CONTINUED

Concussion: Management, Intervention, & Rehabilitation

Nov 13: Concussion Management Update: Recommendations from the Berlin Meeting
Tamara McLeod, PhD, ATC, FNATA

Nov 14: Chronic Post-Concussion Syndrome: Psychological and Cognitive Implications for Treatment
Brady Whetten, PT, DPT, GCS

Nov 15: Concussion: Conditioning the Brain and Body for Return to Sport
Guest Editor: Mike Studer, PT, MHS, NCS, CEEAA, CWT

Nov 16: Concussion and the Older Adult: Does Age Make a Difference?
Debbie Struiksma, PT, NCS

Nov 17: The Management of Cervicogenic Pain and Headaches After Concussion
Rene'e James, MSPT, OCS, CMP and Bailey Denno, PT, DPT

CONTINUED

- If you are viewing this course as a recorded course after the live webinar, you can use the scroll bar at the bottom of the player window to pause and navigate the course.
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Chronic Post-Concussion Syndrome: Psychological and Cognitive Implications for Treatment

Brady Whetten, PT, DPT, GCS

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Objectives

Upon completion of this course, attending clinician will be able to:

- Describe at least two components of differential testing and at least two evidence based outcome measures that quantify functional limitations in cognition and psychological distress in individuals with post-concussion syndrome.
- Identify at least three appropriate strategies to successfully manage abnormal sensory dominance and autonomic nervous system maladaptation in persistent disability.
- List at least three novel interventions based from evidence-based treatment paradigms that address the complex presentation of the patients.
- Describe at least two case studies presented within this course, of challenging patient presentations to allow for immediate clinical application of the treatment paradigms.

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Acknowledgements

- Janene Homberg
- Kenda Fuller
- Mike Studer
- Many patients and their families at NWRA

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Concussion

- Complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces
- Often resolves spontaneously
- Reflected in a functional recovery, not structural
- Imaging typically negative
- Majority of concussions not from athletics

- Axonal stretching → disruption of neural membranes → Potassium and glutamate out → influx of calcium → Na/K pump needs to work overtime → increased energy required…….results in metabolic crisis

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Post-Concussion Syndrome (PCS)

- Varying definitions of PCS
- Generally indicates presence of at least 1 sx > 2 weeks post-injury
- 15-25% continue to experience symptoms > 3 months post injury
- PCS refers to somatic, cognitive, emotional, motor, or sensory sx's ascribed to a concussion or head injury

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Predictors of PCS

- Difficult to predict who will have persistent sx's
- Preinjury psychiatric or other health problems, life stressors
- Concurrent anxiety, depression, posttraumatic stress
- High levels of fear avoidance behaviors in 35% w/ PCS
- 10-15% of high school athletes experience PCS following sports-related concussion (SRC) – Kerr et. al. 2017
  - >10-14 days post injury
  - Presence of cognitive, somatic, and sleep-related symptoms predicted PCS sx's

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Common Symptoms

Physical	Cognitive	Emotional	Sleep
Headache	Feeling "foggy"	Irritability	Drowsiness
Nausea/vomiting	Feeling slow	Sadness	Sleeping less than usual
Dizziness	Difficulty concentrating	More emotional	Sleeping more than usual
Impaired balance	Memory difficulties	Nervousness/ anxiety	Difficulty falling asleep
Visual problems	Confused about recent events		
Fatigue	Answers questions slowly		
Sensitivity to light/sound	Repeats questions		
Numbness/tingling			
Dazed			

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Persistent dizziness causes in Post Concussion Syndrome (PCS)

- Chronic Pain
- Chronic Stress
- Cervical Strain
- Deconditioning
- Pituitary Dysfunction
- Insomnia
- Vestibular Dysfunction
- Oculomotor Dysfunction
- **CNS neuropathology**
  - **Autonomic Dysfunction (cerebral hypoperfusion or attenuated blood flow in the brain**
  - **Anxiety/Depression**
  - **Post Traumatic Stress Disorder**
  - **Psychosomatic effects (classically conditioned responses)**

