



Neuro-rehabilitation in Stroke

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Neuro-rehabilitation

“A process whereby patients who suffer from impairment following neurologic diseases regain their former abilities or, if full recovery is not possible, achieve their optimum physical, mental, social and vocational capacity.”

“Stroke rehabilitation is a progressive, dynamic, goal orientated process aimed at enabling a person with an impairment to reach their optimal physical, cognitive, emotional, communicative and/or social functional level”

Definition of Stroke

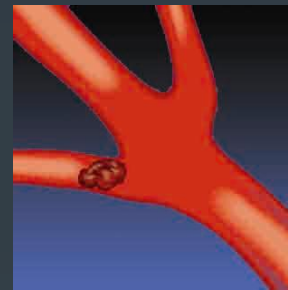


Sudden brain damage

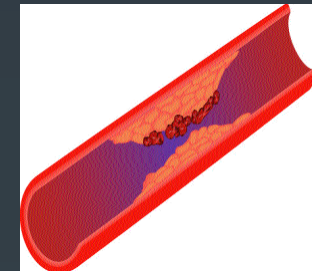
Lack of blood flow to the brain caused by a clot or rupture of a blood vessel

Ischemic = Clot

(makes up approximately 87% of all strokes)



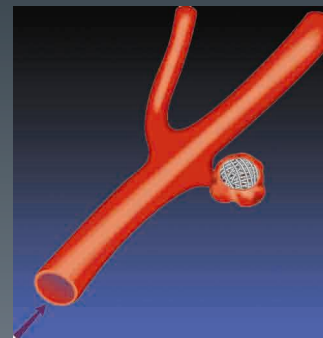
Embolic

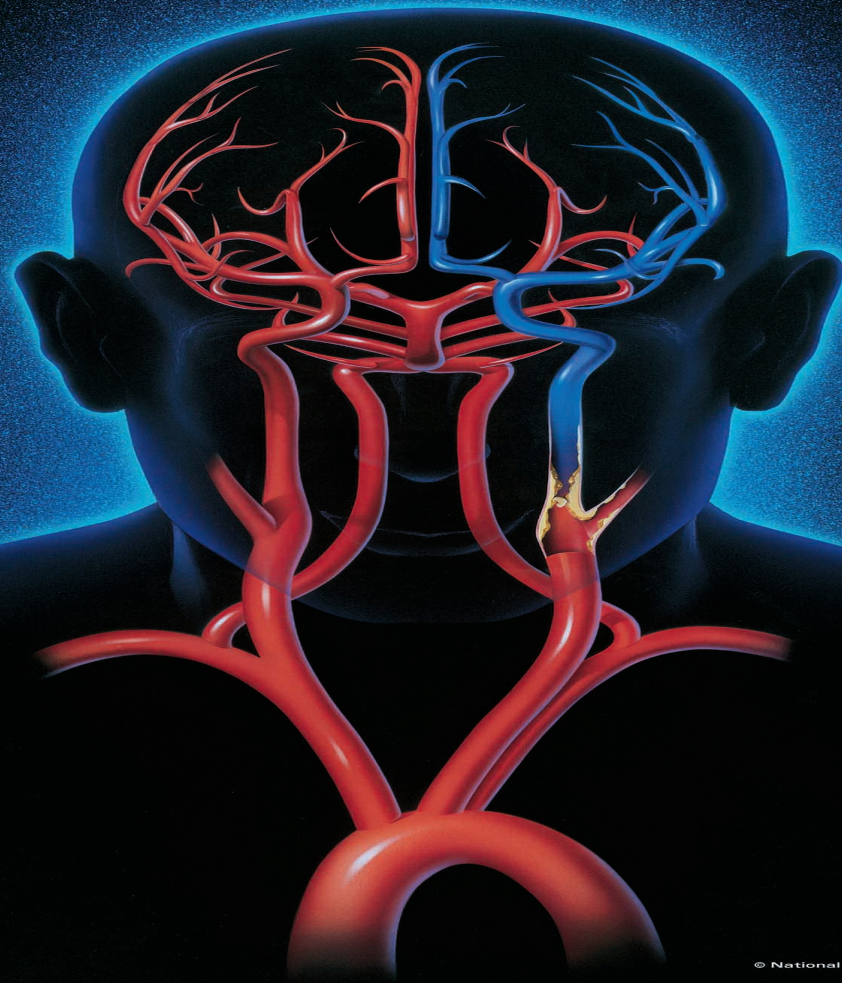


Thrombotic

Hemorrhagic = Bleed

- Bleeding around brain
- Bleeding into brain





© National Stroke Association



The problem is over here only

The nervous tissues here are probably normal

Facts



- 10% of stroke survivors recover full
- 25% recover with minimal impairment
