THE IMPACT OF VESTIBULAR REHABILITATION THERAPY (VRT) POST CONCUSSION IN ADOLESCENTS: A SYSTEMATIC REVIEW

Amanda Kinback, SPT
Matthew Moran, SPT
Jennifer Schwartz, PT, DPT, Board-Certified Clinical Specialist in Neurologic Physical Therapy
Lori M. Walton, PhD, DPT, MScPT, MPH(s), CLT

Objectives

- By the end of this presentation the audience will understand the definition of vestibular rehabilitation therapy and the various interventions that fall within this category.
- By the end of this presentation, the audience will understand the positive effects that Vestibular Rehabilitation Therapy (VRT) may have on adolescents with concussion.

Background: Concussion

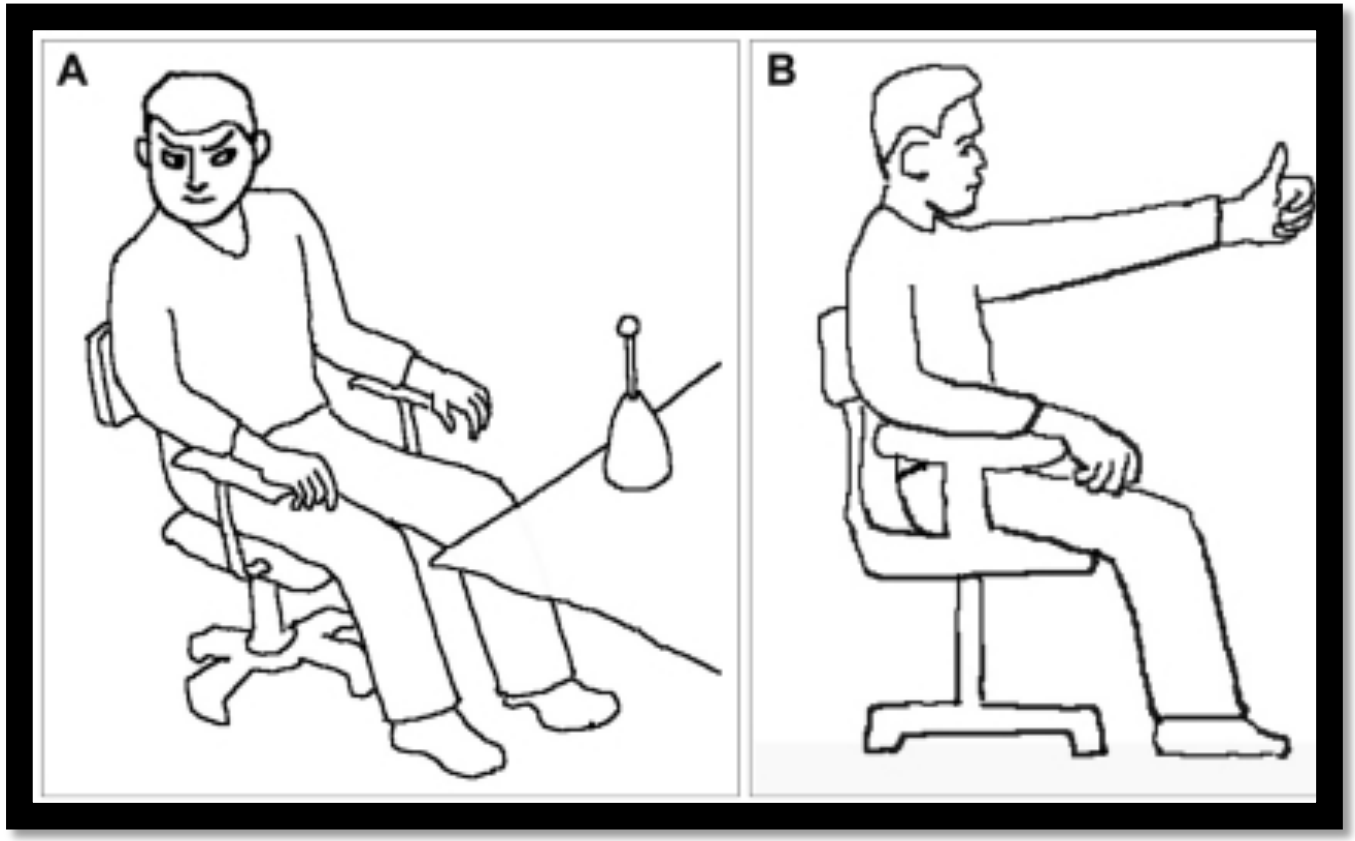
- Operational definition: brain injury which may cause confusion, disorientation, and loss of consciousness for <30 minutes,[1] as diagnosed by a physician.
- ~2.2 million adolescents diagnosed with concussion annually due to sport or recreational activities[1]
- 60%-90% of these adolescents experience vestibular symptoms[1]