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PTSD & mTBI (Bryant 2011)

- Post-Traumatic Stress Disorder
  - Exposed to event that threatens safety, and respond with fear
  - Report re-experiencing symptom
  - Avoidance symptoms
  - Suffer from marked arousal
  - Cause marked impairment to function, present 1 month post injury

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Bryant 2011

- "The emerging evidence that PCS is predominantly influenced by post-traumatic stress reactions suggests that addressing these problems may be crucial in alleviating PCS"

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Trauma

- "The person experienced, witnessed or was confronted with an event, or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others." *(DSM-IV)*
- Individual responds with: intense fear, helplessness, horror
- *"Trauma is in the brain, not in the experience"*

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Memories vs sensitizations

- Normal memory
  - Events are remembered as stories
  - Can change over time
  - Do not evoke intense sensations or emotions
- Traumatic sensitizations
  - Immediate sensory and emotional response
  - Knowledge of event may be absent
  - Dissociation

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Keys to trauma

- The retention of traumatic procedural memories through *fear-conditioning* and *kindling*
- Kindled posttraumatic procedural memories provide repetitive, unconscious cue-related input to fight/flight
- Increased dysfunctional autonomic cycling.

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CONDITIONING IN TRAUMA

- Lack of "completion" imprints the conditioned association of the threat :

The sensori-motor experience of the body

- The emotional state
- The autonomic state of arousal within procedural memory
- This association leads to fear conditioning, or traumatization

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CONTINUED

Signs Suggestive of a Traumatic Past

- Tactile defensiveness
- Defensive intellectualism
- Breath alteration
- Boundary rupture
- Self sabotage - Affinity to put themselves in the wrong place at the right time
- Patient initiated termination

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Sympathetic: Fight/Flight/Freeze

- Adaptation to emergencies
  - General adaptation syndrome
- Neurons in medulla
  - Cardiovascular
  - Respiratory
  - Gastrointestinal
  - Baroreceptors
- Excitation!!!

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PARASYMPATHETIC: Rest and Digest

- Vagal responses
- "Gut feelings"
- **Increases:** digestion, intestinal motility, fuel storage (increases insulin activity) resistance to infection, circulation to non-vital organs, (skin, extremities...) endorphins, the "feel good" hormones
- **Decreases:** heart rate, blood pressure temperature
- Inhibition

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Parasympathetic Dominance

- Palpitations, nausea, dizziness, indigestion, abdominal cramping, syncope, diarrhea and incontinence, exhaustion.
- IBS, PMS, colitis, chronic fatigue, ulcers, interstitial cystitis (IC)
- pelvic floor dysfunction (PFD), orthostatic hypotension, gastric reflux
- Increase in abdominal tension and bloating

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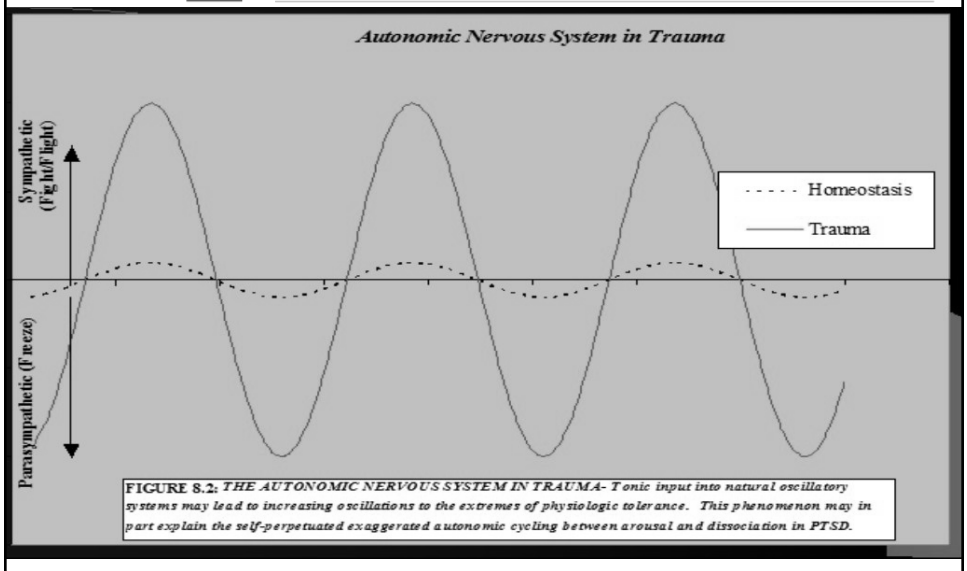

