Managing Movement Disorders and Ataxia

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I have no financial disclosures to make.

Objectives

- Understand how various movement disorders negatively impact attempts to engage in everyday activities.
- Be able to comprehensively evaluate factors that limit or support daily performance for this population.
- Be able to create intervention plans to maximize daily performance for those living with movement disorders.

Motor Control Deficits

- Tremor (Intention, Action, Terminal)
- Hypotonia (is this an issue?)
- Dysdiadochokinesia
- Dysmetria
- Dyssynergia (Movement Decomposition)
- Tituabations

- Impaired Timing of Postural Responses**
  - Normal response: LEs and trunk activate prior to UEs to counterforce motion
  - Cerebellar dysfunction results in LE/trunk responses being generated too early to be effective in counteracting the destabilizing effects of arm movements (insatbility)

- Profound deficits in multi-joint movements as compared to single joint movements**
  - Inability to control degrees of freedom
  - Increased biomechanical/neural demands

- Movement dysfunction as a patient generated compensatory strategy**
  - Hypometria is safe
  - Decomposition
  - Slow movements
  - Postures

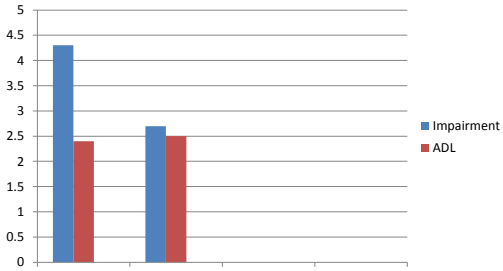
STANDARDIZED EVALUATION

- ****International Cooperative Ataxia Rating Scale** (ICARS) (D'Abreu et al. 2007): limb ataxia, stance disorders, postural disorders, dysarthria, oculomotor disorders
- ****Scale for the Assessment and Rating of Ataxia** (SARA) (Yabe et al. 2008): gait, stance, sitting, speech, dysmetria, tremor, RAMS
- **Brief Ataxia Rating Scale** (BARS) (Schmahmann, 2009) : gait, speech, kinetic arm/leg function,

- Limb Movements: force, displacement, velocity, acceleration
- Gait: kinematic, kinetic, temporal, EMG
- Stance: force platforms, accelerometers
- Frequency Measures: tapping tests, RAMS
- Time measures: pegboard, phrase pronunciation, writing/drawing, standing
- Single joint kinematics
- Peak velocities

TEND TO BE IMPAIRMENT FOCUSED!!!

Impairment Reduction vs. Activity Limitations



Evidence based?

Martin, C., Tan, D., Bragge, P. & Bialocerkowski, A. (2009). Effectiveness of physiotherapy for adults with cerebellar dysfunction: a systematic review. *Clinical Rehabilitation, 23*, 15–26.

"…results need to be interpreted with caution due to the low volume, quality and clinical applicability of this evidence. There is a need for further high-quality research in this area".

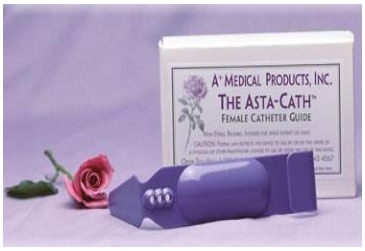
Key Interventions

- **Decrease the Degrees of Freedom in the Limbs and Trunk:** Minimize complexity of movements, decrease # of joints moving simultaneously, avoid multi-joint movements
- **Provide proximal stability** to decrease the inertial effects of limb movements, proximal stability to enhance distal function

- Change velocity of movement
- Adaptive Devices to: stabilize, control degrees of freedom, etc. (Yuen, Gillen)
- Assistive Technology: tremor dampening (W/C and PC), motion-detecting spoon (Liftware spoon)

Stable Slide:

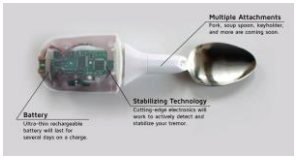
Asta-Cath



Liftware

Pathak, A., Redmond, J. A., Allen, M. and Chou, K. L. (2013), A noninvasive handheld assistive device to accommodate essential tremor: A pilot study. Mov. Disord.. doi: 10.1002/mds.25796

"Our intention is to shift the focus of the meal from the task of eating to an opportunity to enjoy food with friends and family"(A. Pathak)



Pathak, A., Redmond, J. A., Allen, M. and Chou, K. L. (2013), A noninvasive handheld assistive device to accommodate essential tremor: A pilot study. Mov. Disord.. doi: 10.1002/mds.25796

Improved with eating and transferring, but not the holding task. Accelerometer measurements demonstrated 71% to 76% reduction in tremor with the device on.

