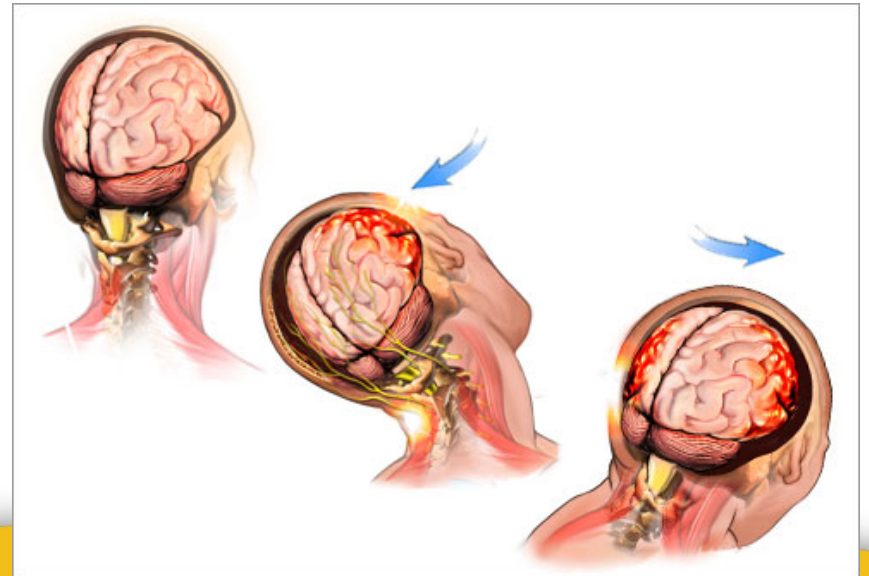


Vestibular Rehabilitation in a Female Volleyball Player

Alison S. Mitchell

Overview

- In the United States, between 1.6 and 3.8 million athletes suffer a sports-related concussion (SRC) each year
- Common symptoms of sport related concussions:
Confusion, headache, nausea/vomiting, dizziness, sensitivity to light or noise, fatigue, attention/concentration problems, emotional lability
- Common treatment: REST
- May cause:
Abnormal vestibular system functioning



Vestibular System

- Complex network: small sensory organs of the inner ear, connections to the brain stem, cerebellum, cerebral cortex, ocular system, and postural muscles.
- Our body's movement
- Timing through space
- Time/awareness of that movement
- Impairment= abnormal signals regarding position/movement
- When impairment exists→ brain most often relies on visual input to stabilize the head on the body

Vestibular Rehabilitation

- VRT = exercise treatment program designed to reduce or extinguish
 - hallucination of movement
 - exaggeration of motion or after motion

And improves or restores

- coordination of head and eye movement
 - balance and equilibrium
- Indicated for any vestibular lesion, outside of acute phase

Vestibular Rehabilitation

Symptom Type	Clinical Finding	Condition	Treatment	Tx Outcomes
1 Positional Vertigo	Positive m-Hallpike (PC) vertical-rotary nys. Positive Lateral Body (HC) horizontal nys.	BPPV- PC BPPV- HC * increased prevalence bilateral/multiple canal	CRM - PC protocols CRM-HC protocols	Extinguish subjective vertigo and associated nystagmus Improved Clinimetric
Dizziness- worse w/ head movement	Vestib/CNS pattern on vestibular sensitive tests e.g. SOP, Fukuda	Labyrinthine Concussion Peripheral/Central	Adaptation/Habituation and Substitution w/ cognition	Normal/improved function Improved Clinimetric
2 Blurred vision- trouble reading worse with head movement	Degraded dynamic visual acuity (DVA) with active head movement	Oscillopsia Abnormal VOR Gain/Phase	Adaptation- Gaze Stabilization: Context specific for direction and velocity	Recovery of VOR DVA improves to non-movement baseline
3 Imbalance	Abnormal - Balance Assessment tools e.g. BGI, CTSIB etc.	Labyrinthine Concussion Peripheral/Central	Substitution, Somatosensory Training	Normal/improved function Improved Clinimetric

Background

- 20 year old female volleyball player
- Defensive Specialist (DS)
- Diagnosed with 3 concussions and potentially several others
- Chronic symptoms:
 - persistent headaches
 - visual deficits
 - impaired balance
 - depression
 - anxiety
- Previous treatment/Diagnostic Testing:
 - physician → CT scan = unremarkable
 - prescribed glasses
 - prescribed Zoloft

Pre-Rehabilitation Measures

- Sport Concussion Assessment Tool (SCAT)
- Dizziness Handicap Inventory (DHI)
- Balance Error Scoring System (BESS)
- Biosway
- Computerized Dynamic Visual Acuity Test (CDVAT)
- GANS Sensory Organization Performance (SOP)

Sport Concussion Assessment Tool (SCAT)

SYMPTOM EVALUATION

3

Child report

Name:	never	rarely	sometimes	often
I have trouble paying attention	0	1	2	3
I get distracted easily	0	1	2	3
I have a hard time concentrating	0	1	2	3
I have problems remembering what people tell me	0	1	2	3
I have problems following directions	0	1	2	3
I daydream too much	0	1	2	3
I get confused	0	1	2	3
I forget things	0	1	2	3
I have problems finishing things	0	1	2	3
I have trouble figuring things out	0	1	2	3
It's hard for me to learn new things	0	1	2	3
I have headaches	0	1	2	3
I feel dizzy	0	1	2	3
I feel like the room is spinning	0	1	2	3
I feel like I'm going to faint	0	1	2	3
Things are blurry when I look at them	0	1	2	3
I see double	0	1	2	3
I feel sick to my stomach	0	1	2	3
I get tired a lot	0	1	2	3
I get tired easily	0	1	2	3

Total number of symptoms (Maximum possible 20)

Symptom severity score (Maximum possible 20 x 3 = 60)

☐ self-rated ☐ clinician interview ☐ self-rated and clinician monitored

4

Parent report

The child	never	rarely	sometimes	often
has trouble sustaining attention	0	1	2	3
is easily distracted	0	1	2	3
has difficulty concentrating	0	1	2	3
has problems remembering what he/she is told	0	1	2	3

COGNITIVE & PHYSICAL EVALUATION

5

Cognitive assessment

Standardized Assessment of Concussion – Child Version (SAC-C)*

Orientation (1 point for each correct answer)

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1

Orientation score of 4

Immediate memory

List	Trial 1	Trial 2	Trial 3	Alternative word list
elbow	0 1	0 1	0 1	candle baby finger
apple	0 1	0 1	0 1	paper monkey penny
carpet	0 1	0 1	0 1	sugar perfume blanket
saddle	0 1	0 1	0 1	sandwich sunset lemon
bubble	0 1	0 1	0 1	wagon iron insect
Total				