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Clinical considerations

- These patients do not like change, as with appointments
- Hard to conceptualize: may need to use pictures
- Create safe place in office, calm environment
- Minimal hand gestures, safe body posture

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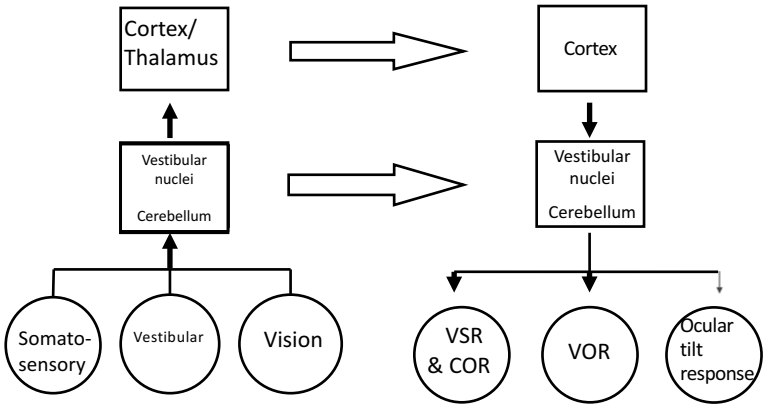
Normal Balance System



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Head trauma

- **Misweighting of sensory information** with heavy dominance on vision and underweighting of proprioception and even reciprocal inhibition of vestibular information
- **Heightened awareness** to motion/destabilizing cues and conscious motor control
- Amygdala Perceives **THREAT** driving increased autonomic dysregulation of sympathetic and parasympathetic responses

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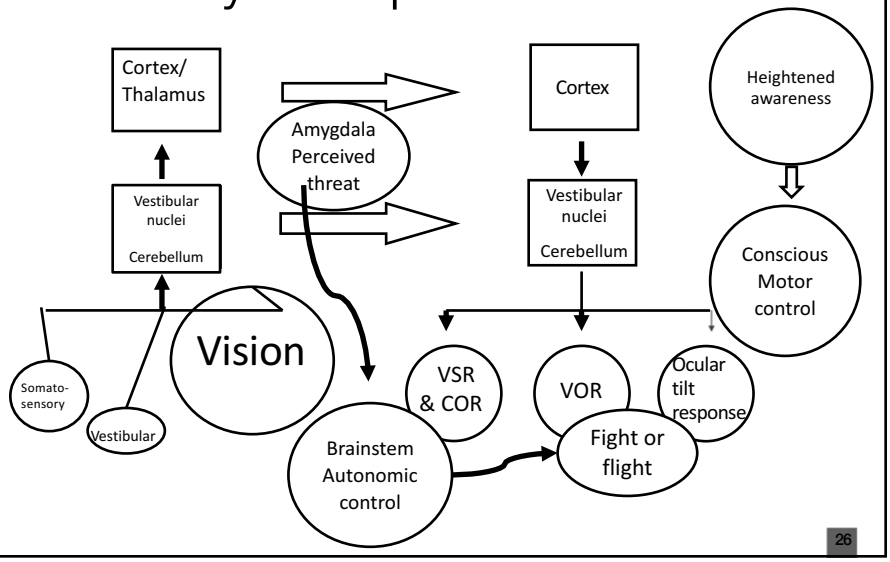
Balance system post-trauma



