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Functional Electrical Stimulation in Occupational & Physical Therapy Group Treatment

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- Post-acute Inpatient Rehab setting
- Pediatric and Adult setting
- Occupational therapist
- Co-treatment in functional E-stim groups with PT in pediatric setting– TEAMWORK IS KEY
- TBI population -- variety of weakened musculature with and without neurological muscle return from post injury

Why Functional E-stim?

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- We chose electrical stimulation as our modality to supplement neurological rehabilitation for muscle strengthening and muscle return.
- Many clinicians shy away from e-stim because of the amount of “dead time” involved (ie. Set up, take down, and usually just sitting while muscles fire).
- We chose to partner together and make a “functional” component to our group– Integrating functional and everyday movements that directly incorporate the muscles we’ve chosen to stimulate.

The Functional Component

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- Functional movement patterns increase chance of muscle return as it taps into procedural memory.
- This intervention performed primarily in pediatrics, thus, movement patterns were adjusted accordingly (i.e. Patterns that young adults more likely to have actively participated in pre-injury).
- We try to do reciprocal movement patterns for clients to engage more in movements that “mirror” planes (i.e. RUE mirroring LUE)
- Each movement pattern/station is modified for each client so that the client may get the most input from these stations (i.e. Modifications with weight, variable surfaces, movement, etc.)

Electrical Stimulation Parameters

- Waveform Frequency: Number of electrical pulses per second
  - 30-50 Hz (But not uncommon to get up to 100 Hz)
  - Higher the frequency, the more fatigued the muscle will be.
  - Will increase frequency to get stronger muscle response if muscle not responding to ES
- Waveform Pulse Width: Time span that a single electrical pulse or current is actively flowing
  - 200-250μs (typical for neuro-rehabilitation)
  - Shorter pulses = more comfortable
  - Longer pulses = ^ electrical power supplied to assist in muscle contraction (High pulses more likely to cause pain vs. any other sensation)
- Desired Response: Motor activation
- Duration: 30-45 minutes, 2x/week
- Electrode Placement: Variable, dependent upon client and needs

FES Schedule

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- 9 week duration
- OT & PT private brain storming meeting to:
  - Mutually decide which muscles to target
  - What functional movements will correlate with these muscles that we've chosen (3 stations)
  - Create a documentation template for the next 9 weeks
- Pre- and Post testing session (not part of the 9 weeks)
- Each session consists of 3 stations (functional movement stations)
- Each client stays at a station for 5 minutes at a time and then cycles through the rest

Data Collection

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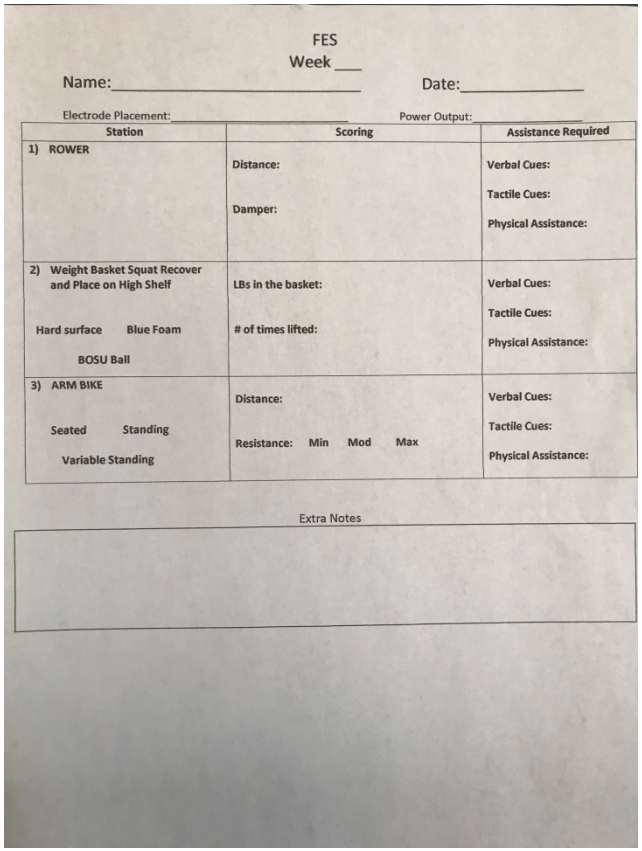
How We Collect Data

- Name, date, week #
- Electrode placement & power output
- Stations with scoring, assist levels, & modifications
- Extra notes (ie. Good/bad day, feeling ill, behavior, etc.)