Immediate memory score total of 15

Concentration: Digits Backward

List	Trial 1	Alternative digit list
6-2	0 1	5-2 4-1 4-9
4-9-3	0 1	6-2-9 5-2-6 4-1-5
3-8-1-4	0 1	3-2-7-9 1-7-9-5 4-9-6-8
6-2-9-7-1	0 1	1-5-2-8-6 3-8-5-2-7 6-1-8-4-3
7-1-8-4-6-2	0 1	5-3-9-1-4-8 8-3-1-9-6-4 7-2-4-8-5-6
Total of 5		

Concentration: Days in Reverse Order (1 pt. for entire sequence correct)

Sunday-Saturday-Friday-Thursday-Wednesday-Tuesday-Monday	0	1
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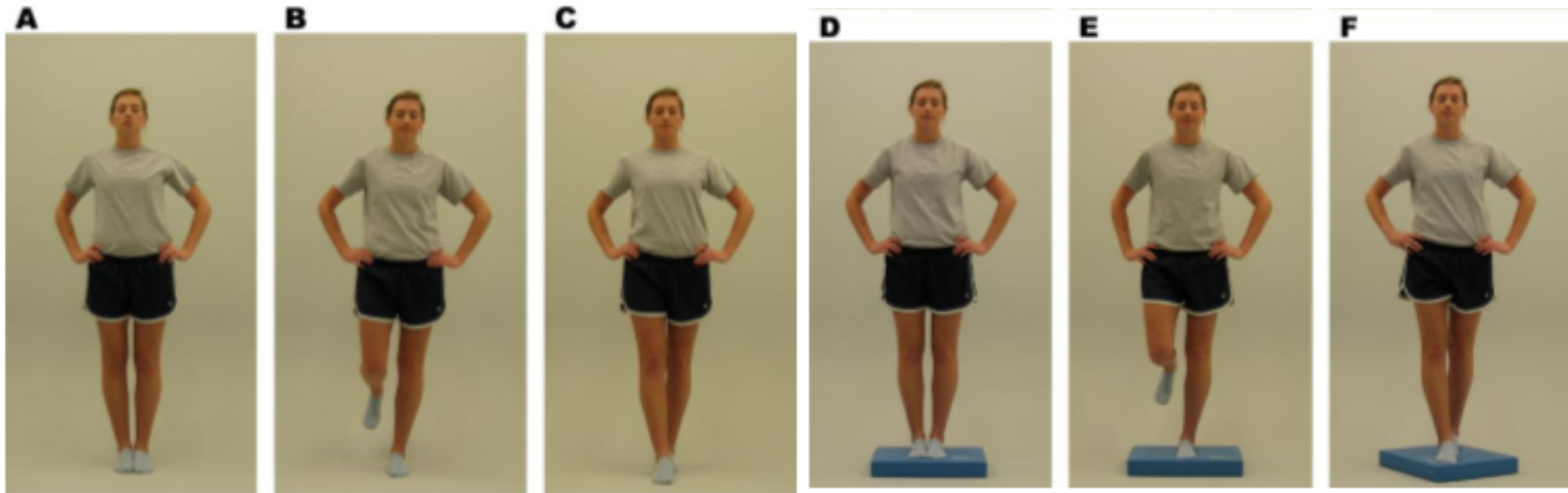
Concentration score of 6

Dizziness Handicap Inventory (DHI)

P
E
F

	Questions	Always	Sometimes	No
P1	Does looking up increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E2	Because of your problem, do you feel frustrated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F3	Because of your problem, do you restrict your travel for business or pleasure?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P4	Does walking down the aisle of a supermarket increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F5	Because of your problem, do you have difficulty getting into or out of bed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F6	Does your problem significantly restrict your participation in social activities, such as going out to dinner, going to movies, dancing or to parties?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F7	Because of your problem, do you have difficulty reading?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F8	Does performing more ambitious activities like sports, dancing, and household chores, such as sweeping or putting dishes away, increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E9	Because of your problem, are you afraid to leave your home without having someone accompany you?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E10	Because of your problem, have you been embarrassed in front of others?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P11	Do quick movements of your head increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F12	Because of your problem, do you avoid heights?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P13	Does turning over in bed increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F14	Because of your problem, is it difficult for you to do strenuous housework or yard work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Balance Error Scoring System (BESS)



Score Card

Balance Error Scoring System (BESS)

(Guskiewicz)

Balance Error Scoring System – Types of Errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position >5 sec

The BESS is calculated by adding one error point for each error during the 6 20-second tests.

SCORE CARD: (# errors)

FIRM
Surface

FOAM
Surface

Double Leg Stance
(feet together)

Single Leg Stance
(non-dominant foot)

Tandem Stance
(non-dom foot in back)

Total Scores:

BESS TOTAL:

Which **foot** was tested: ☐ Left ☐ Right
(i.e. which is the **non-dominant** foot)

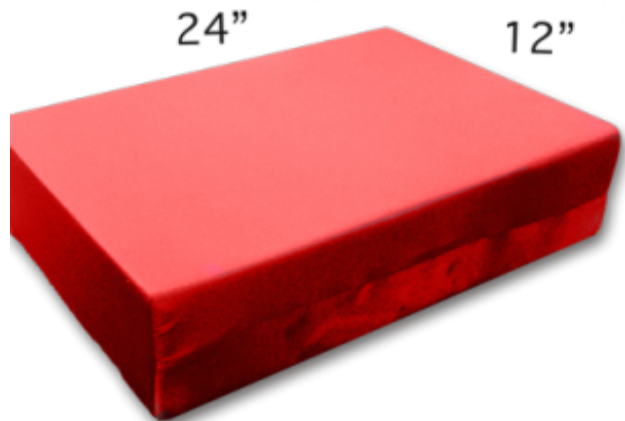
Biosway



Computerized Dynamic Visual Acuity Test (CDVAT)

- Abnormal Vestibular-Ocular Reflex (VOR)
 - Visual acuity with active head movement
 - Eyes focused while head is moving
 - Smooth pursuits, saccades, convergence (VOMS)

GANS Sensory Organization Performance (SOP)



IB Balance Performance Foam

Gans Sensory Organization Performance Test™																																																									
Patient _____	Date _____																																																								
Clinician _____	Physician _____																																																								
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Vestibular Rehabilitation

- Perform 1 x day (7 days a week)
- Establish dizziness scale 0-5 prior to beginning exercises
- 0 no dizziness 5 worst possible dizziness
- Establish dizziness scale after each exercise; return to baseline before moving on to the next exercise.
- Progressed: sets, repetitions, velocity of motion, stability of surface and visual confliction or distraction