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Boundaries

- Small safe world, “invisible but real”
- Collective experiences, positive and negative
- Senses- smell, vision, hearing, vestibular, taste, touch, proprioception and nociception help form these boundaries
  - Eventually tell us where we as a perceptual whole end, and the rest of the world begins
  - Threat, hurt, violence, shame; in a state of perceived helplessness

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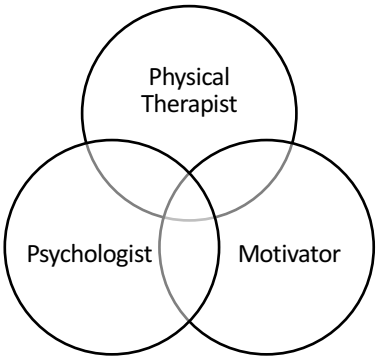
Regardless of the cause…we need to get them better



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Differentiating Subjective Complaints

What is **driving the Disability**?

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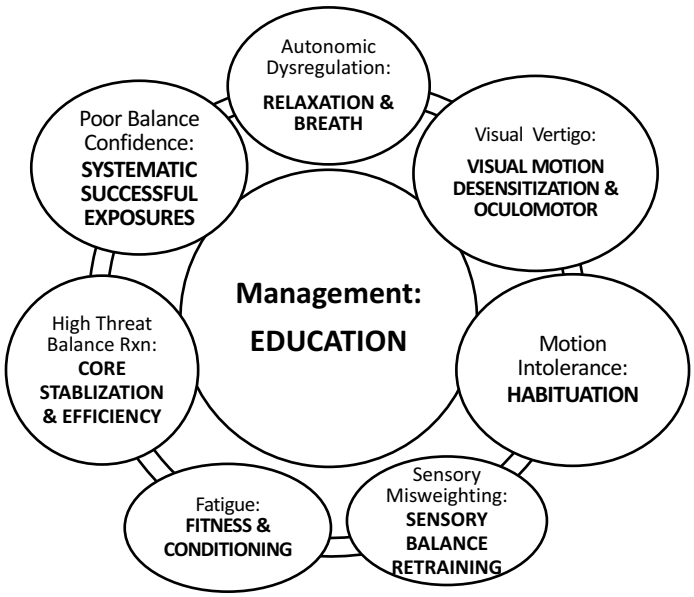

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Critical components of the dizzy history

- **Quality**: Dizziness vs vertigo vs unsteadiness
- **Associations:** stress, marked with FEAR/worry
- **Triggers:** what provokes the symptoms?
- **Duration:** How long does it last?

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Dizziness Handicap Inventory (DHI)

- 25 item "Self perceived handicap"
- Grouped "because of your problem…
  - Function - What is it difficult?
  - **Emotion - Do you feel?**
  - Physical - What increases your symptoms?
- Mild – 16-34
- Moderate – 36-52
- Severe – 54+

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CONTINUED

Situational Vertigo Questionnaire (SVQ)

0 Not at all	1 Very slightly	2 Somewhat	3 Quite a lot	4 Very much	N.T. Not tried

Riding as a passenger in a car on straight, flat roads	0	1	2	3	4	N.T.
Riding as a passenger in a car on winding or bumpy roads	0	1	2	3	4	N.T.
Walking down a supermarket aisle	0	1	2	3	4	N.T.
Standing in a lift while it stops	0	1	2	3	4	N.T.
Standing in a lift while it moves at a steady speed	0	1	2	3	4	N.T.
Riding in a car at a steady speed	0	1	2	3	4	N.T.
Starting or stopping in a car	0	1	2	3	4	N.T.
Standing in the middle of a wide open space (e.g. large field or square)	0	1	2	3	4	N.T.
Sitting on a bus	0	1	2	3	4	N.T.
Standing on a bus	0	1	2	3	4	N.T.
Heights	0	1	2	3	4	N.T.
Watching moving scenes on the T.V. or at the cinema	0	1	2	3	4	N.T.
Travelling on escalators	0	1	2	3	4	N.T.
Looking at striped or moving surfaces (e.g. curtains, Venetian blinds, flowing water)	0	1	2	3	4	N.T.
Looking at a scrolling computer screen or microfiche	0	1	2	3	4	N.T.

