ACL REHABILITATION

CONTROL TO CHAOS TOOLBOX

Natalie Sharp

FICS Global Symposium

Kuala Lumpur 2025

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INTERNATIONAL FEDERATION OF SPORTS CHIROPRACTIC

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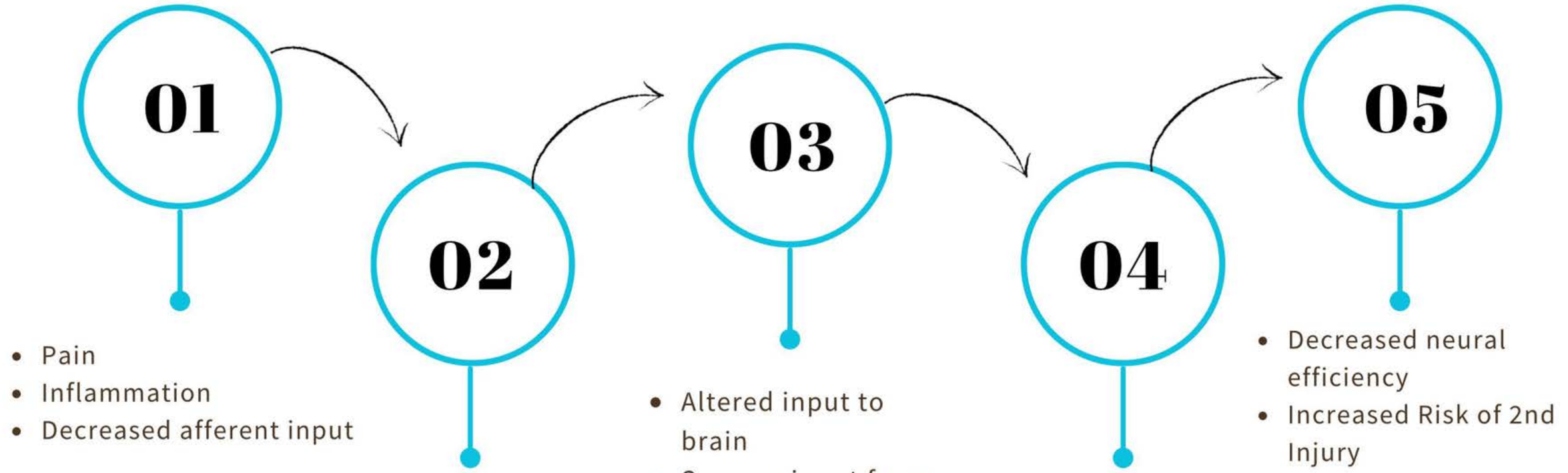
“I DIDN’T EXPECT THE GROUND TO BE THERE”

“I THOUGHT THE GROUND WOULD BE THERE AND IT WASN’T”

WHAT'S IT ALL ABOUT?



- Pain
- Inflammation
- Decreased afferent input

- Decreased JPS
- Spinal inhibition (Quads)
- Biomechanical Adaptations

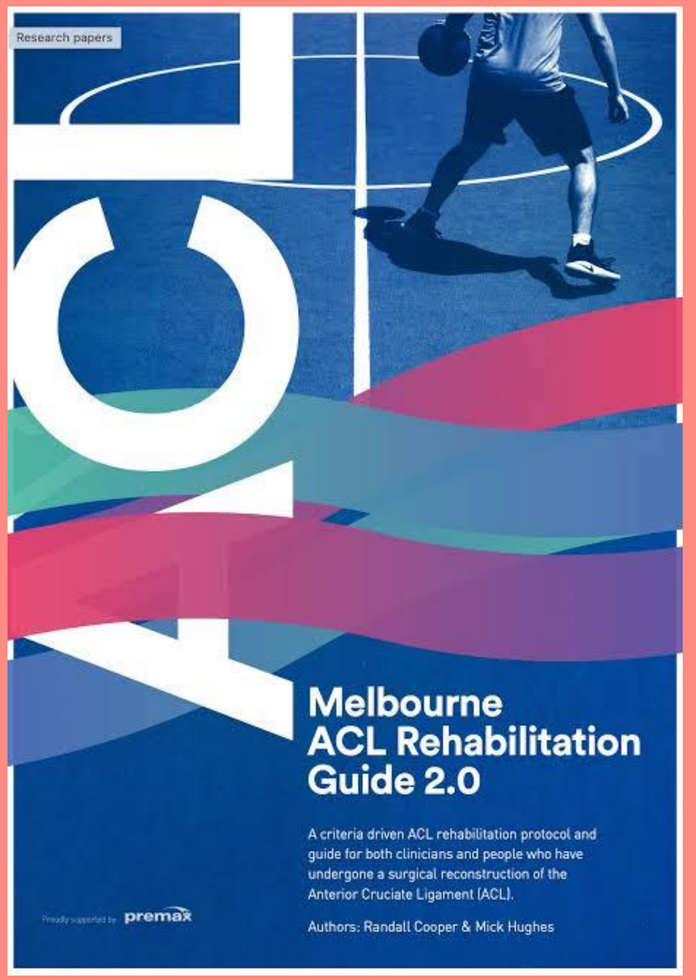
- Altered input to brain
- Sensory input from other cortical areas