Background: Concussion

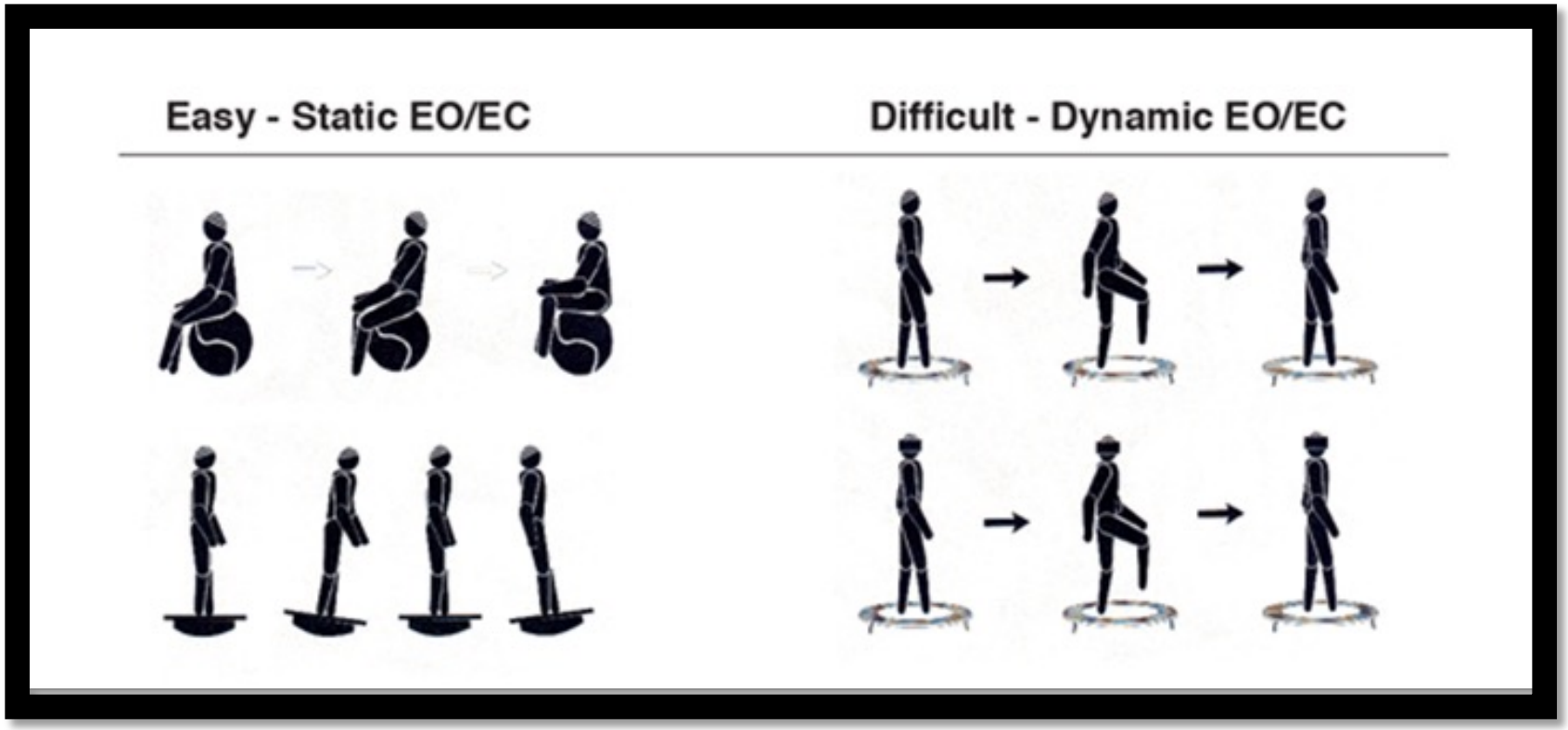
Risk Factors[2]	Signs[1,3-5]	Symptoms[1,3-5]
• Previous concussion • Sex • Age • Genetics • Behavior • Match vs practice • Mechanism of injury • Playing position • Playing level • Protective equipment • Body checking • Environment • Body weight • Physical training & fitness	• Vomiting • Imbalance • Academic difficulties • Appears dazed or stunned • Confusion • Answers questions slowly • Clumsiness • Loss of consciousness • Mood, behavior, or personality changes	• Nausea • Headache • **Dizziness** • **Vertigo** • Attention deficit • Visual disturbance • Fatigue • Sensitivity to light/sound • Confusion • Concentration & memory problems • Not "feeling right" • Feeling "down"