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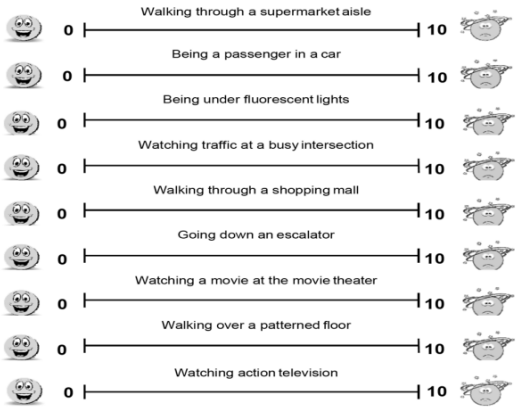
Visual vertigo

- Visual Vertigo Analog Scale (VVAS)



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Positive Affect Negative Affect Scale (PANAS)

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

___interested (P)	____irritable (N)	___jittery (N)
___distressed (N)	____alert (P)	___active (P)
___excited (P)	____ashamed (N)	___afraid (N)
___upset (N)	____inspired (P)	___hostile (N)
___strong (P)	____nervous(N)	___enthusiastic (P)
___guilty (N)	____determined (P)	___proud (P)
___scared (N)	____attentive (P)	

Significant Anxiety
Negative Scale > 29.9

Significant Depression
Positive Scale < 22

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Hospital Anxiety and Depression Scale (HADS)

Hospital Anxiety and Depression Scale (HADS)

Tick the box beside the reply that is closest to how you have been feeling in the past week.
Don't take too long over you replies: your immediate is best.

D	A		D	A	
		I feel tense or 'wound up':			**I feel as if I am slowed down:**
	3	Most of the time	3		Nearly all the time
	2	A lot of the time	2		Very often
	1	From time to time, occasionally	1		Sometimes
	0	Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			**I get a sort of frightened feeling like 'butterflies' in the stomach:**
0		Definitely as much		0	Not at all
1		Not quite so much		1	Occasionally
2		Only a little		2	Quite Often
3		Hardly at all		3	Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			**I have lost interest in my appearance:**
	3	Very definitely and quite badly	3		Definitely
	2	Yes, but not too badly	2		I don't take as much care as I should
	1	A little, but it doesn't worry me	1		I may not take quite as much care
	0	Not at all	0		I take just as much care as ever
		I can laugh and see the funny side of things:			**I feel restless as I have to be on the move:**
0		As much as I always could		3	Very much indeed
1		Not quite so much now		2	Quite a lot
2		Definitely not so much now		1	Not very much
3		Not at all		0	Not at all
		Worrying thoughts go through my mind:			**I look forward with enjoyment to things:**
	3	A great deal of the time	0		As much as I ever did
	2	A lot of the time	1		Rather less than I used to
	1	From time to time, but not too often	2		Definitely less than I used to
	0	Only occasionally	3		Hardly at all
		I feel cheerful:			**I get sudden feelings of panic:**
3		Not at all		3	Very often indeed
2		Not often		2	Quite often
1		Sometimes		1	Not very often
0		Most of the time		0	Not at all
		I can sit at ease and feel relaxed:			**I can enjoy a good book or radio or TV program:**
	0	Definitely	0		Often
	1	Usually	1		Sometimes
	2	Not Often	2		Not often
	3	Not at all	3		Very seldom

Please check you have answered all the questions

Scoring:
Total score: Depression (D) _____ Anxiety (A) _____
0-7 = Normal
8-10 = Borderline abnormal (borderline case)
11-21 = Abnormal (case)

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Evaluation general guidelines

- Unusual balance performance
  - Increased upper body sway reactions, out of proportion to level disturbance
  - Adopting postures that require increased balance e.g. Momentary single leg stance exposures, narrowed heel-toe walking
- Normal performance but with poor tolerance
- Level of disability doesn't match clinical findings/impairments
- Aphysiologic/Inconsistent Performance
- Don't over read non-localizing findings clinical findings IF HISTORY doesn't support

