Best Practice Updates
Brain Injury Rehabilitation

Lymphedema
Jessie Mihalovich, COTA/L, CBIS, CLT

Anatomy
Lymphatic Organs
- Lymph nodes
- lymph vessels
- thymus gland
- spleen
- tonsils
- peyer’s patches
Lymph Nodes

- Lymph nodes are the filtering system of the lymphatic system for noxious matter such as bacteria, toxins, and dead cells
- Production of lymphocytes (white blood cells) **important for fighting infections and enhancing the body’s immune capabilities**
- When damaged during cancer radiation or trauma, must re-route lymph fluid to another regional area across the body’s natural water sheds

Lymph Vessels Subdivided

- Capillaries
- Pre-collectors
- Collectors
- Trunks
- Ducts

Lymph Vessels

**Capillaries**
- Originate in the tissue spaces and form a plexus in the body
- No valves, able to absorb interstitial fluid by anchoring filaments
- Lymph capillaries know no direction

**Pre-Collectors**
- Duties are to partially absorb and transport lymph fluid
- Have more of a vertical orientation
- Transports from capillaries to collectors
Collectors/Trunks

- transports lymph fluid
- Difference between a collector and trunk is that the trunk are formed by joining collectors and are thicker
- presents with valves and determines the flow direction, prevent return of fluid and guarantee transport from distal to proximal to the regional lymph nodes
- valves move fluid in a dilation like movement with the space between the distal and proximal valve called "lymphangion"
- frequency of lymphangioactivity is 6-10x/min at rest or 10x that amount with exercise

Ducts

- 75% of the lymphatic load is drained into the Thoracic Duct (2-4 liters per day)
- 25% of the lymphatic load is drained into the right lymphatic duct

Watersheds

A watershed is an area which divides two lymphatic drainage regions.

- Mid Sagittal (vertical watershed)
- Transverse (horizontal watershed)
- Clavicular
- Spine of the Scapula
- Chaps (gluteal watershed)

Diagnosis and Treatment

- Various types of edema including:
  - Lymphedema – what we are seeing in mild forms
  - Lipedema
  - Venous Edema
  - Cardiac Edema
  - CHF
  - Malignant Lymphedema
  - Others

http://www.nortonschool.com/aboutlymphedema.html
Complete Decongestive Therapy includes:

- Manual Lymph Drainage
- Compression Bandages
- Remedial Exercises
- Skin care
- Instructions in self care

Manual Lymph Drainage/Compression

- Increases lymph vessel activity
- Increases re-absorption of lymph fluid
- Promotes relaxation

Compression alone does not improve edema, MLD is needed to arouse the lymph system

Treatment goals

- Volume reduction
- Restore mobility/ROM
- Infection prevention
- Improve cosmesis
- Improve psychosocial well being
- Improve quality of life
Principles of MLD

• Decongest central areas first
  – Treatment of the extremity will start proximally and progress towards the distal regions
  – wake up the area where the lymph fluid will be drained before draining the fluid
  – Then push the fluid proximally to the lymph nodes for reabsorption

Lymphedema in Neuro

• Dependent Edema
• After brain injury, mild to moderate edema can be noticed in the affected extremity, both upper and lower.
• This area can be difficult to treat for many reasons (ex. Various medications, ambulatory, flaccidity, inattention to the extremity, etc.)
• Clinician's responsibility to determine if it can be effectively managed with a compression garment or if MLD and compression wrapping is necessary for that person served.
• Collaboration required between disciplines and the treating medical doctor.

Lymphedema in Neuro

• Concerns:
  – Tissue fragility, atrophy
  – Insensate within the compression
  – Joint subluxation with ambulating patients

• Limitations:
  – Neuro re-education /mobility can be limited
  – ADLs can be more difficult
Garments

- Once a person served has tolerated and completed a cycle of CDT, maintenance phase occurs with compression garments during the day, bandaging/night garment at night, remedial exercises and skin care.
- There are many types/companies/brands of compression garments to trial and use.
- Usually comes down to cost/payment and therapist/client preference.