- Visuomotor upregulation
- Increased M1 Excitability
- Excessive or inappropriate motor responses in high-demand or unpredictable environments

- Decreased neural efficiency
- Increased Risk of 2nd Injury


Aspetar clinical practice guideline on rehabilitation after ACLR
Timing and structure
Pre-operative rehabilitation
Unsupervised exercise execution
Rehabilitation duration
Modalities
Continuous passive motion
Cryotherapy
Neuromuscular Electrical Stimulation
Electromyographic biofeedback
Low load blood flow restriction
Kinesio-tape
Dry-needling
Whole-body vibration
Local vibration
Return to activities
Return to driving
Return to running
Return to sport
Strength and motor control training
Plyometric and agility training
Motor control training
Isotonic and isokinetic training
Concentric and eccentric training
Open & closed kinetic chain exercises
Cross-education
Core stability
Aquatic therapy
Exercise initiation
Consider any surgical instructions
Active knee motion
Early weight-bearing
Isometric quadriceps
Early eccentric quadriceps
Early leg press
Open Kinetic Chain
recommended
not recommended
no recommendation


Isokinetic ACL Protocol
ACL INJURY
ACL reconstruction
Start rehabilitation
Start hydrotherapy
Walk without crutches
Run on a treadmill
Start GREEN ROOM rehabilitation
Start ON FIELD rehabilitation
Return to the team
RETURN TO THE TEAM
ACL PROTOCOL