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Evaluation Specifics

- Oculomotor Testing (Quality and Tolerance)
  - Smooth, Saccade, Convergence, OPK, VOR cancellation, Cover/uncover or Maddox Rod
- Visual Motion Sensitivity
  - Subjective intolerance: oculomotor testing & CTSIB (including conditions 3/6)
  - Subjective report and questionnaires
- Motion Sensitivity Testing (MSQ)
  - Positioning and positional testing

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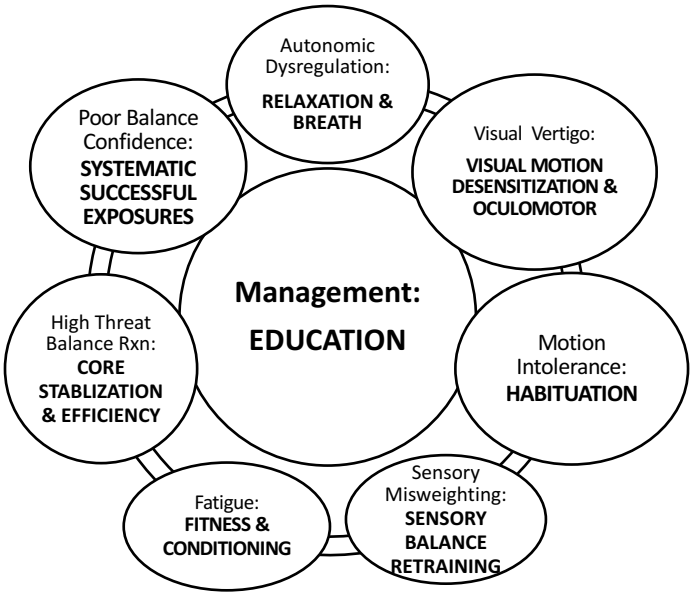

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Management of PCS

- Identify what is driving the persistent symptoms
- Critical to get that under control first
- Look at the whole person
  - "It is more important to know what sort of a patient has a disease, than what sort of disease a patient has." Sir William Ostler 1911
- Task specificity and principles of vestibular rehabilitation are still critical

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RELAXATION TRAINING: ANS Calming

- Guided Relaxation/mindfulness training/experiencing
- Grounding (G)
- Sound (S) Quieting the Mind
- Breathing (B) training awareness
  - Mindful, diaphragmatic, resonant frequency breathing
- Body Scan: Muscle tension awareness
- Imagery
- Assigned practice 10-40 min daily and frequent GSB during day
  - Podcasts, Scripts, Online, Apps

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Relaxation/mindfulness resources

- Book: The Mindful Way through Depression by J Mark G. Williams
  - CD included with Jon Kabat-Zinn
- Apps
  - "Calm : 7 free sessions that can be repeated different length, subscription needed to fully use the program
  - "Insight Timer": Free guided meditations, music tracks, talks and courses
- Online Resources:
  - Martin Rossman: https://thehealingmind.org
  - Tara Brach: https://www.tarabrach.com

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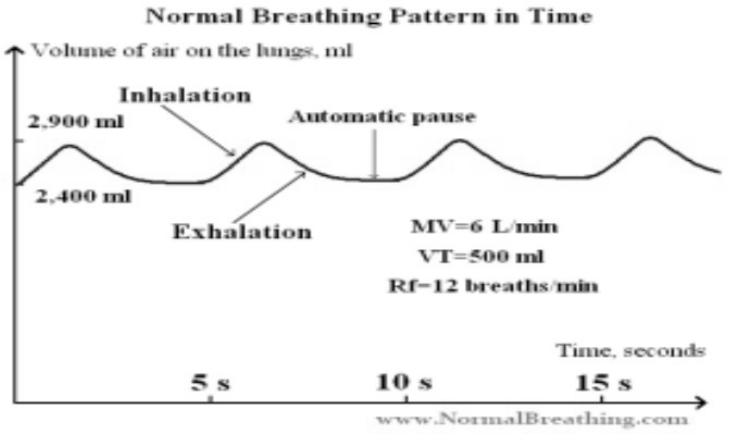
Focus on breathing pattern



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Breathing

- Oxygenation of the organism can be determined by monitoring how long the patient can pause their breath w/o stress.
- 20-60 Sec in health
- 5 Sec in diseased states.
- Breathing can be trained!!!!