Two Phase Lymphedema Treatment

- Phase 1
  - 1. Skin treatment/care
  - 3. Compression bandages
  - 4. Movement and exercise
- Phase 2 (outpatient)
  - 5. Compression therapy
  - 6. Ref check up with Dr.
  - 7. Skin care

Functional iPad Use in Brain Injury Rehabilitation

Megan Jones M.A. CCC-SLP, CBIS

Objectives

- Increase participant knowledge of iPad application in patient populations with acquired brain injury.
Applications

• See handout for a list of application ideas targeting:
  – Language
  – Speech Production & Apraxia
  – Memory
  – Visual Scanning / Attention
  – Executive Functions
  – Minimal and Emerging Consciousness
  – Functional Mobility
• Several specific applications will be highlighted throughout the presentation

Beyond Applications

• Email
• Skype
• YouTube
• Google Maps
• Google Earth
• Pictures/Videos
• Home exercise programs

Additional benefits

• Divided attention tasks
• “buy-in” from younger population
• Novel task learning for unfamiliar patients
• Auditory and visual feedback
• Efficiency of providing stimulation
• Consistency across disciplines
• Familiar voice
Language

- 4-in-1 TheraAppy
- Spoken Photo
- Proloquo2go
- Verbally, iComm
- Flashcards
- QuickVoice / MIT techniques
- Picture Scenes
- Music / YouTube
- Google Maps / Google Earth

Speech Production & Apraxia

- BlaBlaBla
- QuickVoice
- dB Meter Pro
- Music / YouTube
- Lingraphica
- VAST

Memory

- Reminder apps
  - It’s Done!
  - Todo
  - Errands
  - AudioMemos
  - Alarmed
- QuickVoice
- Calendar
- Memory game
- Story recall
  - News / current events
### Visual Scanning / Attention
- iMazing
- Visual Attention TheraAppy
- Word find apps
- Tangram
  - high level visuospatial activity
- Reading / scanning internet
- Google Maps
- Google Earth

### Executive Functions
- Skill game
- RushHour
- Tangram
- 4 pics 1 word
- Card games
- BI education material
- Bill pay / money management
- Novel Task learning / sequencing
- Research Projects

### Minimal and Emerging Consciousness
- Familiar Voice
  - Video / audio recordings
  - SpokenPhoto
- Yes / No Cards
- Audio/Visual Stimulation
  - YouTube
  - Garage Band
Functional Mobility

• Metronome
• Videos
  – Breakdown / Biofeedback
  – Before and after
• Uswing
  – Split video comparison
• Home exercise programs

Anatomy of a Community Outing
Kim Reed, CTRS, CBIS
Why do we do them?

- Important for quality of life
- Meaningful and fun
- Helps achieve functional goals
- Eliminates barriers to leisure
- Extend rehabilitation/therapy

What do we work on?

- Mobility and Balance
  - Speech and communication
  - Problem solving
  - Executive functioning skills
- Memory
- Leisure education
- Money Management
- Organizational skills
- Social Pragmatics
- Endurance
- Transfers

What are the benefits?

For staff
- Insight into work that still needs to be done
- Can better address needs in functional setting
- New and unique treatment interventions
- Fun

For Persons Served
- Better prepared for reentry into the community
- Realistic
- Meaningful
- Better picture needs for discharge
- Challenging
- Self confidence
Neuroplasticity & Motor Learning
After Brain Injury
Jacque Thole, DPT

Objectives

• Demonstrate a basic understanding of neuroplasticity as pertains to motor learning in the brain injury rehabilitation setting.
• Demonstrate a basic understanding of at least 3 fundamental skills upon which the complex motor task of gait is based

Did you know...