- 40% experience mod.-severe impairments that require special care
- 10% require long-term facility
- 15% die shortly after the stroke
- Approximately 14% of stroke survivors experience a second stroke

Stroke Rehabilitation Outcomes

- 80% Independent Mobility
- 70% Independent Personal Care
- 40% Outside Home
- 30% Work

Disabilities can result from a stroke



- Paralysis or problems controlling movement (motor control)
- **Sensory disturbances including pain**
- Problems using or understanding language (aphasia)
- **Problems with thinking and memory**
- **Emotional disturbances**

Myth and Reality

Myth

- Stroke is not preventable
- Stroke cannot be treated
- Stroke only strikes the elderly
- Stroke happens in the heart
- Stroke recovery ends after 6 months

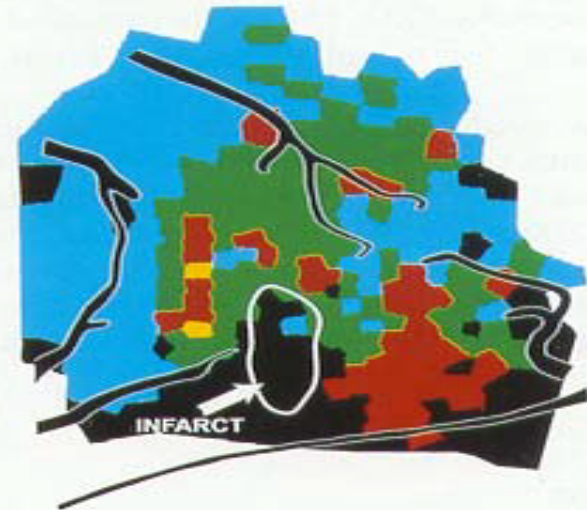
Reality

- Up to 80% percent of strokes are preventable
- Stroke requires emergency treatment
- Anyone can have a stroke
- Stroke is a “Brain Attack”
- Stroke recovery can last a lifetime

A PRE-INFARCT



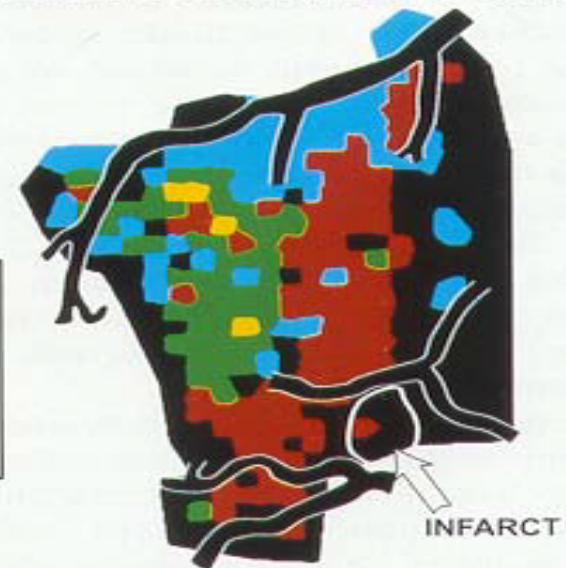
B POST-INFARCT & SPONTANEOUS RECOVERY



C PRE-INFARCT



D POST-INFARCT & REHABILITATIVE TRAINING



What is Neural Plasticity?