Background: Vestibular Rehabilitation Therapy (VRT)

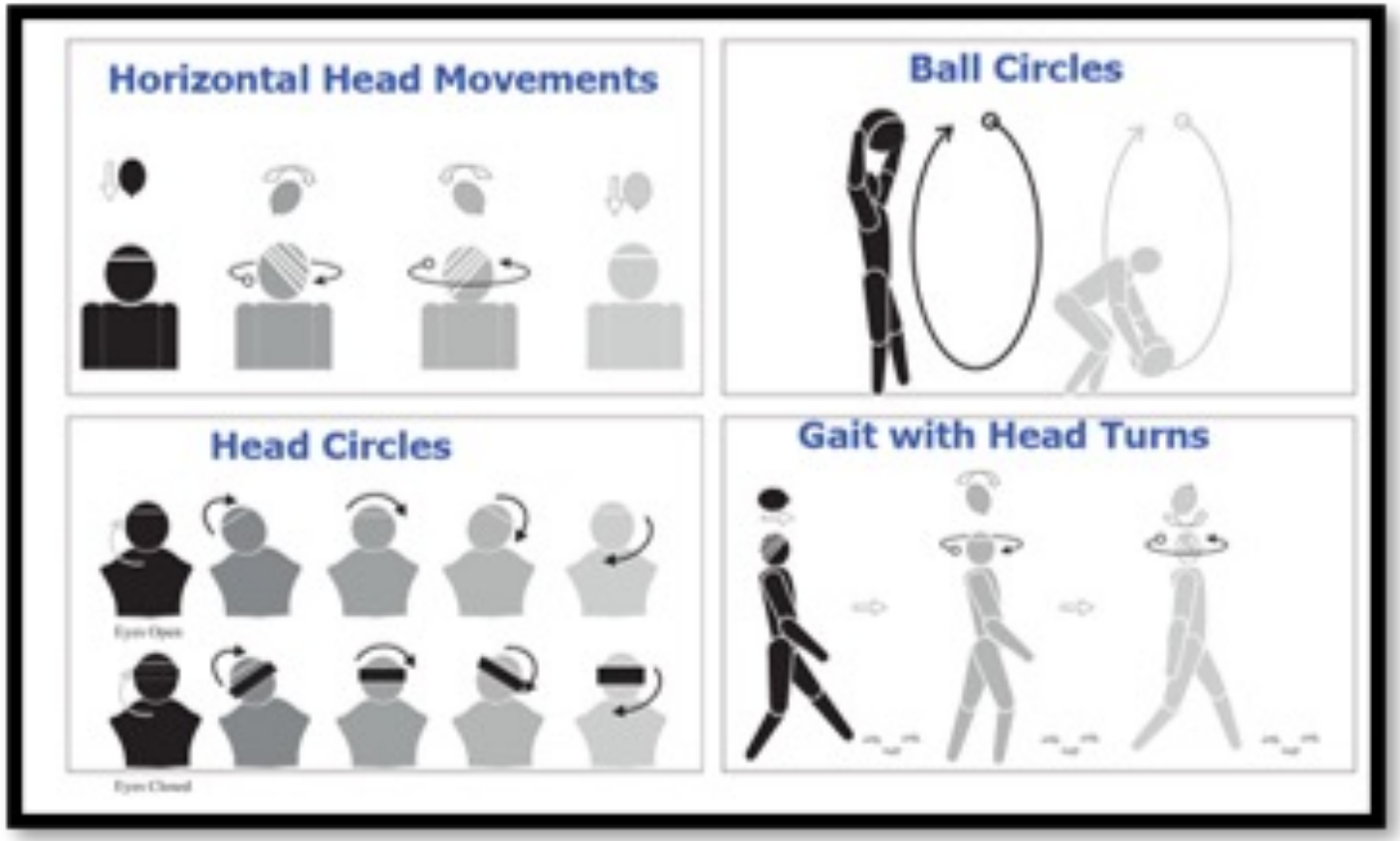
- Operational definition of VRT: specialized form of exercise-based therapy intended to alleviate problems caused by vestibular disorders[5]
- Uses an individualized, problem-focused approach[5]
- Promotes compensation[5]



