Neuroplasticity and Recovery After A Traumatic Brain Injury

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Outline

- Brain Injury
- Neuroplasticity
- Interventions
Brain Injury

- Is an injury to the brain that is not hereditary, congenital, or degenerative

- Primary damage
  - Focal injury
  - Axonal injury, hypoxic damage and edema
  - Multiple areas of small hemorrhages

- Secondary damage
  - Brain swelling
  - Impaired blood flow
  - Increased ICP
Brain Injury

- 5 million people living with the effects of TBI

- 1.7 million new Brain Injuries each year
  - 60% related to car accidents
  - 15% Sports injury
  - 15% Work related accidents
  - 10% Assault related injuries including gunshot wounds.
Neuroplasticity

- The ability of the central nervous system (CNS) to undergo structural and functional change in response to new experiences.
  - Strengthening existing pathways
  - Formation of new pathways and connections
  - “Pruning” or focusing of neural connections
Neuroplasticity

- Once thought to be hard wired/unable to change
- Now recognized that the Central Nervous System (CNS) has the ability for neuroplastic changes throughout the life course
- Can occur very soon after injury and persist for a significant period of time
Spontaneous recovery
- Over the first 6 months after brain injury
- Further advances and optimization of this spontaneous recovery rely on rehabilitation training
Optimizing Neuroplasticity

- Use it and Improve it
- Use It or Lose it
- Specificity
- Time Matters
Optimizing Neuroplasticity

- Repetition Matters
- Meaningful practice
- Transference Matters
Neuroplasticity

- Ability to alter nerve connections
  - Repetitive use strengthens connections
  - Possible to deliver 300 repetitions of an activity during a 1–hour therapy session
  - Task specific

- Maladaptive plasticity
  - Disuse can weaken synapses
  - Impedes recovery
  - Use it or lose it, interference plasticity
Interdisciplinary Team

- Members of interdisciplinary team
  - Engage and modify surviving pathways
  - Provide new response strategies that compensate for tissue lost to injury
  - Patient centered care
  - Enriched environments
Exercise has been shown to facilitate the release of molecules that support neuroplasticity and offer protection from brain damage.

- Improves
  - Sleep quality
  - Cognition
  - Mood
  - Motor learning
Physical Therapy

- Aerobic exercise
  - Shown to improve mobility, balance and motor function
  - Enhances Brain–derived neurotrophic factor (BDNF)
    - Facilitates neuroplasticity
    - Levels of BDNF are increased for approximately 10–60 minutes following aerobic exercise
    - Aerobic exercised used as “a primer” before performing other tasks
Aerobic Training

- Guidelines for an individual with a Brain Injury
  - 20 minutes of moderate intensity aerobic exercise 3 days per week
    - Cycling, NuStep, Biostep, Treadmill, arm bike, Zumba, dance, pole-walking
Gait training

- Gait
  - Treadmill and over-ground walking
    - Partial weight body-weight suspension (BWSTT)
    - Robotic assisted gait
    - Functional Electrical Stimulation
    - Facilitation of movement from PT
    - Promotes motor learning and neuroplasticity of the lower limbs
    - Rhythmical acoustic pacing
In conclusion

- Humans have an astounding potential for recovery and adaptability!!!

- Never give up and advocate for yourself!
References


[www.traumaticbraininjury.net](http://www.traumaticbraininjury.net)
Questions?