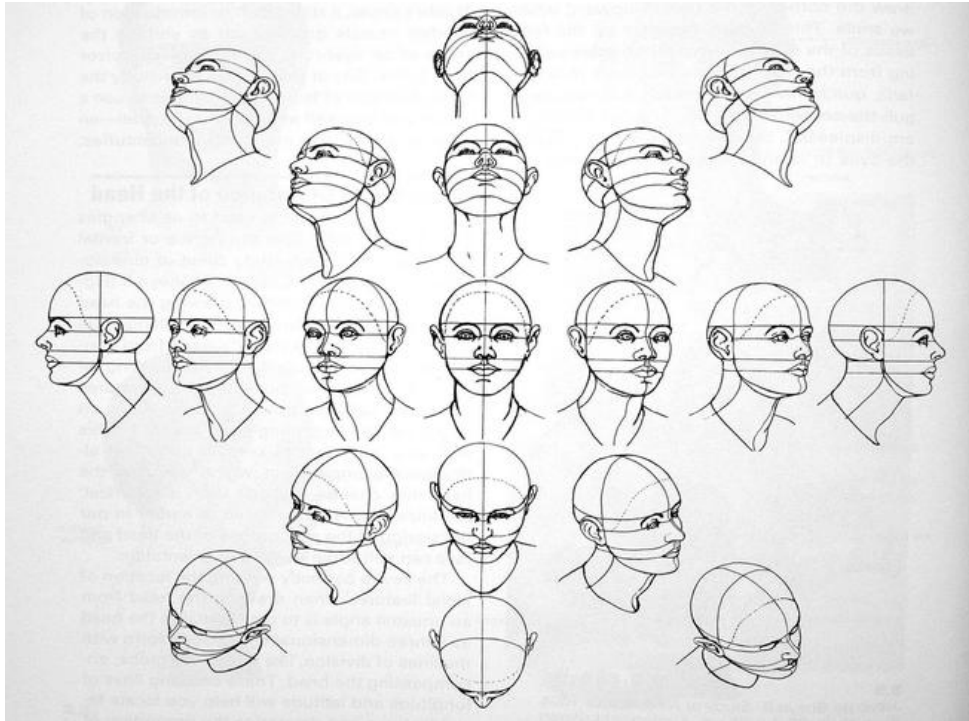
Head Circles



- Stand in corner, do not touch corner
- Eyes move with your head
- 10 circles clockwise, stop and refocus
- 10 circle counter clockwise, stop and refocus

Increased sets → stand on foam → stand on foam with feet together → increase speed

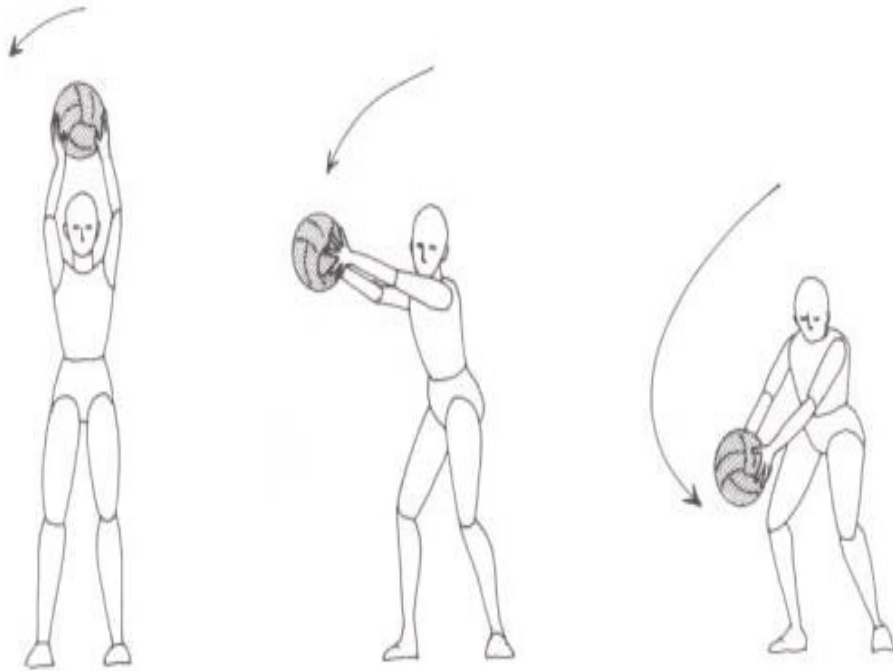
Head Turns



- Stand in corner, do not touch corner
- Turn your head to look
side to side
up and down
up to the right/down to the left
up to the left/down to the right
- Focus on target in each direction
- 30 seconds in all directions

Increased sets → stand on foam → stand on foam with feet together → increase speed

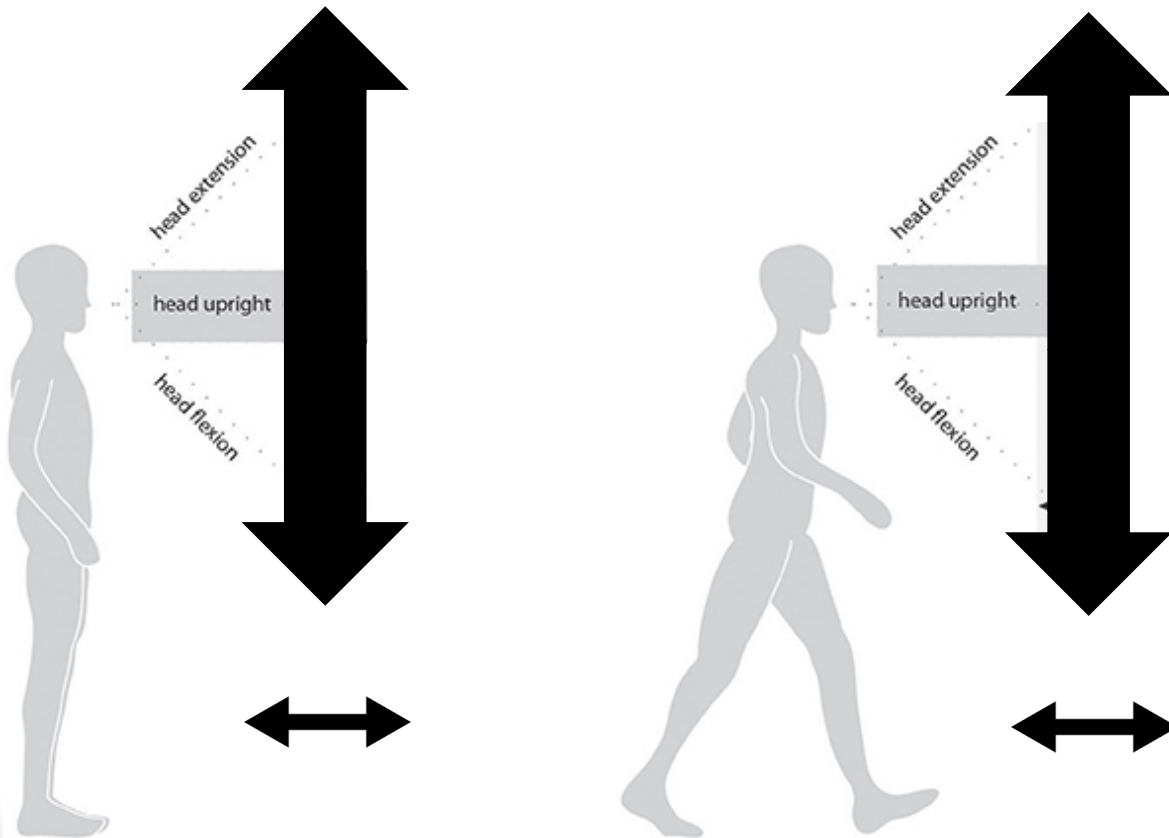
Ball Circles



- Stand in corner, do not touch corner
- Both feet shoulder width apart, holding a ball with both hands and arms straight out in front of you
- Move ball in large complete circles
- Eyes and head follow the ball
- Smooth and continuous
- 10 x clockwise
- 10 x counter clockwise