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CONTINUED

Breathing

- Oxygen is a natural anti-inflammatory
- High blood pressure can be related to poor breathing
- Sleep disturbance when breathing is not normal
- Increase in upper quadrant tension
- Modulates anxiety/relaxation

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CONTINUED

Mechanoreceptors

- Touch
  - Cutaneous stimulation
- Pressure
  - Weighted blanket, weights on/through shoulders
- Temperature
  - Neutral Warmth
- Sound
  - Inner voice, language and music

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Habituation=Guided neuroplasticity

- Habituation WITH emphasis on control/groundedness
  - Small doses, long rest periods
  - Calm fight/flight responses
  - Primary goal is control of symptoms
  - Watch for inefficient stabilization/ high threat behaviors
- ID & Rx patient's exact trigger
  - Progress intensity as tolerance builds & autonomic reactivity decreases
  - GOAL: reduce sensitivity to head/visual motion intolerance
  - 3-5 repetitive motions (2-4 minutes), rest, repeat 3 sets, TID
  - Visual tracking and or slow VORx1 in sitting (supine if needed) 10-20 seconds up to 1-2 minutes, TID
  - Add into standing & gait: 90, 180, to 360 degree turns independently then within gait

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NEUROPLASTICITY AND HEALING TRAUMA

- Therapy rewires the brain and takes time
- Regulatory skills restore homeostasis, reduce serum cortisol, restore the hippocampus
- Mindfulness and attunement skills inhibit the amygdala, enlarge frontal cortex
- Fear extinction of traumatic memory cues inhibits kindling
- Empowerment replaces helplessness
- Increased frontal cortex, hippocampus in meditation

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Therapeutic Alliance

- "The therapist ability to form an alliance is possibly the most crucial determinant of his effectiveness."
  - Luborsky et al (1985)
- Therapeutic alliance: subtle, dynamic relationship between patient and therapist. Not an intervention or technique, rather vehicle within which therapeutic process is facilitated.
  - Schore

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Therapeutic Presence

- Safety
- Establish a non Threatening Presence
- Be able to Allow the Client to Downregulate
- Meet all levels
- Create a sense of security, normalize their experience

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PCS Autonomic Dysregulation

- Pain management
- Cervical /Headache protocols
- Sleep Regulation
- Sleep Hygiene
- Behavior treatments
- Anxiety management
- Relaxation/breathing skills

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Common Symptoms

Physical	Cognitive	Emotional	Sleep
Headache	Feeling "foggy"	Irritability	Drowsiness
Nausea/vomiting	Feeling slow	Sadness	Sleeping less than usual
Dizziness	Difficulty concentrating	More emotional	Sleeping more than usual
Impaired balance	Memory difficulties	Nervousness/ anxiety	Difficulty falling asleep
Visual problems	Confused about recent events		
Fatigue	Answers questions slowly		
Sensitivity to light/sound	Repeats questions		
Numbness/tingling			
Dazed			

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CONTINUED

Measuring and defining attention

Focused – amount/vigilance
Sustained – duration
Divided – simultaneous two or more
Alternating – switching
Selected – filtering

No ONE clear way to define OR measure it!

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CONTINUED

Attention: How do we measure it?