• There are ~100 billion nerve cells/neurons in the brain
• When a stroke occurs, it kills less than 2 billion of these cells
• Brain injury has long been thought to be permanent with little to no potential for brain repair and recovery
• We have all seen people get better, but how?
Neuroplasticity

- Big word, long word
  - Neuro – having to do with nerves
  - Plasticity – when heated, becomes flexible and can be molded into most any shape

- Defined as “the ability of the brain to change and repair itself”
  - How we adapt to changing conditions, learn new facts, and develop new skills
  - After an injury, there are two types of recovery, spontaneous & function induced

- Mechanisms of change
  - Anatomical – nerve growth
  - Chemical – changes at the synapses: injured axons sprout to innervate previously innervated synapses
  - Receptive – Synaptic strength increases to serve as basis for all memory and learning

- In a nutshell: Neuroplasticity is how we adapt to changing conditions, learn new facts, and develop new skills

Basic principles of neuroplasticity

1. Use it and improve it
2. Use it or lose it
3. Specificity
4. Repetitive practice
5. Intensity
6. Importance
7. Age
8. Transference
9. Time

Neuroplasticity & Time

- Initial medical interventions important to reducing amount of tissue damage follow injury.
  - Time from onset of injury influences the recovery of neuronal function.
- Rehab efforts target initial 3 months of recovery to increase adaptive plasticity of surviving tissue.
- Most substantial recovery occurs within first 30 days following stroke.
- In moderate and severe stroke, improvements continue for at least 90 days.
- Focal traumatic brain injuries follow similar patterns as stroke.
- Diffuse brain injuries require longer amounts of time for recovery.
## Motor learning & Motor control

- **Learning**
  - The way by which motor skills are acquired and modified
  - Defined: a set of internal processes associated with practice or experience leading to relatively permanent changes in the capability for skilled behavior

- **Control**
  - Process by which actions are executed
  - Integration of sensory information from the individual and environment to determine the appropriate muscles required to generate a desired movement/action

## Motor control

- Interaction between CNS and musculoskeletal system
- Involves processing of information, coordination, biomechanics and cognition
- Control is necessary for regulating balance and stability to allow interaction with the environment.

## Stages of motor control

- Mobility
- Static postural control
- Dynamic stability
- Skill
Mobility

- Ability to move from one position to another independently and safely
  - Moving the body while maintaining postural control
- Examples: Rolling, supine to sit, sit to stand, transfers
- Impairments
  - Failure to initiate or sustain movements
  - Poorly controlled movements

Static postural control

- Ability to maintain postural stability and orientation with center of mass over the base of support at rest
- Examples: Maintaining anti-gravity positions (POE, quadruped, sitting, kneeling, half kneeling, plantigrade, standing)
- Impairments
  - Failure to maintain steady body position
  - Increased postural sway
  - Wide base of support
  - Requires physical assistance
  - Loss of balance

Dynamic stability

- Ability to maintain postural stability and orientation with the center of mass over the base of support while parts of the body are moving
- Examples: Weight shifting and reaching in any of the previous postures
- Impairments
  - Failure to control posture during weight shift or reaching
  - Loss of balance
Skill

- Ability to consistently perform coordinated movements for the purpose of interaction within the environment
- Examples: Ambulation
- Impairments
  - Poorly coordinated movements
  - Lack of precision, control
  - Increased effort required

Gait, Walking, Ambulation

- Frequently the #1 goal of PS – “want to walk”
- A significant factor in determining discharge placement (return to home vs. facility placement)
- But it’s so complex!
  - Requires integrated function of many systems
    - Established rhythmic stepping pattern
    - Body support and propulsion in the intended direction
    - Dynamic postural control
    - Ability to adapt to changing task/environmental demands

How to get from here to there

- Interventions/Treatment focus
  - Improve ROM and strength of weak muscles
  - Improve control of muscles through functional training tasks
  - Pre-gait tasks – improve strength, range and control
    - Bridging, transfers, static/dynamic balance tasks
  - Stepping – and you’re off!
Not so fast...

• Barriers
  — Obvious
    • Impaired ROM, strength, balance, coordination
  — Not so obvious
    • Cognition
      — Impaired attention, memory, orientation
    • Visual deficits
    • Impulsivity
    • Limited safety awareness
    • Neglect

Concluding remarks

• After an injury, the brain goes through a period of recovery, spontaneously and also facilitated by therapy
• The areas around the injury undergo plastic changes to relearn the skills that were previously controlled by the injured areas
• Mobility is often significantly affected by these injuries, with extensive re-education required
• A variety of factors will impede progress, but it is our responsibility as clinicians to help return an individual to their highest functional potential

References

• Norton School of Lymphatic Therapy certification course Foldi’s Textbook of Lymphology 3rd edition
Questions?

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