Increased sets → increase speed → use distraction → more difficult distraction

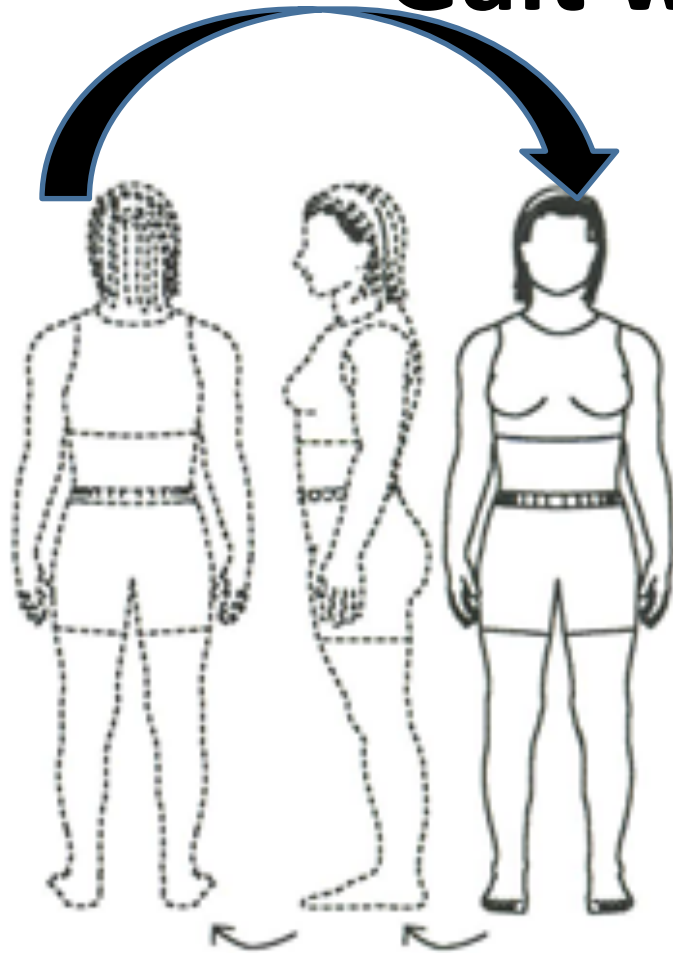
Gait with head turns



- Walk down a hallway; no set distance to walk
- Move head right and left
- Move head up and down
- No set amount of times to turn your head
- Eyes follow your head
- 30 sec up and down
- 30 sec left and right

Increased sets → increase speed → nods

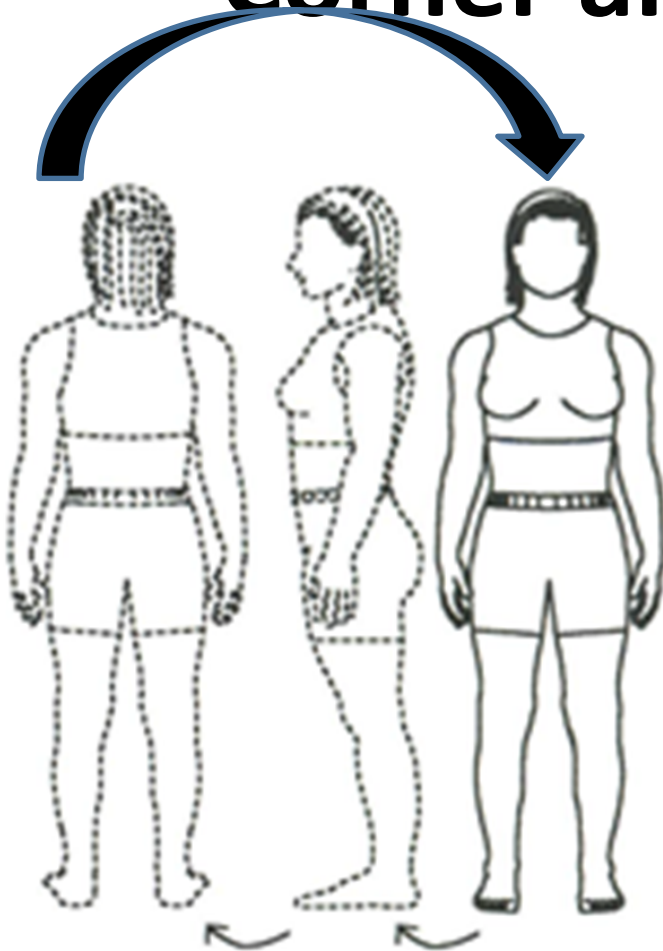
Gait with full turns



- Walk down a hallway; no set distance to walk
- Take 2-3 steps then turn completely around in a circle to the right
- Alternate between right and left turns
- Stop and refocus in between turns
- No set number of turns to take
- 30 sec

Increased sets → increase speed → same side turns

Corner alternating turns



- Stand in corner, do not touch corner
- Turn around to the right, stop and refocus
- Turn around to the left, stop and refocus
- Continue to alternate between right and left turns for a total of 10 turns

