Splinting, Casting, and Physical Therapy

Caryn McAllister, DPT
High Quality Home Therapy
Sacred Heart University
Fairfield, CT
Disclosures

- Received an educational grant for a study from Allergan plc on the Post Stroke Study.

- Served as a consultant for Ipsen and Merz and for study trainings and educational programs.
Objectives

- Explore the role of physical and occupational therapy in the management of upper extremity (UE) and lower extremity (LE) spasticity in individuals with neurological impairments.
- Review therapy approaches used to manage spasticity and improve function post-botulinum neurotoxin (BoNT) injections.
- Provide a brief overview of relevant research on post-BoNT therapy interventions.
Role of Therapy

“(Therapists) provide intervention to maximize the benefits of BoNT”\textsuperscript{14}

Post BoNT therapy objectives:
- Minimize contractures
  - Stretch spastic (injected) muscle groups
  - Strengthen antagonist muscle groups
- Acquire new motor skills/increase motor control
- Spasticity reduction + increased motor control $\Rightarrow$ increased FUNCTION and occupational performance\textsuperscript{5}
Role of Therapy

- **When**: During the “window of opportunity”
  - Period of clinically beneficial reduction spasticity
  - Lasting 12-16 weeks
- **How much**: Higher frequency, shorter duration
- **Who**: Rehab potential is influenced by the following:
  - Dynamic vs. fixed contracture
  - Degree of voluntary movement / underlying muscular strength
  - Sensory impairment
  - Motivation and ability to participate in therapeutic activities
  - Caregiver support
Stretching to increase passive range of motion (PROM) and ultimately to elongate muscles

- Manual stretch: moving through available range of motion with momentary hold at end range
  - At least 20-30 seconds
  - Longer hold better than a quick stretch
  - Repetition

- Prolonged stretch: splinting, casting, positioning
  - Maintain stretch over several hours/days/weeks
  - Neurophysiologic rationale: increases muscle length and number of sarcomeres, inhibits tone by decreasing muscle sensitivity to stretch during movement
  - Biomechanical rationale: increases or preserves length of connective tissue and mobilizes joint
Kinnear et al. (2014)

- BoNT combined with stretch-based interventions more effective at reducing spasticity than BoNT alone\(^\text{10}\)
Splinting

- Static splints: immobilize to prevent muscle shortening or contracture
  - Serial static splinting: remolding a static splint to gradually increase PROM
- Static progressive splints: provide constant position and have built in mechanism which is reset to progressively move joint toward end range
- Dynamic splints: moving parts (e.g. elastic or spring) apply constant force and keep joint at end range
Splinting: Summary of the Evidence

- Lai et al. (2009)
  - Greater improvements in AROM and spasticity reduction with use of dynamic elbow splint at night following BoNT

- Kanellopoulos et al. (2009)³
  - Combination of static night splint and OT resulted in greater improvements in function after BoNT compared to OT alone
  - Improvements maintained at 6 months
Serial Casting $^{15,17}$

- Cast applied over joint(s) crossed by spastic (i.e. injected) muscles
- Intensity of stretch adjusted by changing joint angle
- Reapplied at established intervals based upon increase in PROM
- Continues until full range achieved or plateau reached
- Some type of positioning device worn during periods of rest once casting complete
Serial Casting: Summary of the Evidence

- Bottos et al. (2003)
  - Greater spasticity reduction and functional gains achieved when casting used after BoNT

- Lannin et al. (2007)
  - Serial casting associated with improvement in quality of UE movement and range of motion

- Yasar et al. (2010)
  - Casting associated with statistically significant improvements in PROM and FIM gait scores

- Kay et al. (2004)
  - Casting alone appears more effective in reducing FIXED equinus contracture
Therapeutic Exercise and Functional Approaches

- Strengthening to increase AROM and correct muscle imbalance
  - Strengthening program individualized based on abilities and level of function
  - In order to increase strength a muscle must:
    - Contract at maximal capacity
    - Be given multiple repetitions
- Principles of motor learning theory support use of repetition/mass practice and task oriented approach
  - Activities selected given consideration of patient/family goals
  - Graded tasks provide a “just right challenge”
Constraint-Induced Movement Therapy (CIMT) \(^{12}\)
- Scientifically supported method of UE rehabilitation for individuals with hemiplegia
- Involves constraint of non-affected UE in combination with intensive therapy
- Foundations for treatment include neuroplasticity and motor learning theory
- Shaping activities are used in a systematic manner to achieve the following:
  - Facilitate more spontaneous use of affected UE
  - Improve motor skill quality
  - Increase overall function and quality of life
Therapeutic Exercise and Functional Approaches: Summary of the Evidence

- Kinnear et al. (2014)
  - BoNT combined with CIMT interventions more effective at reducing spasticity than BoNT alone.\(^ {10} \)
Other Therapeutic Modalities

- Therapeutic Taping
  - Improve alignment (position)
  - Muscle re-education (activating or inhibiting a muscle)
  - Various techniques and brands

- Neuromuscular Electrical Stimulation (NMES)
  - Purpose to increase strength of antagonist and increase range of motion or length of agonist \(^{15, 17}\)
  - Pulsating, alternating electrical current applied to muscle via electrodes to create contraction

- Heat Therapy
  - Creates short term tissue elasticity \(^{15, 17}\)
    - Caution use in neurological population due to sensory and/or cognitive deficits
Other Therapeutic Modalities: Summary of the Evidence

- Santamato et al. (2015)
  - BoNT in combination with adhesive taping showed a decrease in muscle spasticity and functional impairment \(^{(16)}\)
- Wright et al. (2012)
  - BoNT in combination with NMES associated with increased range of motion, improved strength, and decreased spasticity \(^{(19)}\)
- Wilkenfeld et al. (2013)
  - BoNT in combination with electrical stimulation of muscle group improves the results of the BoNT injections \(^{(18)}\)
In Conclusion…

What we know \(3, 6, 10\)
- BoNT appears to be more effective when combined with therapeutic intervention than when used alone
  - There is high level evidence to support the use of BoNT in combination with physical and/or occupational therapy for best outcomes
  - Therapy approaches are not harmful
- There is not a clear consensus as to which therapeutic approaches (or combination of approaches) are most beneficial for which circumstances
  - Professional judgment and individual considerations remain a key component of treatment planning
- More rigorous studies are needed to determine best practice related to post BoNT therapeutic interventions and the long term effects/maintenance of gains
References


Thank You
Break