GAZE STABILITY[5]



BALANCE[5]



HABITUATION[5]

Purpose

- Determine the impact of VRT on adolescents, post-concussion

Methods

Databases:

- CINAHL
- ProQuest Central
- PubMed
- Wiley Online Library

Registers:

- EU Clinical Trials Register
- WHO International Clinical Trials Registry Platform
- NIH clinicaltrials.gov
- Cochrane Library

Methods: Search Terms

adolescent AND concussion AND vestibular

(adolescent* OR teen* OR "young adult*" OR youth* OR pediatric*)

AND

(concussion OR "mild traumatic brain injury" OR "mild tbi" OR mtbi)

AND

("vestibular rehabilitation" OR "vestibular therapy")

Methods:

Search Limits:

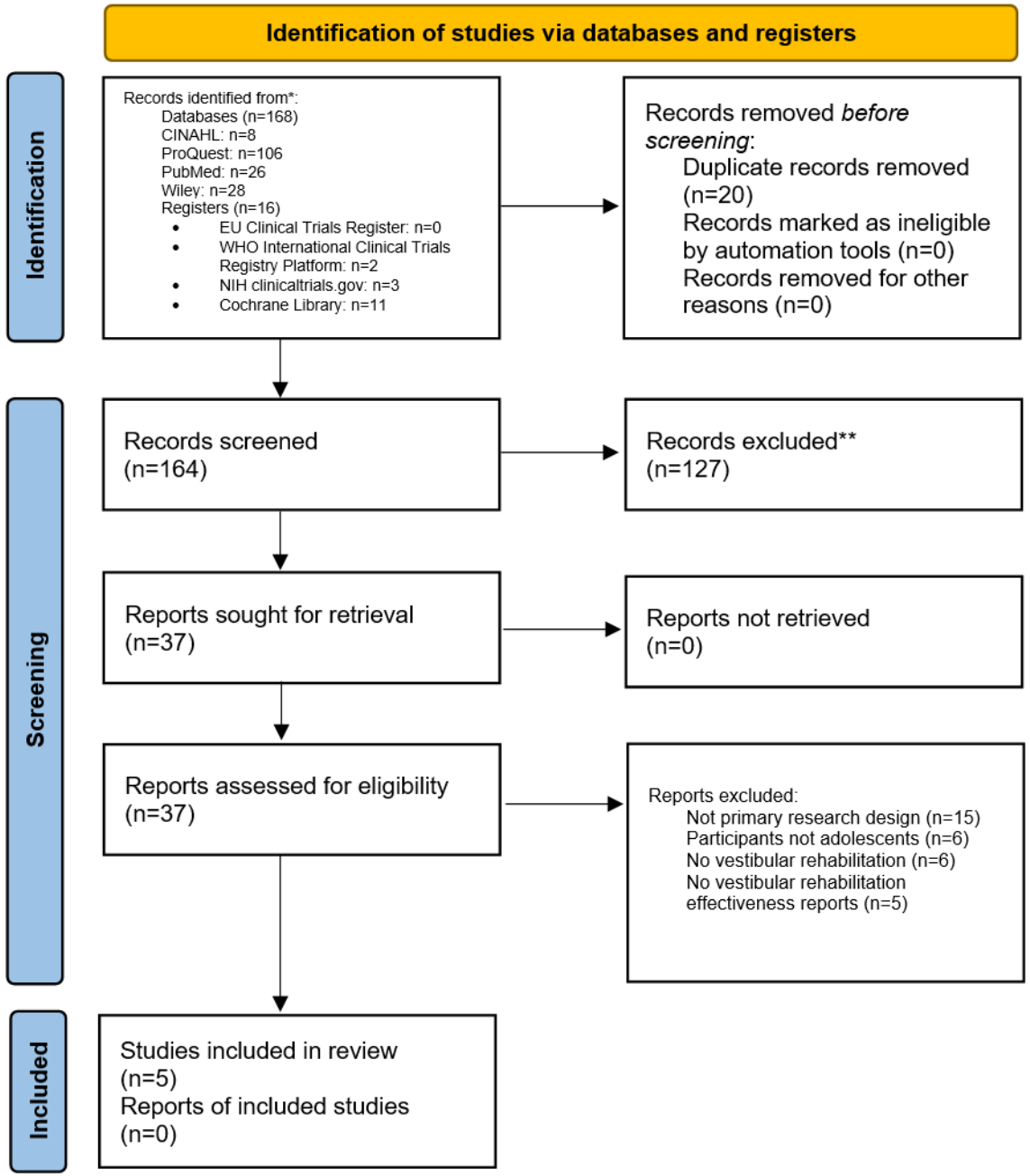
- English language
- Peer reviewed journals
- 2012-2022

Methodological Assessment Tool:

- Oxford Centre for Evidence-Based Medicine (OCEBM)

Methods: Selection Criteria

- Adolescents (10-24 y/o)[6]
- Concussion
- VRT
- All primary outcomes
- All primary research designs
- No co-interventions excluded


Identification of studies via databases and registers
Identification
Records identified from*:
Databases (n=168)
CINAHL: n=8
ProQuest: n=106
PubMed: n=26
Wiley: n=28
Registers (n=16)
EU Clinical Trials Register: n=0
WHO International Clinical Trials Registry Platform: n=2
NIH clinicaltrials.gov: n=3
Cochrane Library: n=11
Records removed *before screening*:
Duplicate records removed (n=20)
Records marked as ineligible by automation tools (n=0)
Records removed for other reasons (n=0)
Screening
Records screened (n=164)
Records excluded** (n=127)
Reports sought for retrieval (n=37)
Reports not retrieved (n=0)
Reports assessed for eligibility (n=37)
Reports excluded:
Not primary research design (n=15)
Participants not adolescents (n=6)
No vestibular rehabilitation (n=6)
No vestibular rehabilitation effectiveness reports (n=5)
Included
Studies included in review (n=5)
Reports of included studies (n=0)

PRISMA

Results

- 151 articles screened
- 5 articles met criteria
- OCEBM scores ranged from 2-3
- Training varied widely in:
    - Intensity
    - Frequency
    - Duration

