




**[Flawless]**  
Sports Medicine Concepts



"I'm gonna bend your knee. If it hurts, I want you to scrunch up your face in agony and let out a blood-curdling scream."

Concussion Management Specialist  
Protracted Recovery and Rehabilitation

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## The CMS Resources Page

- Session Recordings
- Pre-Recorded Sessions
- Seminal Readings
- Open Quizzes
- Case Study / Essay
- RFQ



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## Physician Evaluation Form

- Signs and symptoms checklist
- Explicit diagnosis of concussion
- Physician follow-up
- Policy overrides ER/Physician



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## Special Consideration for Young Athletes

Age related difference exist between HS and college athletes

- Increased symptom severity
- Prolonged recovery

Sports-related head injury has a relatively high incidence rate in youth

- 15% of all ER head injuries
- 3% of all sports related injuries
- 24% of all serious head injuries

Guskiewicz KM, Bruce SL, Cantu RC, Ferrara MS, Kelly JP, McCrea M, Putukian M, Valovich McLeod TC. National Athletic Trainers' Association position statement: management of sports-related concussion. J Athl Train. 2004;39(3):180-191.



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## Equipment Issues

*Proper Fit*




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## Predictors of Protracted Recovery

**Significant:**

- amnesia, balance abnormalities, tinnitus & visual impairments at 20 min.

**87% probability:**

- headache & amnesia at 5 min

**73% probability:**

- headache, dizziness & balance abnormalities at 20 min




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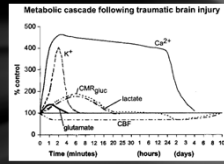
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## Indications for Clinical Rehabilitation

Clinical Rehabilitation should be considered in the management of concussed individuals who do not recover with rest in 7-10 days

- Symptom free within 7-10 days
- Completion of CRP



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## Protracted Recovery Theories

CBF Disconnect

Post-Concussion signs and symptoms that do not resolve with rest within 7-10 days may be due to reduced cerebral blood flow resulting from initial injury

Vestibular Disorders

Vestibular impairments common following concussion may delay recovery

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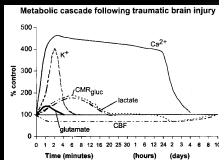
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## The CBF Disconnect

Reestablish CBF



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Leddy Article

In patients with lingering S/S proper exercise prescription can result in improvement

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## Vestibular System

Small Sensory Organs of the Inner Ear

- Utricle
- Saccule
- Semicircular canals

Connections to

- Brain stem
- Cerebellum
- Cerebral Cortex
- Ocular System
- Postural Muscles



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## Vestibular System

- Provides information regarding head movements and position
- Maintain balance and visual control

Symptoms of Dizziness

- Vertigo
- Feeling faint
- Lightheadedness
- Feeling as if the room is spinning
- Loss of balance (disequilibrium)
- Visual disturbances
- Light-headedness
- Unsteadiness
- Weakness
- Fatigue
- Nausea



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## Why The Vestibular System?

1. Headache (71%)
2. Feeling slowed down (58%)
3. Difficulty concentrating (57%)
4. Dizziness (55%)
5. Fogginess (53%)
6. Fatigue (50%)
7. Visual blurring/dbl vision (49%)
8. Light sensitivity (47%)
9. Memory dysfunction (43%)
10. Balance problems (43%)



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*Lavell et al, 2004*  12

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## 2 Distinct Functional Units


Vestibulo-Ocular System


*VOMR*

Maintains visual stability during head movements

- Eye position in orbit
- Head position in space
- Eye position in space

Dizziness  
Visual instability



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## 2nd Distinct Functional Unit

Vestibulo-Spinal System

*Vestibulo-Spinal Reflex (VSR)*

Balance Control  
Most active when vision and somatosensation are reduced



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## Vestibular System Injury

Distinct Functional Units

Possible to have injury to one system without impairment of the other



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## Vestibular System Injury


Signs and Symptoms of


*Acute signs and symptoms typical of vestibular system involvement may not be accurate indicator of VS injury*

