Contemporary Therapy Approaches for Stroke Rehabilitation

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Objectives

- The participant will identify the various widely used contemporary therapy approaches for patients with stroke and their explained rationale.
- The participant will review the literature and research associated with such contemporary approaches.
- The participant will determine the best evidence based therapy practice patterns for patients with stroke.

Rehabilitation is the process of maximizing learning. Some factors that promote recovery in neurological populations include:

- Understanding of the initial disease process
- Identification of impairments created by disease process
- Effects these impairments have on function
- Creating client-centered goals
- Skill of clinician to constantly adapt and progress treatment goals/environments to promote therapeutic carry-over
Our brains have the ability to rewire neurons to compensate for damage and adjust their activity in response to new situations or changes in their environment.

We know that the area of the brain that was insulted will remain necrotic, however the area immediately adjacent to the insult (penumbra) remains very active after the shock resolves (typically 1-2 weeks) and begins to compensate for the injured portion of the brain.

Neuroplasticity occurs via two options:
- Cortical re-wiring: creating new synapses
- Neuronal Un-Masking: tapping into unused neurons

Neuroplasticity is constrained by the time constants governing coincident input co-selection and by the time structures and potentially achievable coherence of extrinsic and intrinsic cortical input sources.

- Earlier intervention + increased time = better outcome
- Various systems can be rewired (visual, cognitive, motor)
- Use it or lose it!
- You CAN teach an old dog new tricks
- Area of brain affected and genetic predispositions can determine recovery
- Educate your patients on principles of neuroplasticity

What?!
Therapeutic activities:
- Must be goal directed, motivating/fun
- Accurate behaviors must be repeated
- Give feedback on performance accuracy
- Make stimulus strength adequate for detection
- Stimulation must be progressed in difficulty
- Behaviors should be age appropriate
- Strengthen responses with multisensory modalities
- Do training in gravitational positions that facilitate task achievement
- Behaviors should be performed in different environmental contexts
- Always reward accurate and improved behaviors

- Increase in area of representation
- Improved order of representation
- Improved organization
- Increased myelination
- Increased complexity of dendrites
- Increased strength of responses
- Improved neurochemical transmission
- Increased interconnectedness
- Spread of healthy neurons to take over damaged areas

Exercising the Brain is Fun!
Functional training is a method of retraining the motor system using repetitive practice of functional tasks in an attempt to re-establish the client's ability to perform activities of daily living. Functional training can be implemented only after the clinician has fully identified the client’s functional limitations/disabilities.

Established by the Bobaths in the 1960s, initially based on hierarchical levels of reflex integration and promotion of normal postural reflexes. In recent years the reflex model has been replaced by control model of the nervous system—Nervous system is viewed as dynamic system capable of initiating, anticipating and controlling movements with sensory feedforward and feedback.

Basic Principles:
- Task Analysis Approach
- Facilitate normal movement patterns to counteract compensatory patterns
- Use of skilled, physical handling techniques
- Utilizes concepts of neuro-muscular re-education (NMR) and motor learning principles

3 Week certification course for therapists through the NDTA
PNF: Proprioceptive Neuromuscular Facilitation
- Developed in the 1940s-1950s by Herman Kabat, Margaret Knott and Dorothy Voss.
- Basic Principles:
  - Based on the principle that movement occurs in natural patterns (particular diagonals)
- Utilizes the concept of radiation
- Coursework:
  - International PNF Association – Residencies in Vallejo
  - Institute of Physical Art – Multiple PNF courses

NDT/IFRAH, PNF: Research
- At present time, there is no research to support or disprove these modalities as a treatment approach for brain injury and/or stroke.
- The research does demonstrate the approaches to be more effective than no treatment but not more effective than standard care.
- Limitations in research studies

CIMT: Constraint Induced Movement Therapy
- Based on research by Dr. Edward Taub: Highly researched and highly credible treatment approach
- Basic Principles:
  - Encompasses a family of treatments that integrate basic concepts of neuroplasticity
  - Force Use of involved extremity to avoid non-use
  - Massed Practice: Dosage = 6 Hours / Day
  - Motor Learning
- 1 Week Certification Course in UAB
In a 2008 study on modified CIMT by Stephen Page et al., the magnitude of changes using modified CIMT were found to be consistent with more intense constraint induced therapy protocols.