Increased sets → increase speed → same side turns

Rolling on wall

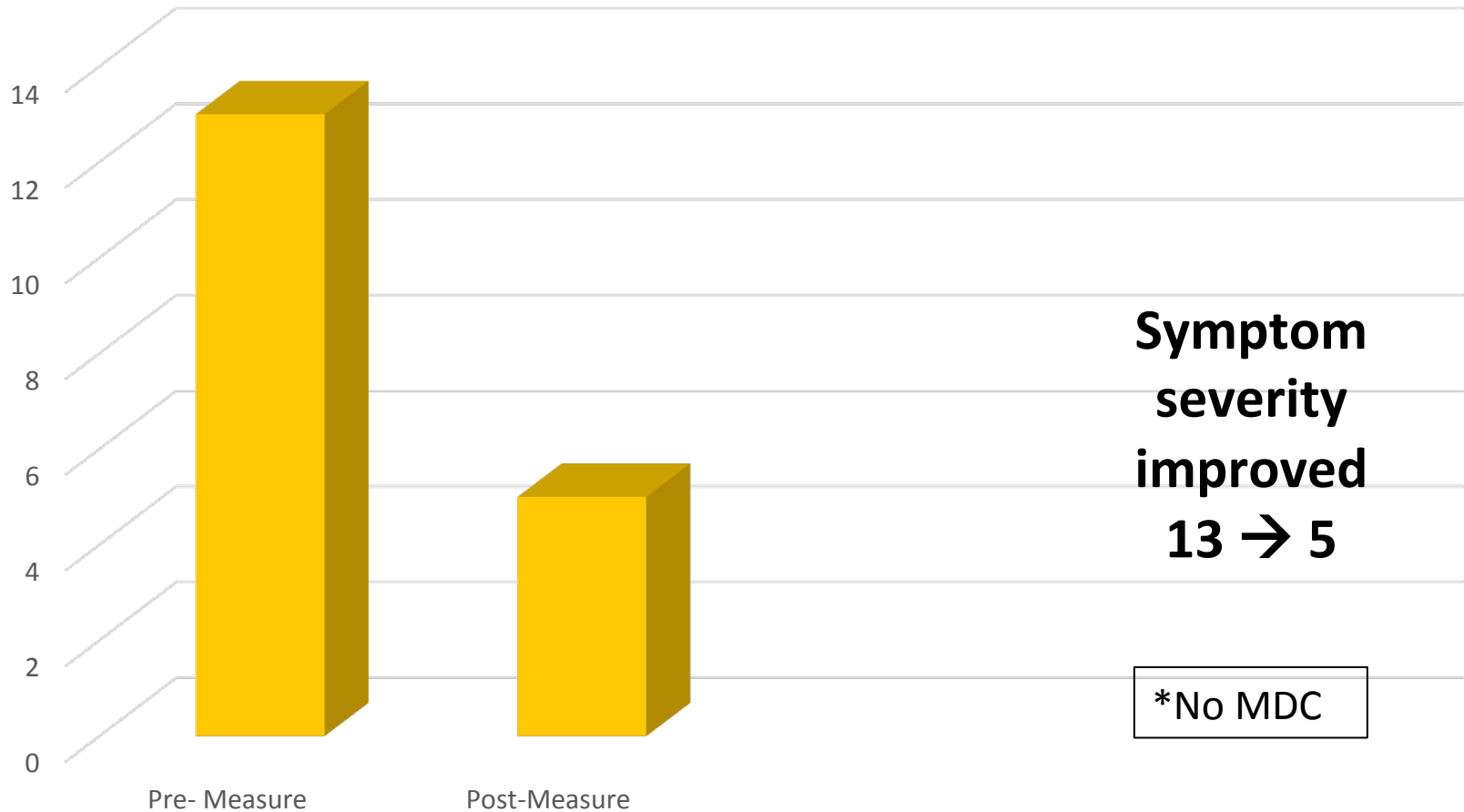


- Stand with back against wall
- Bend elbows and keep fists near face to protect yourself
- Roll in a circle on the wall making sure some part of your body is always touching the wall
- Roll 3-4 times to the right
- Roll 3-4 times to the left
- Always stop with your back against the wall and eyes closed until dizziness completely resolves

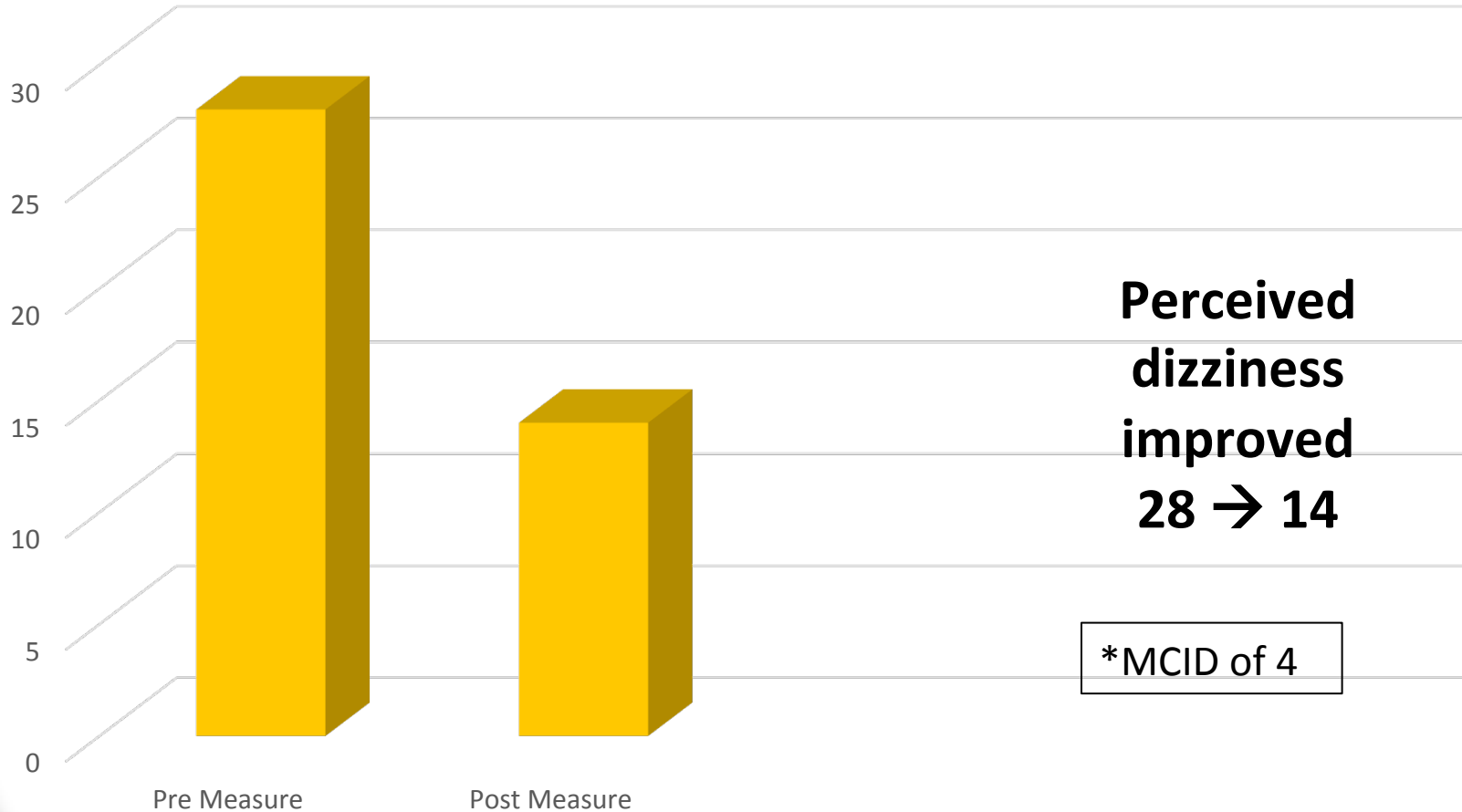
Increased sets → increase speed → rolls with eyes closed