Weights: "The first line of defense and the last resort" (unfortunately…)

- Cuff weights, weighted devices, and weights for immobilization, weighted gloves, weighted walkers, vests
- What is optimum weight? If surpassed, quality of movement decreases.
- Mechanism is unclear: change in limb inertia, change in agonist/antagonist relationships, increased proprioception and sensory awareness??

Weights

- Weighted wrist cuffs for eating. Five adults with intention tremor: significant reduction in time to take a bite (n=3); fewer spills (n=2); dampened tremor (n=2). (McGruder, et al)
- No support for the clinical recommendation of using weighted utensils or cuffs to alleviate postural hand tremor in PD. (Meshack & Norman)
- Adding weights to the hand did not improve performance on manual tracking tasks. (Morrice at al.)
- Not compelling!

- Biofeedback: case study support for tremor dampening and relaxation.
- Compression garments; anecdotal evidence.

Jones L, Lewis Y, Harison J, *et al*. (1996). The effectiveness of occupational therapy and physiotherapy in multiple sclerosis patients with ataxia of the upper limb and trunk. Clin Rehabil, 10, 227–82

Objective: To evaluate the effectiveness of therapy intervention in reducing impairment and disability due to upper limb and trunk ataxia in chronic multiple sclerosis. N=29

Concluded that "therapy (OT/PT) used to improve dynamic postures and methods of performing functional tasks can result in improvements of functional ability…where spontaneous improvement would not otherwise be expected."

Jones, et al (cont)

8 half hour sessions of both OT/PT over consecutive days.

Treatment focused on:

- Adaptive device prescription
- Postural stabilization (Swiss Ball)
- Limb Bracing
- Weighting devices (walker, pens, etc.)
- Encouraging alignment in postures and movements

Stoykov, M. et al. (2005). Beneficial effects of postural intervention on prehensile action for an individual with ataxia resulting from brainstem stroke. *Neurorehabilitation,* 20(2), 85 – 89.

- Before-after, single-subject experimental design.
- Four-week course of postural training, comprised of three one-hour sessions/week.
- The patient demonstrated an increase in function of the ataxic limb, as evidenced by appreciable increases in the Fugl-Meyer score and modest increases in the Postural Assessment Scale for Stroke Patients (PASS) score.
- Improvement in postural control influences upper extremity function affecting the speed and accuracy of the movement.

Llg, W., Synofzik, M., Brotz, D., Giese, A., & Schols, L.(2009). Intensive coordinative training improves motor performance in degenerative cerebellar disease. Neurology, 73, 1823-1830.

- N=16 patients with progressive ataxia due to cerebellar degeneration or degeneration of afferent pathways.
- 4 weeks/3 sessions of 1 hour per week. Exercises included the following categories:

1) static balance, e.g., standing on 1 leg;

2) dynamic balance, e.g., sidesteps, climbing stairs;

3) whole-body movements to train trunk-limb coordination;

4) steps to prevent falling and falling strategies;

5) movements to treat or prevent contracture

Outcomes for intensive coordination training:

- Training improved motor performance and reduces ataxia symptoms (ICARS, SARA, BBS).
- Subjects achieved personally meaningful goals in everyday life (GAS).
- Training effects were more distinct for patients whose afferent pathways were not affected.
- For both groups, continuous training seems crucial for stabilizing improvements and should become standard of care.

Miyai, I., et al., (2012). Cerebellar ataxia rehabilitation trial in degenerative cerebellar diseases. *Neurorehabilitation & Neural Repair, 26*, 515-522.