- **Protocol:**
  - 30 minutes of 1 on 1 therapy
  - 3 days per week
  - 5 hours per day in restraint (weekdays)
  - 10 weeks

- Outcome measures: Action Research Arm Test (ARAT), Fugl-Meyer (FM), and Motor Activity Log (MAL)

  Page, S. et al., 2008

**Modified CIMT**

Most researched treatment approach for stroke and brain injury

Treatment approach has been found to be effective in its ability to:

- Regain lost motor function (especially of the upper extremity)
- Regain lost function
- Added effectiveness when used with handling technique such as NDT
**Vestibular Rehab**

- Addresses dizziness symptoms/vertigo
- Peripheral or central origin
- Exercises to improve VOR (vestibular ocular reflex) and to address motion sensitivity
- Common after stroke and affects balance
- Increased fall risk for patients with vestibular dysfunction
- Highly significant research on treatment effects

**Body Weight Support Treadmill Training**

- Active modality for PT since 1980-90s especially with SCI population
- Basic Principles:
  - Safe Environment
    - Allows for early and repetitive gait training after injury
  - Task Specific / Motor Learning
    - Gait is practiced as a task as opposed to parts
    - Treadmill provides facilitation to Central Pattern Generators and Golgi Tendon Apparatus
- Limitations:
  - Comfort of harness
  - Unstable Spine
  - Unstable BP

**BWSTT: Research**

- One of the most widely researched modalities in Physical Therapy
- BWSTT has proven effective with Stroke & BI:
  - Improved Independence with Functional Mobility tasks including gait, transfers and sitting balance
  - Improved gait speed / cadence
  - Improved outcomes associated with Berg, TUG, Modified Falls Efficacy, 10M Walk
  - LEAPS study (comparison of 2mo vs. 6mo and HEP)
- Limitations:
  - Discussion of gait quality/symmetry
NMES: Neuromuscular Electrical Stimulation

- Started to become widely used by exercise physiologists in the 1960s-70s (especially in Russia)
- Basic Principles:
  - Use of high-voltage electrical stimulation to facilitate lost movement through direct electrical impulse
  - Typically used in conjunction with other tasks:
    - Isolated exercise to increase isolated muscle strength
    - Functional tasks (such as gait) to increase particular motor control during task

Proven to be an effective modality for use of motor re-learning of isolated muscle activation
Proven to be an effective modality for functional task training:
- Improved gait speeds with patients with hemiplegia
- Improved quad control during stance with patients with hemiplegia
- Improved heelstrike when used for tibialis anterior
- Improved grasp/release function with patients with hemiplegia

Traditionally, 5 sources of information can be distinguished in relation to motor (re-)learning:
1) proprioceptive information
2) tactile information
3) vestibular information
4) visual information
5) auditory information.

But… What about imagination?!
Motor Imagery

- Motor imagery can be defined as the covert cognitive process of imagining a movement of your own body (part) without actually moving that body (part) (Kosslyn et al.).
- Initially developed in sport sciences, motor imagery can facilitate the learning of movements.
- The first clinical studies are promising and suggest that motor imagery training influences motor recovery in a positive way.
  - Mirror Box Therapy

How Do We Measure Success?

- Evidence-based practice (EBP) has been defined as "integrating individual clinical expertise with the best available external clinical evidence from systematic research" (Sackett et al. 1996).
- In clinical practice EBP includes the five components: assess, ask, acquire, appraise, and apply and this includes the selection of standardized assessment tools, the interpretation of scores on assessment tools, and the selection of therapeutic, rehabilitative, or preventive interventions (Leung 2001, Sackett et al. 1996).

Standardized Functional Tests

- Functional Mobility:
  - PASS – Postural Assessment Stroke Scale
  - Timed Up & Go /Timed Up & Go with Dual Task
  - Berg Balance Test
- I/ADL’s
  - Barthel Index
  - Lawton IADL Test
  - Action Reach Arm Test
  - Fugl-Meyer Assessment of Motor Recovery after Stroke
- Gait
  - 10 Meter Walk Test
  - 2 Min & 6 Min Walk Test
  - HMAT
  - Tinetti Gait and Balance Assessment Tool
In Summary...

- The future of rehabilitation is heavily reliant on the ability of clinicians to adapt to ever changing health care models.
- Learn, adapt and provide the best treatment
  - Evidence based practice
  - For the least cost
  - Establishing most efficient and adequate care plans
  - With best outcome
  - Measuring patient’s functional gains with standardized tests

QUESTIONS?

References