- Balance impairment reported in 40% of concussed athletes within first week
- Recover within 3-5 days

Symptoms of Dizziness

- Vertigo
- Feeling faint
- Lightheadedness
- Feeling as if the room is spinning
- Loss of balance (staggering)
- Visual disturbances
- Light-headedness
- Unsteadiness
- Fatigue
- Nausea



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## Implications

Protracted recovery

- Post-traumatic Benign paroxysmal positional vertigo
- Co-existing Labyrinthine concussion
- Post-traumatic migraine-related dizziness
- Central vestibular dysfunction/brainstem concussion

Return to play

Treatable

- Rehab techniques
- Time



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## More Predictive Subjective Symptoms

- Dizziness
- Impaired balance (particularly in the dark)
- Blurred vision
- Motion discomfort
- Height phobia
- Difficulty in busy visual environments



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## Space and Motion Discomfort

Space and Motion Discomfort (SMD)

- Jacob et al, 1993

Visual Vertigo

- Bronstein, 1005

Chronic Subjective Dizziness

- Staab, 2004

Uneasiness created by situational stimuli

- Moving crowds, supermarkets, malls, staircases, heights
- Heightened awareness of normal motion

Coexists with migraine and/or anxiety

Seems to be responsive to medication, vestibular therapy, & behavior therapy

- Whitney et al, 2005; Jacob et al, 2001

Or Time?



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## Aural Symptoms

May indicate labyrinthine injury

- Changes in hearing
- *Tinnitus, particularly lateralizing*
- Pressure/fullness in ear(s)]

Tend to be associated with protracted recovery

- Referral to Otology or Otoneurology




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## Dizziness Handicap Inventory

Somewhat more objective measure of

- 25-item subjective self-rating
- Each item answered "yes", "no", or "sometimes"
- Score:
  - Yes = 4
  - No = 0
  - Sometimes = 2
- Higher score reflects higher disability

Jacobson and Newman, 1990



Some modifications to questions required for younger athletes



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## Balance Inquiry

**Subjective**

- Falls since concussion?
- Staggering, veering or near falls?
- Imbalance in the dark/getting out of bed?
- Motion sickness (particularly in the car?)
- Looking up?
- Quick head movements?
- Turning over in bed?
- Bending over?
- Lying down?

**Vestibular Screening Examinations Form**

- Materials section



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## Balance Error Score (BESS)



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## Balance Error Scoring System

<b>Types of Errors</b>	<b>Calculation of BESS Score</b>
<i>Lift hands off iliac crest</i>	Adding one error point for each error during the 6 20s tests
<i>Opening eyes</i>	
<i>Step, stumble or fall</i>	
<i>Moving hip into &gt;30 degrees abduction</i>	
<i>Lifting forefoot or heel</i>	
<i>Remaining out of testing position &gt; 5sec</i>	



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## BESS Score Card

SCORE CARD: (# of errors)	FIRM Surface	FOAM Surface
Double Leg Stance (feet together)		
Single Leg Stance (non-dominant foot)		
Tandem Stance (non-dominant foot back)		
<b>TOTAL SCORES:</b>		
<b>BESS TOTAL</b>		

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*Prepare to Respond Flawlessly™*

## Normative BESS Scores

BESS Norms	Firm Surface	Foam Surface
Dbi Leg Stance	.009 +/- .12	.33 +/- .90
Single Leg Stance	2.45 +/- 2.33	5.06 +/- 2.80
Tandem Stance	.91 +/- 1.36	3.26 +/- 2.62
<b>Surface Total</b>	<b>3.37 +/- 3.10</b>	<b>8.65 +/- 5.13</b>
<b>BESS Total Score</b>	<b>12.03 +/- 7.34</b>	

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## Medically Supervised X-Cise Rx

*Step-Wise RTP*  
 Physical and Cognitive Progression  
 Sub-Symptom Progression



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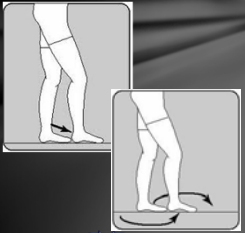
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## BESS as Rehab

Foam Surface

Increased tactile surface theorized to increase proprioception

Tandem Walking



SME [Flawless]

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## Physical Exam

- Ocular-Motor
  - Smooth pursuits
  - Saccades
  - Convergence
  - Nystagmus
- Vestibulo-Ocular
  - VOR
- Vision Therapy?
  - Expensive
  - Insurance?
  - Effectiveness?