- N=42 patients with pure cerebellar degeneration were randomly assigned to the immediate group or the delayed-entry control group.
- Inpatient rehabilitation:

PT: general conditioning; range-of-motion exercise for trunk and limbs; muscle strengthening; static and dynamic balance exercise with standing, kneeling, sitting, and quadruped standing; mobilizing the spine while prone and supine; walking indoors and outdoors; and climbing up and down stairs.

- OT: Improving ADLs and relaxation, hygiene, dressing, writing, eating, toileting, bathing, balance exercises, reaching, coordinative tasks of the upper limbs and trunk, and dual motor tasks such as handling objects while standing and walking.

Outcomes

- The immediate group showed significantly greater functional gains in ataxia, gait speed, and ADLs than the control group (SARA & FIM).
- Improvement of truncal ataxia was more prominent than limb ataxia.
- The gains in ataxia and gait were sustained at 12 weeks and 24 weeks, respectively.

Recommended Evaluation Procedures

STEP 1:

Interview re: task difficulties, tasks of importance, satisfaction with performance, treatment goals, rank importance, *Canadian Occupational Performance Measure*

STEP 2:

Observe specified tasks, skilled observations, impact of limb and trunk ataxia.

STEP 3:

Change task parameters. Which changes dampen or exacerbate ataxia?

- Positioning (supine, seated, standing, walking, leaning on wall)
- Control degrees of freedom
- Manual stabilization of head, upper trunk, pelvis
- Weight-bearing through hand or forearm
- UEs stabilized against trunk
- Emotional state
- Reach into space
- Postural insecurity
- Effort
- Target Size
- Coordinating 2 body parts
- Add weights
- Velocity of movement
- Proximal stabilization
- Distraction
- Automatic vs. voluntary

STEP 4

Retrain task performance integrating techniques, movements, equipment, and positions that dampened ataxia and enhanced function

STEP 5

Re-evaluate and re-interview. Does patient report increased performance and/or satisfaction?

Specific Interventions for Ataxia

(Gillen, 2000, 2001, 2011; Jones et al., 2006; Miyai et al., 2012; Stoykov, 2005;)

- See handouts…..
- Videotapes

Orthotics

Goal is to provide joint stability in order to decrease control requirements.

- Philadelphia collar
- Opponens orthosis
- Wrist supports
- Task specific orthoses (typing, writing, etc.)

Environmental Interventions

Utilizing the environment for stability: Focus on stabilizing upper/lower trunk, stabilize arms, decrease DOF:

- High back chairs
- Forearm weight bearing on work surface or wall
- Stabilize head on wall
- Sit at table against wall (anterior/lateral stability)
- Use corner of wall (anterior/lateral stability)
- Pillows and foam
- Stabilize with one arm holding chair

Retrain Movements

- Maintain arm contact with work surface or body (slide don't reach)
- Move in flexion and adduction
- Co-contract trunk
- Push head into back of chair
- Break down movement pattern to cahnge target (feeding example)
- Slow vs. quick movements
- Slide objects/tools on counter
- Avoid reach into space

Adaptive Devices

- Soap on a rope
- Electric toothbrush/razor
- Coated utensils
- Cup covers
- Long straws
- Weights
- Dycem
- Basket for transport
- Adapted cutting boards
- Suction brushes (nail, meal preparation, dish washing)

Assistive Technology

- Tilt-in-space power base
- Tremor dampening electronics
- Contoured seating
- High back chairs with head support
- Tremor dampening electronics
- Speaker phone/head sets, blue tooth
- Speech to text

Positioning

- Semifowler in bed
- Tilt in space for mobility
- High back chairs
- Avoid unsupported sitting
- Leaning against wall for sitting/standing
- Platform walkers for gait

Therapeutic Exercise

- Closed chain strengthening
- Proximal stability (core/scapula)
- Body weight as resistance
- Postural alignment
- Bridges, POE, quadruped, wall squats, kneeling, wheelchair pushups

Questions, comments, concerns…….

Additional References/Resources

http://www.ataxia.org/

http://www.movementdisorders.org/

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