- Neural Adaptation
- ability of the CNS to change & adapt in response to cues
- A mechanism by which the brain encodes experience & learns new behaviors, and by which a damaged brain relearns lost behavior in response to rehabilitation

Plasticity is associated with...

- Decreases, increases, and shifts in brain activation to facilitate the behavioral improvement
- Reallocation in hemispheric resources
 - Example: relative dominance of left and right hemispheres
- Recruitment of additional brain regions
- Strengthening of an anatomical structure
 - Example: Increased white-matter density
- Functional Connections
 - Increased coherence among regions in neural pathways
 - “Neurons that fire together, wire together.”



Recovery – interaction of neural and behavioral events:

- Spontaneous neural recovery
- Neuroplasticity
 - Behavioral compensation
 - Functional recovery

NEUROPLASTICITY

Behavioral Compensation:

- Response to damage and behavioral attempts to compensate for effects of damage.

Functional Recovery :

-Response to a behavioral experience that enhances functional outcomes and promotes functional reorganization.



Successful Rehabilitation

Depend on

- how early rehabilitation begins
- the extent of the brain injury
- the survivor's attitude
- the rehabilitation team's skill
- the cooperation of family and caregiver

What the basic science tells us about the functional reorganization of motor cortex:



Post-injury behavioral training can influence structural plasticity (Nudo et al. 1996, Jones et al., 1996).

Skill acquisition is more important than movement repetition (repetitive use) for functional reorganization (Plautz et al., 2000)



Principles Governing Neuroplasticity

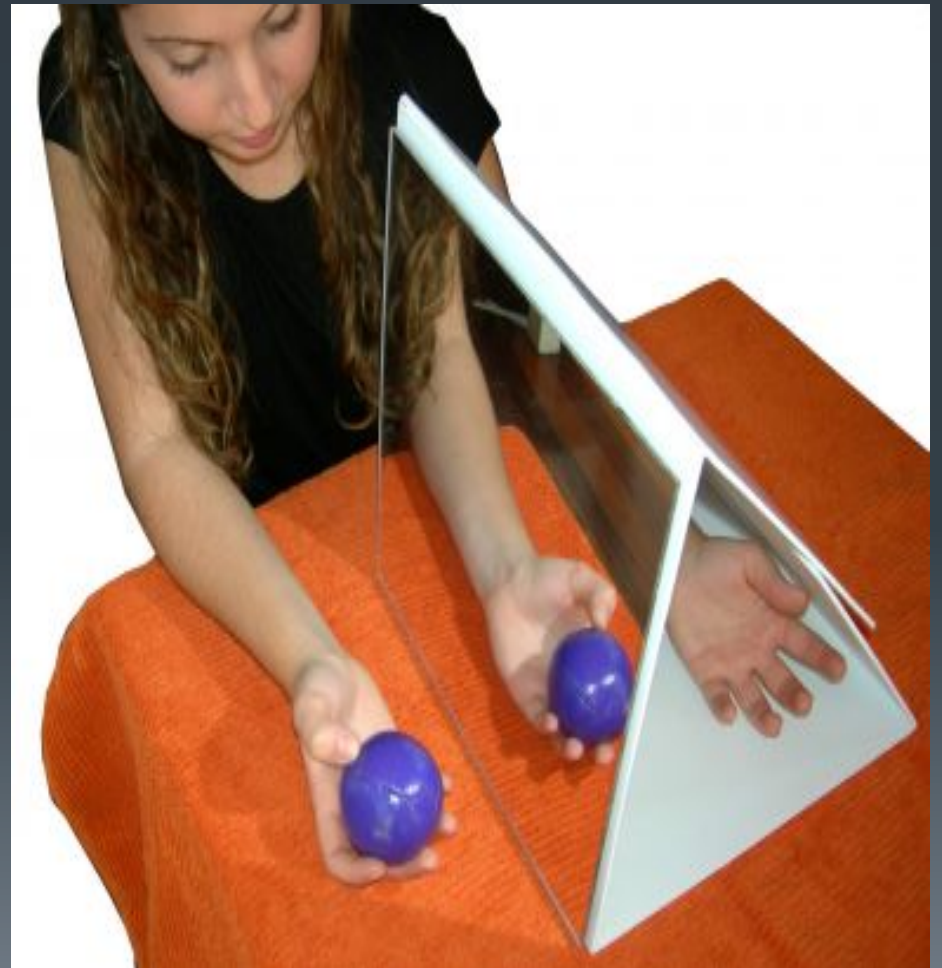
- **Body parts compete for brain representation**-Opposite effect is “learned non use”
- **The ipsilateral and contralateral hemisphere can contribute to motor control!**
 - If 1 hemisphere is damaged, the intact hemisphere may take over some of its functions.
- **Sensory stimulation enhances plasticity!**
- **Reduction of inhibition enhances plasticity!**
- **Pharmacologic agents can enhance plasticity!**