Use standardized, objective measures of function in concert with formal distractions

- Test patient without distractions, record score
- Test patient with distractions, compare score

- "Functional attention cost" is the difference

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CONTINUED

Clinical recommendations

- Have a clinical hypothesis that you wish to test with the patient
- Measure single tasks and dual tasks
  - Determine dual task cost and overall tolerance
- Select tasks that target areas of interest for your patient
- Be sure that single tasks have clear objective measures
- Use more than one combination of tasks

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CONTINUED

Screening DT tolerance

Tenets of screening:

1. Overlapping of modalities will happen
2. Testing is *not* intended to be task-specific or functional
3. Test EACH primary and distracter alone
4. To cue, or not to cue…? You must decide…

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CONTINUED

Categorizing Interventions

Primary Motor	Cognitive	Motor
Walking - forward	Serial subtraction	Dialing a phone
- backwards	Memory tasks	Throwing a ball
- obstacles	Play formations	Pouring water
Balance - static	Autobiographical info	Pulling items out of a purse
- dynamic	Information processing task	Button a shirt
Sports- specific exercises	Read a magazine	Turn pages of a magazine

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CONTINUED

Interventions

Tenets of intervention:

1. Overlapping of modalities will happen
2. Intervention MUST be task-specific/functional
3. Interventions MUST consider patient preference
4. Underestimate patient expectations in DT
5. Either vary or choose NOT to cue prioritization

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Interventions

Primary tasks should:

- Be safe to perform with the available assistance: PT, BWS, harness/tracking, etc.
- Be improving in performance through practice
- Have potential to improve

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Intervention progression

Functional demands of the person's environment
  Home, work, avocation, sport

Psychological response to error/need for success

Multi-task considerations:
  Secondary motor control needs (UE)
  Higher-level motor control (gait deviations)

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A balance of allowing the patient to struggle enough during safe practice that the nervous system sees a need to make a change. This takes into consideration patient awareness, personality and their current levels of physical abilities.

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Goldilocks principle

- "Just right"
- Risks of under dosing
  - Wasted health care dollars
  - Loss of Physician/patient trust
  - Failure to achieve maximum potential
- Risks of overdosing
  - Pain cycle/dizziness/vertigo/possible falls
  - Fear of returning/cancellations

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Reminders

Dual task:

- 2 simultaneous tasks
- Can each can be performed and measured alone?
- Do they have separate goals?

Complex single tasks require processing

- can be more than some dual tasks
- depends on novelty & complexity of each task
- Influenced by capability of systems / modalities

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GOAL

- Focus on adding more demands to enable the learner to make the primary task (functional mobility, ADLs, sports, etc.) more automatic

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LM - dizziness

- B fistula with surgery May 2016
- Presented to PT Aug 2016 with significant dizziness & dystonia
  - Unable to drive or ride as passenger
  - Required min A to ambulate 281' (2 min) – severe ataxia
  - DHI 78/100 - severe
  - Constant head tremor
- Progress eval (2 months after starting PT)
  - Single TUG – 9.00 sec
  - TUG cognitive – 11.06 sec
  - TUG manual – 15.24 sec

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LM case study

- Progress eval (6 weeks later)
  - Single TUG – 9.00 sec → 7.35 sec
  - TUG cognitive – 11.06 sec → 7.68 sec
  - TUG manual – 15.24 sec → 10.68 sec
- 2 min walk – 281' w/ mina→493' no AD
- DHI – 78/100 (severe)→28/100 (mild)
- Now able to drive, ride as passenger w/out sx's
- Has returned to work

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Videos #1-4

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LM case study

- Progress eval (6 weeks later)
  - Single TUG – 9.00 sec → 7.35 sec
  - TUG cognitive – 11.06 sec → 7.68 sec
  - TUG manual – 15.24 sec → 10.68 sec
- 2 min walk – 281' w/ mina→493' no AD
- DHI – 78/100 (severe)→28/100 (mild)
- Now able to drive, ride as passenger w/out sx's
- Has returned to work

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CONTINUED

Video #5

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CONTINUED

Conclusion

- We must be willing to connect to individuals with post-concussion syndrome…look at the whole person
- We must be comfortable delving into the psychological domain, and find ways to motivate them
- Dual-task training allows for increased automaticity of primary tasks…and increased healing

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brady@northwestrehab.com

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