Templates



FES
Week ___

Name:_____ Date:_____

Electrode Placement:_____ Power Output:_____

Station	Scoring	Assistance Required
1) ROWER	Distance: Damper:	Verbal Cues: Tactile Cues: Physical Assistance:
2) Weight Basket Squat Recover and Place on High Shelf Hard surface Blue Foam BOSU Ball	LBs in the basket: # of times lifted:	Verbal Cues: Tactile Cues: Physical Assistance:
3) ARM BIKE Seated Standing Variable Standing	Distance: Resistance: Min Mod Max	Verbal Cues: Tactile Cues: Physical Assistance:

Extra Notes

Getting Started

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Pre/Post Testing

- Manual Muscle Testing in clinic of all extremities (OT– BUEs, PT– BLEs)
- Then take each client to weight room
  - We find 1-rep lift maxes for each client
  - We take measurements of bilateral and ipsilateral muscle groups
  - I.e. Leg press, Hamstring curl, Knee ext., Lat pull-down, Bench Press, Low Row, Dynamometer

Week 1

- This session usually takes longer
- Find best electrode placement
- Getting clients and ancillary staff acclimated to stations
- Usually will take a picture of electrode placement for time efficiency for weeks 2-9

What is a “1-Rep Max”?

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- 1- Repetition Maximum (1-RM) of weight lifted
- ”A standardized 1RM testing protocol with a short warm-up and familiarization period is a reliable measurement to assess muscle strength changes regardless of muscle group location or gender (Dong-il, p. 221).”
- Addressing heavy resistance maximums targets the CNS in releasing hormones pertaining to muscle growth (ie. Testosterone, HGH)

Example Individuals Served

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Individual A

- GSW to right cranium, left side affected
- Admitted with 0/5 MMT of LUE, LLE; weakened core/trunk support on affected side
- Targeted areas: Left Ant. Deltoid, Trapezius, Triceps, Rhomboid

Individual B

- MVA with DAI to brain, left side weaker, however, deficits are global
- Admitted with generally 3-/5 LUE, 3+/5 RUE, poor core/trunk support globally
- Targeted areas: Left Rhomboids

Pre/Post Scores

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Client A

With longer rehab admission, able to participate in more 9-week units than Client B.

Muscles	Right		Left	
	Pre-test	Post- test	Pre-test	Post-test
Horizontal shoulder adduction (pectorals)	3+/5	5/5 MMT	0/5 MMT	4/5 MMT
Shoulder shrug (trapezius)	3/5	4/5	0/5 MMT	2+/5 MMT
Triceps	3+/5	5/5	0/5 MMT	0/5 MMT
Rhomboids	3/5	4+/5	0/5, NT	1/5 MMT

Client B

Muscles	Right		Left	
	Pre-test	Post-test	Pre-test	Post-test
Rhomboids	45#	65#	55#	75#

Considerations/Barriers

- Clients with variable lengths of stay, participating in more/less 9-week units
- “Freshness” of injury
- Severity/type of neurological injury
- Types of electrodes

Questions?

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References

- Dong-il, S., et al. “Reliability of the One-Repetition Maximum Test Based on Muscle Group and Gender.” *Journal of Sports Science & Medicine*, Vol. 11(2), June 2012, p. 221-225.*https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3737872/.*

- *Allan, K. & Goodman, C. (2014). Using Electrical Stimulation: A Guideline for Allied Health professionals. Sydney Local Health District and Royal Rehabilitation Centre; Sydney, Australia. https://www.aci.health.nsw.gov.au/data/assets/pdffile/0004/211819/Using-Electrical-Stimulation-January-2014.pdf.*