Management



- **Body parts compete for brain representation**
CIMT-constraint induced movement therapy
 - **The ipsilateral and contralateral hemisphere can contribute to motor control!**
Mirror therapy
 - **Sensory stimulation enhances plasticity!**
Electrical stimulation/functional electrical stimulation
Stroking, massaging
Neuromuscular facilitation exercise techniques
Hilot?
Stimulate all the senses!
- “Physical Activity must be task specific and repetitive; retrain functional tasks eg. rolling in bed, sitting, standing up, walking”

Mirror therapy



Exercise Therapy

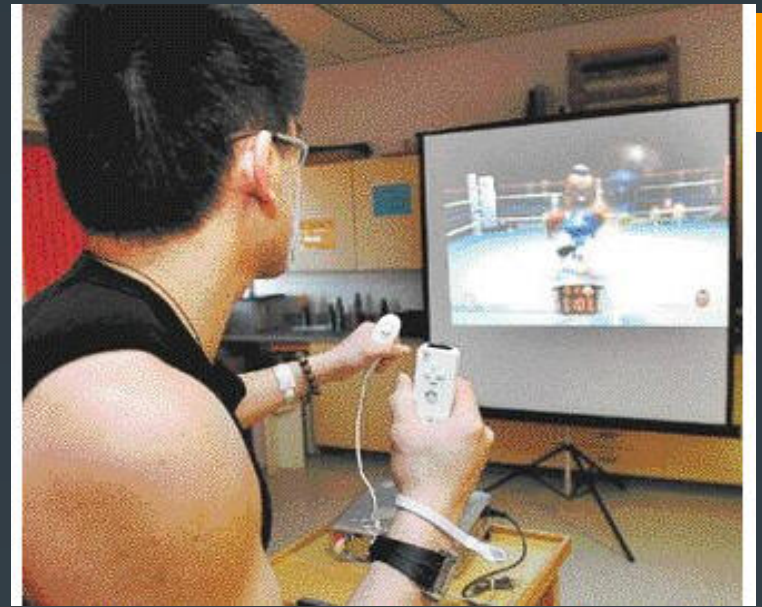


- Neurodevelopmental techniques (NDT) by Bobath stresses exercises that tend to **normalize muscle tone** and prevent excessive spasticity through special reflex-inhibiting postures & movements
- Rood- involves **superficial cutaneous stimulation** using stroking, brushing, tapping & icing or vibration to evoke voluntary muscle activation
- Brunnstrom- emphasized synergistic patterns* of movement that develop during recovery from hemiplegia. Encouraged the development of **flexor & extensor synergies** during early recovery, hoping that synergistic activation of muscle would, with training, transition into voluntary activation.