Post-Rehabilitation Measures & Scores

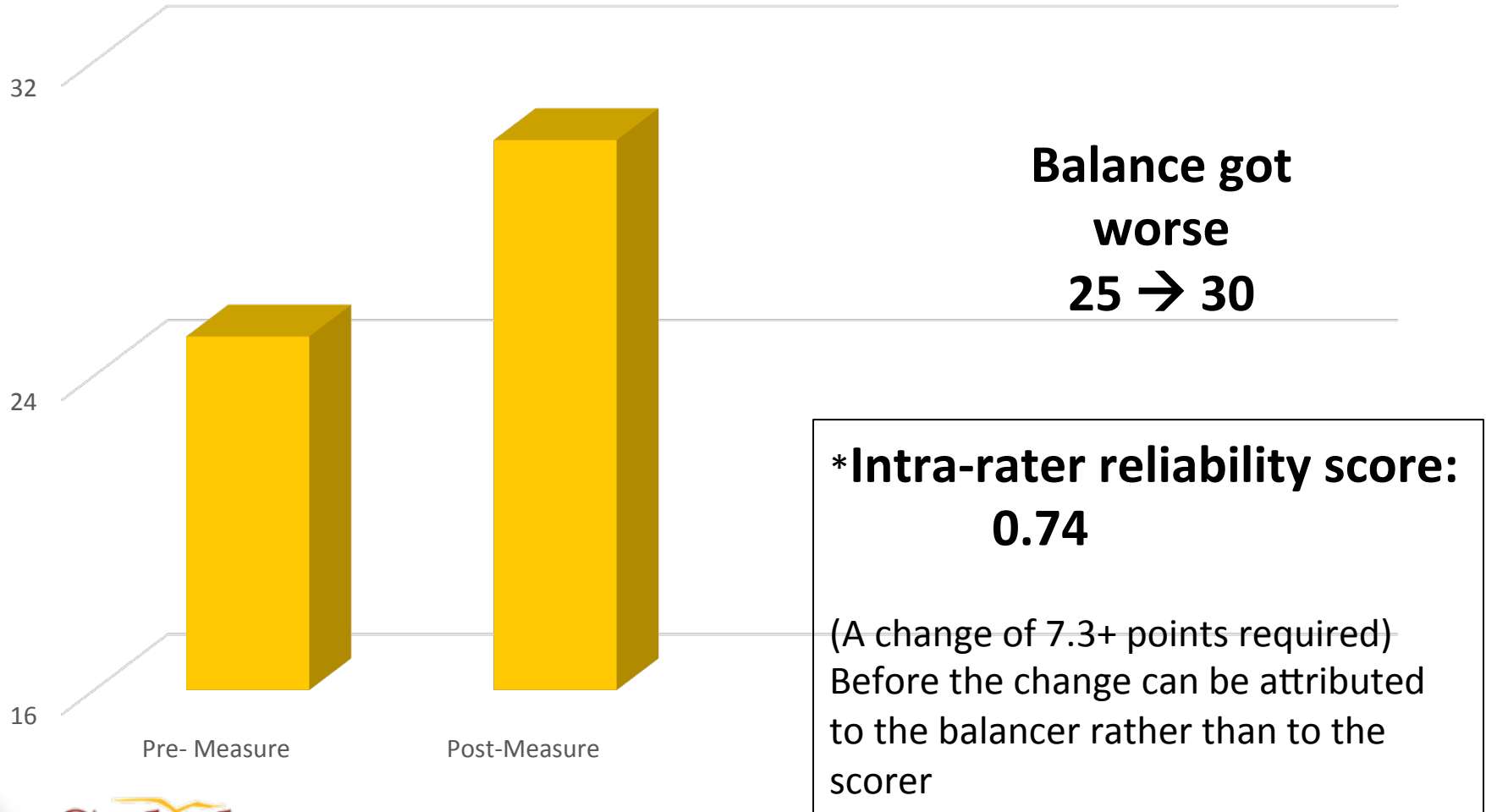
SCAT



DHI

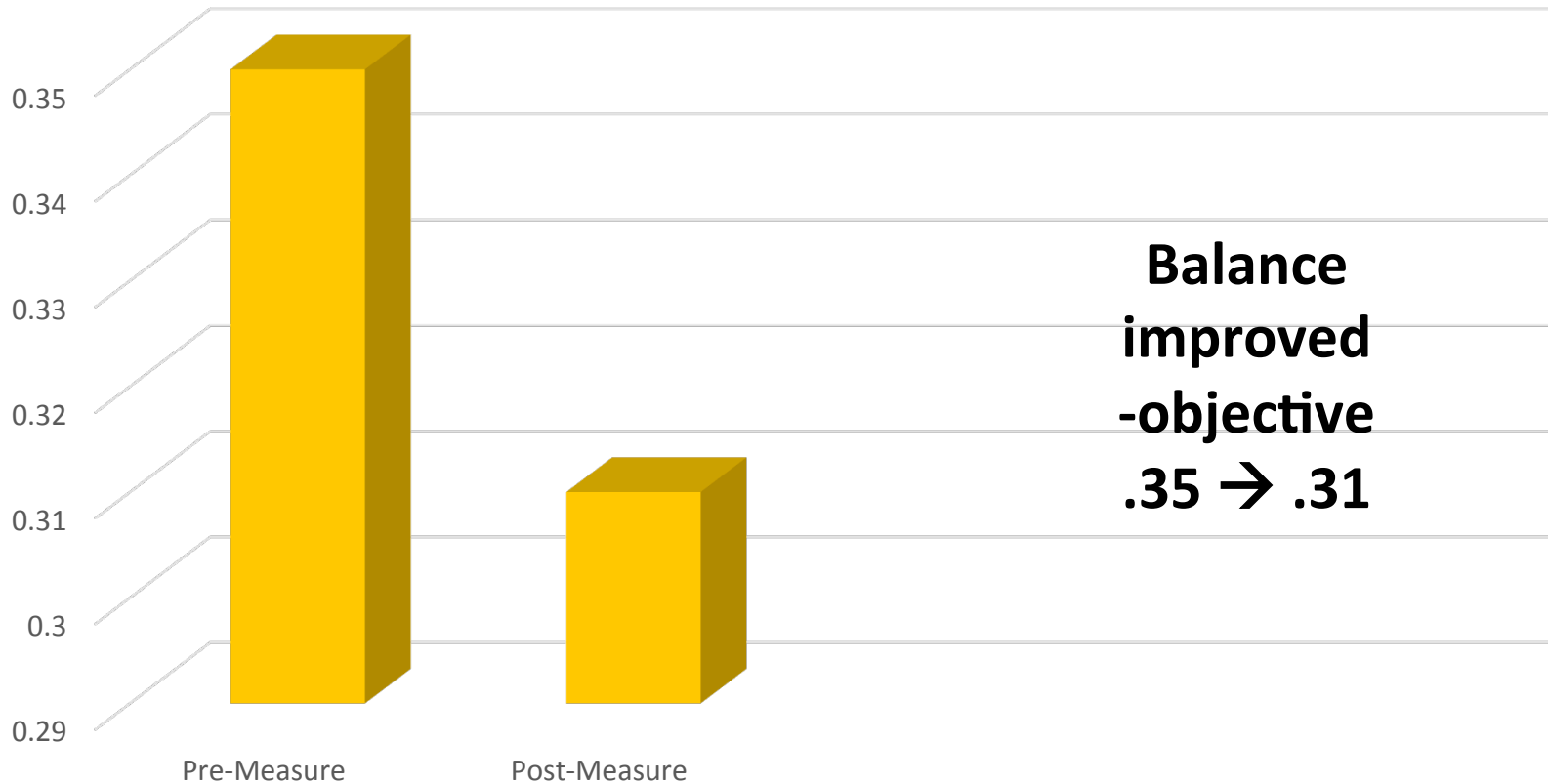


BESS



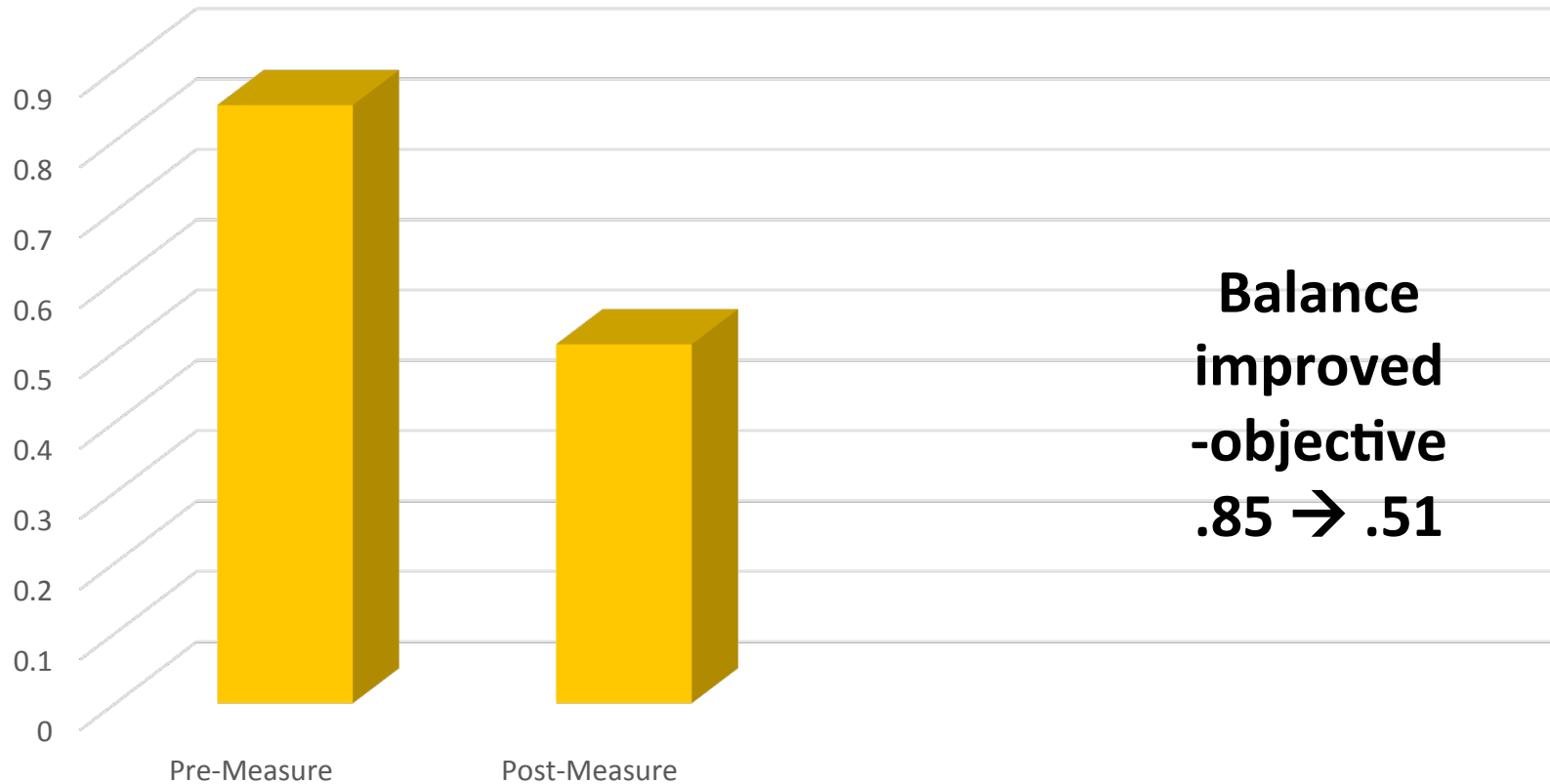
Biosway

EO Firm



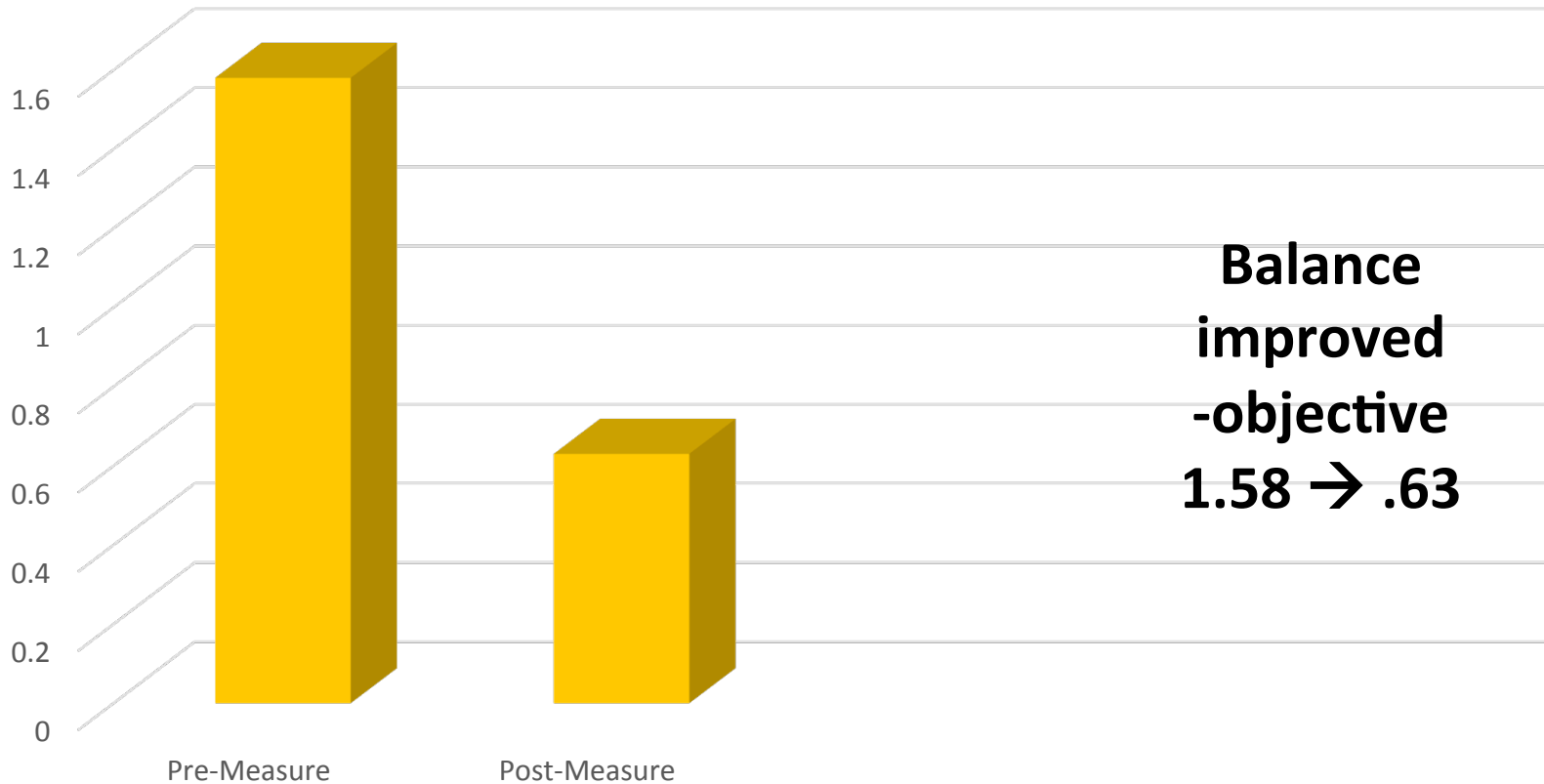
Biosway

EC Firm



Biosway

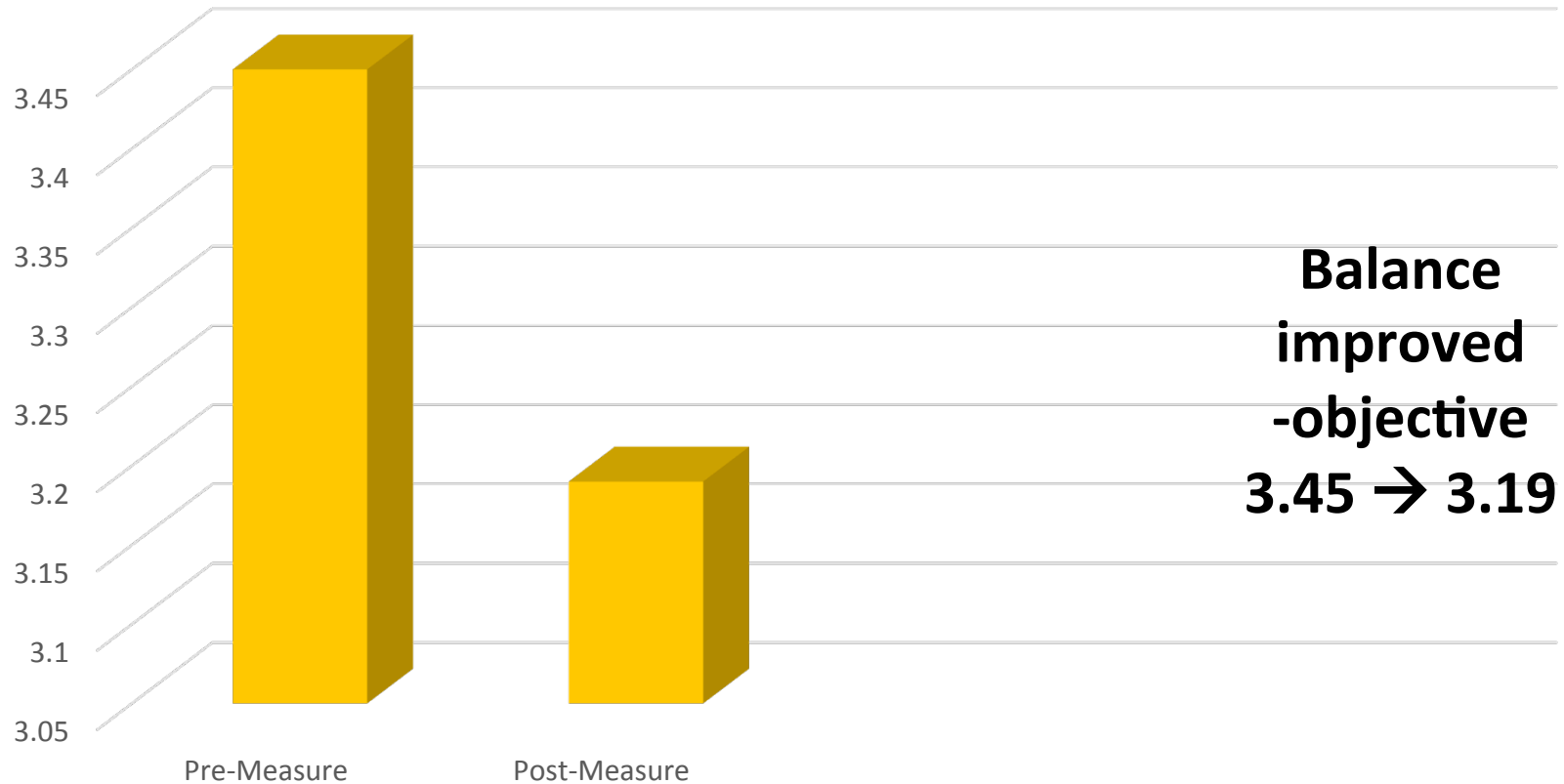
EO Foam



**Balance
improved
-objective
1.58 → .63**

Biosway

EC Foam



Limitations

- Was lifting with Volleyball Team for the first 4 weeks of study
- 5th week was sick with cold and ear infection prescribed steroids
- 6th, final week of study, she began spring volleyball practice with team
- Exertional recreational activities
- Compliance
- Not being able to complete each day in the clinic while monitored
- Trigger points, myofascial tightness-self massager and portable TENS

Conclusion

- Recognition of chronic symptoms and vestibular deficits
- Appropriate assessment and categorization of symptoms
- Determine proper treatment strategy
- Vestibular rehabilitation is generally underutilized in Athletic Training
- Vestibular rehabilitation should be considered in the management of individuals post-concussion who demonstrate prolonged symptoms

Acknowledgements

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- MAATA Student Program

Samuel W. & Marilyn C. Seidel School of
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