SME [Flawless]

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## Pursuits Movements

*At about 40 cm, head fixed.*

*Do they pass through full range?*

*Do they move smoothly – is there evidence of nystagmus?*

*Do they move synchronously?*



SME [Flawless]

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## Saccades

Quickly move from point to point. Look for patient to overshoot or undershoot target.

King-Devick Test

Source: Br J Ophthalmol © 2009 BMJ Publishing Group Ltd

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## Convergence

10 cm or less from nose to target

- \*Discomfort
- \*Headache
- \*Pain in eyes

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## Vestibulo-Ocular Reflex

Side to side movement at comfortable speed with eyes fixed on target

- \*Dizziness
- \*Nystagmus
- \*Unsteadiness
- \*Motion sickness

Figure 2A. Look straight ahead. Figure 2B. Turn your head 45 degrees towards the right. Figure 2C. Turn your head 45 degrees towards the left.

Note: Side-to-side movement should be performed at eye level. © 2011 S.M.C. Concepts, Inc.

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## SMC Enhanced VOM Screen

*Provides easy opportunity to record wealth of vestibular information*

Record Symptom Onset with

- Baseline Symptoms
- Balance Screen
- BESS

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## Early Management of Balance Abnormalities



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## Visually Conflicting Environments

Treadmill



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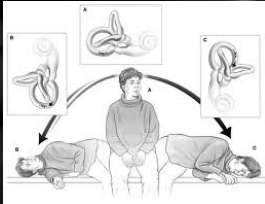
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### Management of Vestibular Dysfunction

Hallpike-Dix Maneuver

- Observe for side-lying or positional nystagmus/dizziness



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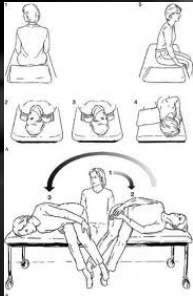
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### Canalith Repositioning Maneuver

Benign paroxysmal positional vertigo (BPPV)

- Start on affected side
- Hold 20-45 s, watch for nystagmus
- Turn 45deg to affected side
- Turn 45deg to unaffected side
- Wait 30sec after nystagmus/dizziness subsides



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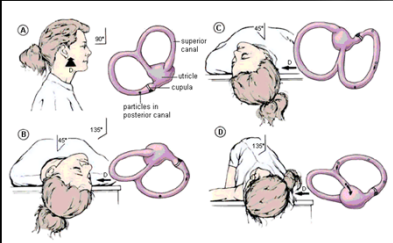
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### Canalith Reposition Maneuver



Moves otoliths out of SCC  
Broken free via impact

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## Canalith Reposition Maneuver

Head up/vertical head position for next 48 hours

Soft collar may help maintain vertical head position

May require multiple tx

80-90% cure rate?

**Contraindications**

- Ongoing CNS disease, including stroke
- Unstable heart disease
- High grade carotid stenosis
- Severe neck disease



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## Get Them OUT of the Clinic

*Pursuits*

*Saccades*

*Convergence*

*Computer*

[www.Eyecanlearn.com](http://www.Eyecanlearn.com)



- Free! School's like that!
- Easy on i-Pad, tablet, etc

*VOR: Sports specific rehab include:*

- free throws
- ground balls/pass
- Max protect

**Slippery Slope**

- On-set of depression

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## Pharm-X and Modifying Conditions



*Pharmaceutical and prescription med profile review should be intricate part of your on-going assessment*

*Depression*

*ADD/ADHD*

*Sleep disorders*

*Anxiety*

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For Tomorrow

Step-Wise Recovery Progression

Review CMS Resources

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