* *synergy-a whole series of muscles are recruited when just a few are needed*

- Kabat's Proprioceptive Neuromuscular Facilitation (PNF)-Relies on **quick stretching and manual resistance** of muscle activation of the limbs in functional direction, which are often **spiral and diagonal**

Virtual Reality/EMG Bio feedback



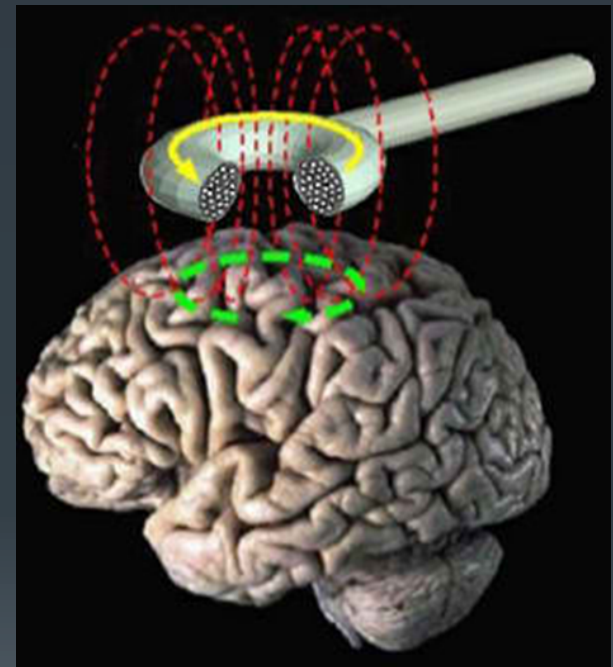
Conventional Physical Therapy

Treadmill training with body weight support by a harness:



Therapeutic Exercises

- Brain Imagery/ Mental Practice
- Repetitive Transcranial Magnetic Stimulation (rTMS)
- Tai-Chi exercises
- Acupuncture
- Yoga
- Robotic-Assisted Therapeutic Exercise





Recovery

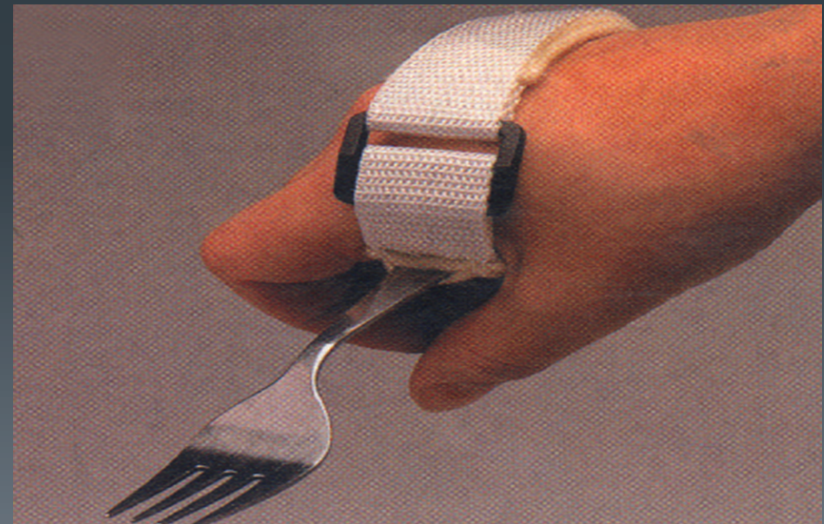
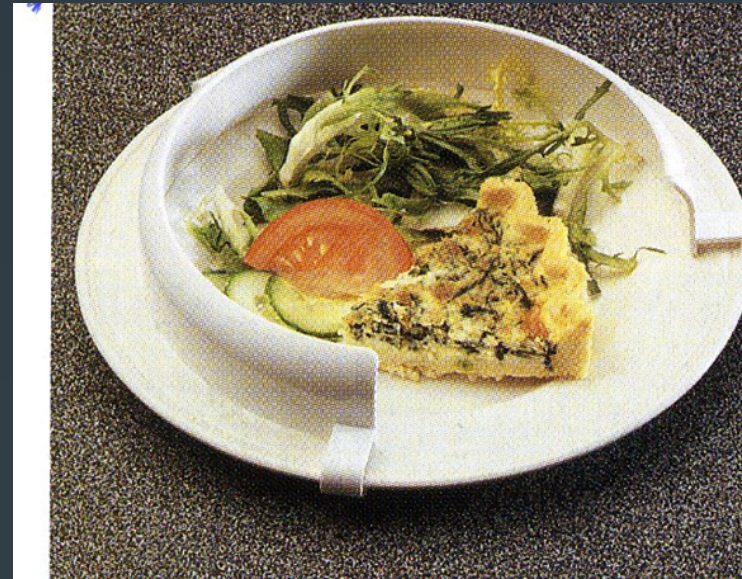
Improved function may occur with vigorous and intensive therapy, strong motivation and good cognition; provided some selective hand movement is present”!*

