico-cortical interactions across the involved functional network

Concepts

- Penumbra area is not the sole responsible for recovery
- Contralateral, healthy brain cortex plays an important role in recovery process
- Natural recovery mostly occurs in the first 6 months, but interventional recovery can be achieved at any time

remodeling of motor output maps representing forelimb

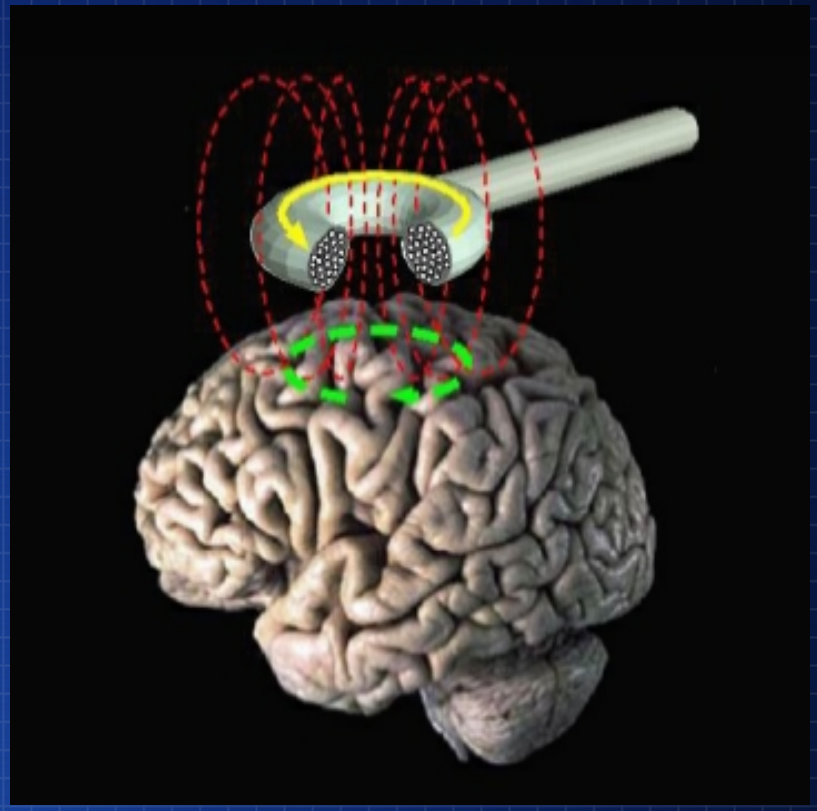


Transcranial Magnetic Stimulation

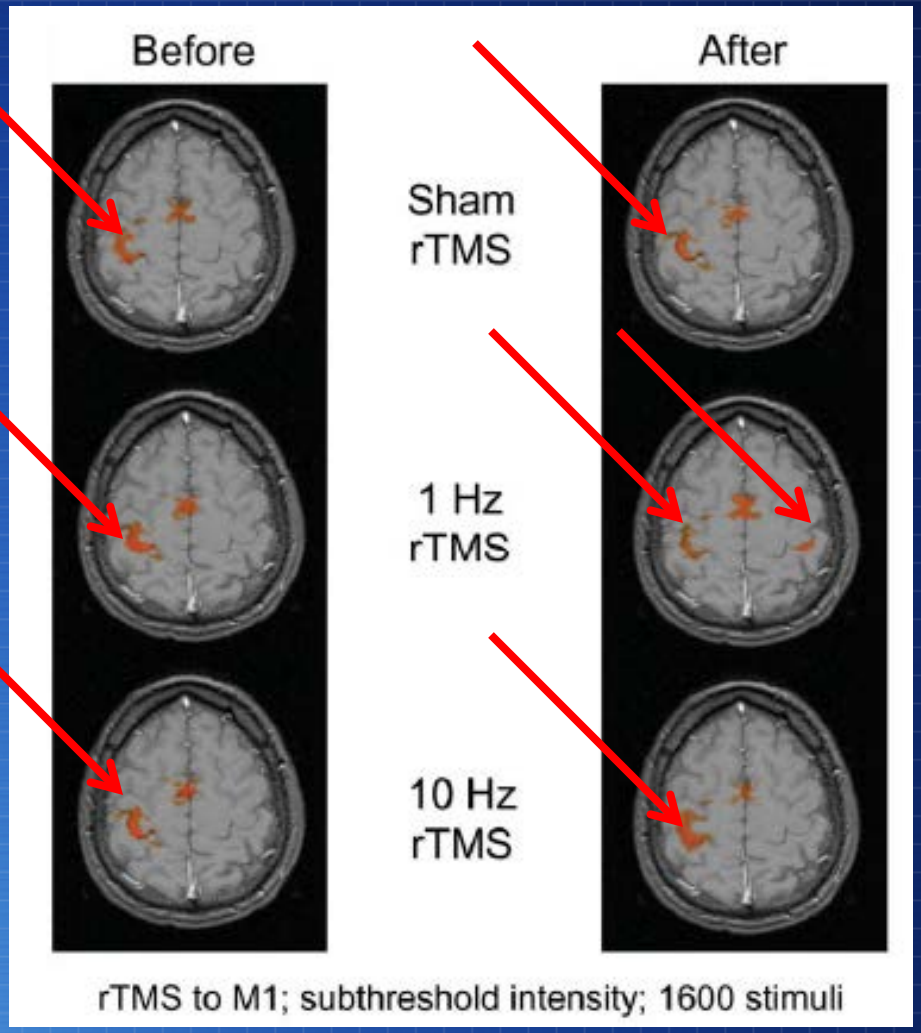
- Produced by rapidly changing magnetic field
- rTMS: application of a train of TMS pulses of the same intensity to a single brain area at a given frequency
- Low frequency vs high frequency rTMS
  - Low frequency: generally less than 1 Hz: Inhibitory
  - High frequency: generally more than 5 Hz: excitatory

Evidence

- Recent Meta-analysis on pooled 392 patients showed effect size of 0.79, 0.63 and 0.66 for acute, subacute and chronic stroke respectively
- There is still some controversy
- Evidence is conflicting (Level 4)



fMRI after Magnetic Stimulation



rTMS

Transcranial Direct Current Stimulation (tDCS)

- More recently introduced
- Very simple setup
- Weak direct current flow (1-2 mA)
- Induces excitation or inhibition according to electrode placement
  - Anodal montage: excitatory
  - Cathodal montage: inhibitory
  - Bilateral montage: both excitatory and inhibitory
- Evidence: strong (Level 1a) in chronic stroke

VIRTUAL REALITY REHABILITATION

VIRTUAL REALITY REHABILITATION

- Temporary fusion of experience and function with an artificial environment
- It uses high levels of “immersion”, i.e. the perception that the subject has entered in a virtual world
- It is effective equal or more than practicing in real world

ADVANTAGES OF VR

- Safety
- Motivation
- Embedding in robotic systems
- Can be done at home
- Evidence: strong (Level 1a) for chronic stroke

GROSS UPPER LIMB FUNCTION

FINE HAND FUNCTION

Virtual Reality and Robotic device

Head Mounted Display and Haptic Glove

ROBOTIC SYSTEMS

Robots

- Sense movements
- Use these information to make decisions and plan next movement
- Provide force feedback to the user
- Provide visual performance feedback

GENTLE/s

HWARD

LOCOMAT

Evidence:

- Strong evidence (Level 1a) to improve shoulder and elbow function but not wrist and hand
- Conflicting evidence (Level 4) that they are superior to conventional gait training for lower limb function


See good
Do good
Be good