Results: OCEBM

Question: Does this intervention help?	Level 1	Level 2	Level 3	Level 4	Level 5
A pilot study evaluating the timing of vestibular therapy after sport-related concussion: is earlier better?[7]	Systematic review of randomized trials or n-of-1 trials	Randomized trial or observational study with dramatic effect	**Non-randomized controlled cohort/follow-up study**	Case-series, case-control studies, or historically controlled studies	Mechanism-based reasoning
Changes in Vestibular/Ocular-Motor Screen scores in adolescents treated with vestibular therapy after concussion[8]	Systematic review of randomized trials or n-of-1 trials	Randomized trial or observational study with dramatic effect	**Non-randomized controlled cohort/follow-up study**	Case-series, case-control studies, or historically controlled st udies	Mechanism-based reasoning
Multimodal impairment-based physical therapy for the treatment of patients with post-concussion syndrome: a retrospective analysis on safety and feasibility[9]	Systematic review of randomized trials or n-of-1 trials	Randomized trial or observational study with dramatic effect	**Non-randomized controlled cohort/follow-up study**	Case-series, case-control studies, or historically controlled st udies	Mechanism-based reasoning

Results: OCEBM

Question: Does this intervention help?	Level 1	Level 2	Level 3	Level 4	Level 5
A randomized controlled trial of precision vestibular rehabilitation in adolescents following concussion: preliminary findings[1]	Systematic review of randomized trials or n-of-1 trials	**Randomized trial or observational study with dramatic effect**	Non-randomized controlled c ohort/follow-up study	Case-series, case-control studies, or historically controlled studies	Mechanism-based reasoning
Vestibular rehabilitation is associated with visuovestibular improvement in pediatric concussion[10]	Systematic review of randomized trials or n-of-1 trials	Randomized trial or observational study with dramatic effect	**Non-randomized controlled c ohort/follow-up study**	Case-series, case-control studies, or historically controlled studies	Mechanism-based reasoning

Results

Ocular Function	Significant Findings	P Value	MCID
Total VOMS	• Significantly improved scores compared to initial treatment.	p<0.001	4
Horizontal VOR	• 3.78pts increase • Dec symptom provocation 46%	p<0.001	1
Vertical VOR	• 4.44pts increase • Dec symptoms provocation 43.7%	p<0.001	1
Horizontal Saccades	• Avg. increase 12.3reps • Dec symptoms provocation by 58.1%	p<0.0001	1
Vertical Saccades	• Avg. increase 13.3 reps • Dec symptoms provocation by 62.3%	p<0.0001	1
Maximum SFHR	**Significant Findings**	**P Value**	**MCID**
Graded Exercise Testing	• 23% overall improvement	p<0.01	---

Results

Balance	**Significant Findings**	**P Value**	**MCID**
BESS	• Avg. decrease overall score of 12.1pts • Dec errors by 52%	p<0.001	1
Backward tandem gait eyes open/closed	• 63% overall improvement	p<0.023	1
Self-Reported Symptoms	**Significant Findings**	**P Value**	**MCID**
PCSS	• Avg. decrease of 9.1pts	p<0.01	4
Time to Initiation of VRT	**Significant Findings**	**P Value**	**MCID**
Earlier VRT (≤30 days after injury)	• Faster symptom resolution (54 vs 121.5 days) • Earlier return to play (avg 79 days)	p<0.05	---

Conclusion & Clinical Relevance

- **Moderate-high** level evidence supports VRT for adolescents, post-concussion.
- VRT is a safe and effective intervention for adolescents, post-concussion, to improve:
  - Balance
  - Ocular function
  - Self-reported symptoms
  - Time to symptom resolution
  - Return to play
  - Maximum SFHR

Conclusion & Clinical Relevance

- Best practice which showed **clinically meaningful changes** are focused in:
  - Balance
  - Oculomotor function
  - Self-reported symptoms

Limitations & Future Research

- **Limitations**:
  - Use of retrospective analysis
  - Lack of detailed/standard interventions
  - Lack of control groups

- **Future research**:
  - Prospective analysis
  - Large sample sizes
  - Detailed/standard interventions to determine an optimal VRT protocol

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THANK YOU

Questions?