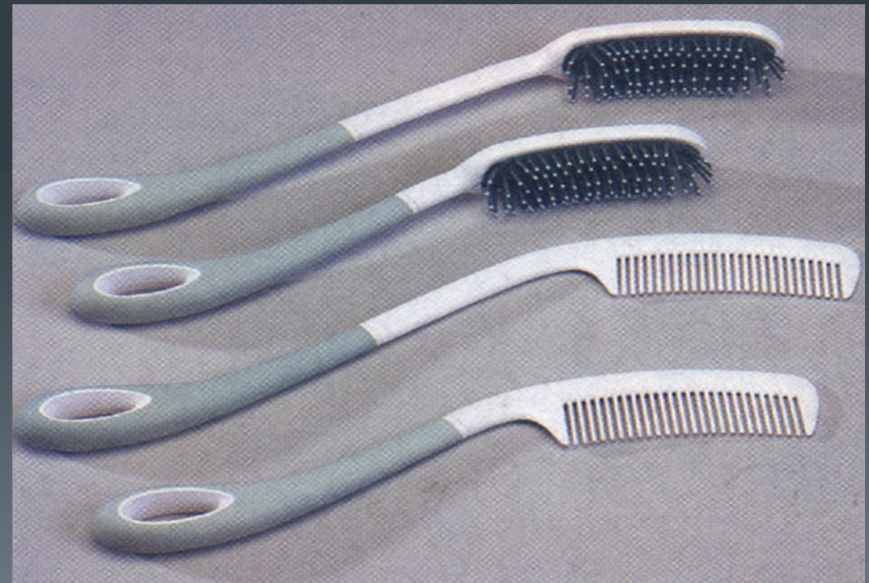
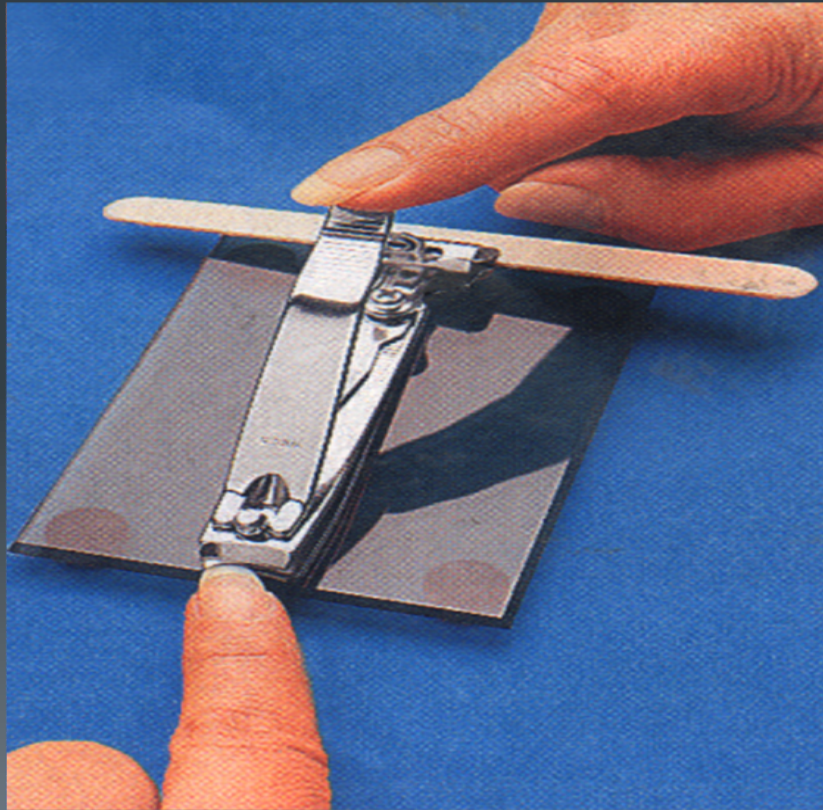
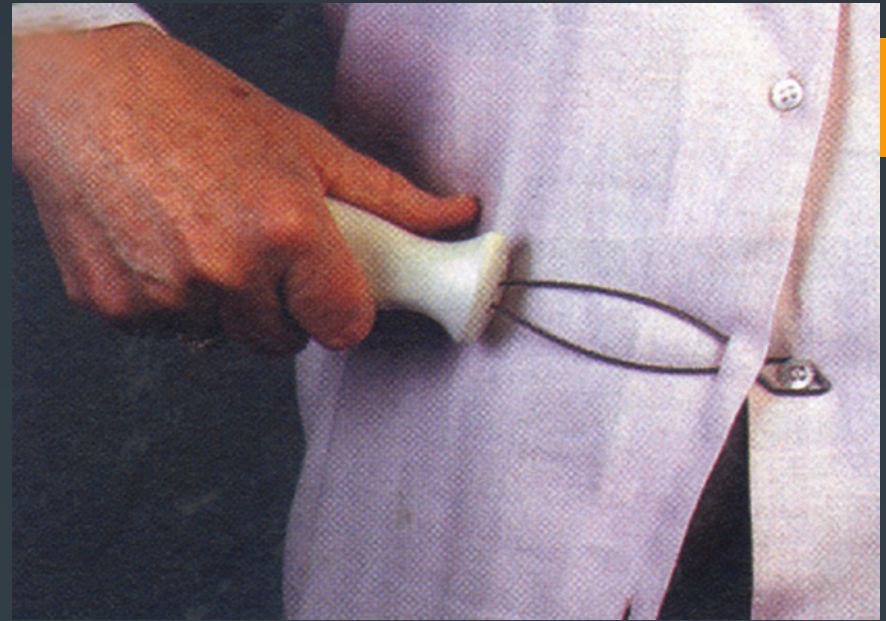
- Recovery in Stroke Depends on:
 - Location and extent of damage
 - Activation of secondary areas
 - Activation of contralateral areas
- “Neuroplasticity occurs better in motivated & moving patients”.

Hand splints



Adaptive aids







Conclusion

- Rehabilitation therapy should start as early as possible, once medical stability is reached
- Spontaneous recovery can be impressive, but rehabilitation-induced recovery seems to be greater on average.
- Even though the most marked improvement is achieved during the first 3-6 months, rehabilitation should be continued for a longer period to prevent subsequent deterioration.
- No patient should be excluded from rehabilitation unless he is too ill or too cognitively devastated to participate in a treatment program.
- Proper positioning and early passive ROM exercises help to avoid complications at a flaccid stage.

**TRY GROWING
BRAIN CELLS
NOW**



Thank You!