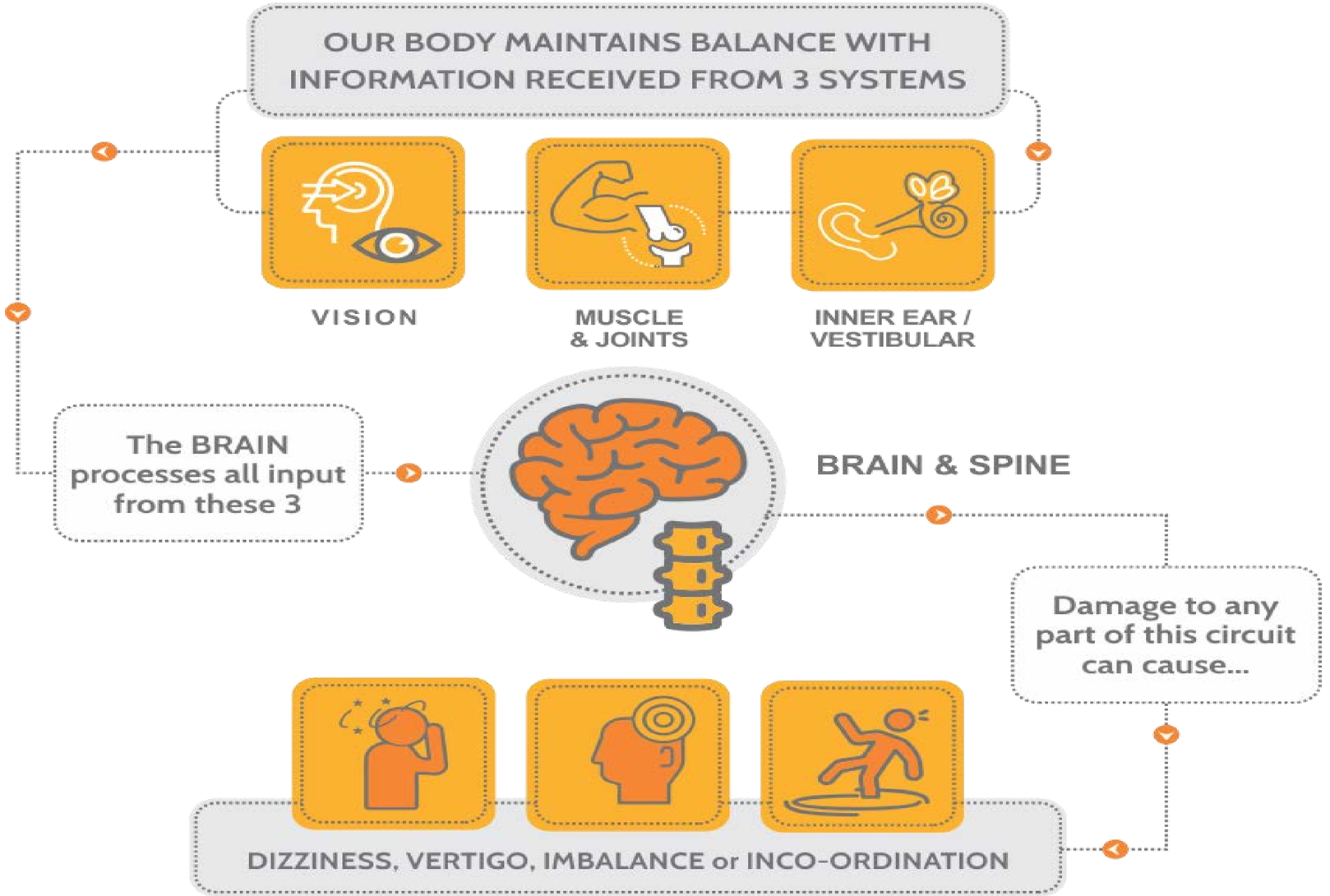

Research papers
ACL
Melbourne ACL Rehabilitation Guide 2.0
A criteria driven ACL rehabilitation protocol and guide for both clinicians and people who have undergone a surgical reconstruction of the Anterior Cruciate Ligament (ACL).
Authors: Randall Cooper & Mick Hughes
premax


FIFA 11+

TIME	GOALS	STRENGTH & BIOMECHANICS	EXERCISES	PROGRESSION CRITERIA	MILESTONE
PRE-OP	- Restore ROM (especially extension) and reduce swelling. - Improve quadriceps and hamstring strength. - Educate the patient on the upcoming rehabilitation process.	- Quadriceps strength: 70% of the non-injured side. - Hamstring strength: 75% of the non-injured side.	- Quadriceps Isometrics: -Hamstring Curls (band-resisted or prone machine): - Straight Leg Raises: - Heel Slides for ROM: - Patellar Mobilisation:	Full knee extension and flexion ≥120°. - Minimal swelling and quadriceps control during straight leg raises.	-
0-6 WEEKS	- Control pain and swelling. - Restore ROM (focus on full extension). - Regain quadriceps activation and begin weight-bearing.	- Quadriceps strength: 60-70% of non-injured side. - Hamstring strength: 50-60% of non-injured side.	- Quadriceps Activation (Neuromuscular Electrical Stimulation): - Heel Slides/Wall Slides: - Mini Squats (0-30°): - Calf Raises (bilateral, progressing to unilateral): - Glute Bridges	- Full weight-bearing without crutches. - Quadriceps strength at least 60% of the non-injured leg. - Full knee extension, flexion ≥125°. - Symmetrical gait without compensations.	- Return to Walking: - Full weight-bearing with a symmetrical gait.
7-12 WEEKS	- Transition to single-leg loading and more dynamic movements. - Increase quadriceps and hamstring strength.	- Quadriceps strength: 70-80% of the non-injured side. - Hamstring strength: 75-80% of the non-injured side. - Q:H ratio: 0.6-0.7:1.	- Leg Press (0-60°): - Single-leg Romanian Deadlift: - Lunges (static, progressing to walking lunges): - Step-ups (low height, progressing to higher step): - Balance Training (single-leg stance with perturbations):	- Single-leg stance with minimal wobble. - Handheld dynamometry for quadriceps and hamstrings: 70% and 75% of the non-injured leg, respectively.	- Return to Running: - Can begin running on treadmill/grass if passed RTR testing protocol
13-18 WEEKS	- Incorporate plyometrics and low-level sport-specific drills. - Focus on agility, proprioception, and neuromuscular control.	- Quadriceps strength: 80-90% of the non-injured side. - Hamstring strength: 85-90% of the non-injured side. - Q:H ratio: 0.7:1.	- Squat Jumps (controlled landing): - Bounding Drills (linear and lateral): - Box Jumps (30-60 cm height): - Single-leg Hops (for distance): - Agility Ladder Drills:	- Pass single-leg hop tests with at least 85% symmetry. - Vertical jump test symmetry ≥85%. - Strength symmetry ≥85%.	Return to Cutting: Begin controlled cutting drills at this stage if strength symmetry is ≥85% and agility tests (e.g., T-test) show proper mechanics.
19-24 WEEKS	- Develop full sport-specific strength and neuromuscular control. - Incorporate high-intensity agility, cutting, and pivoting drills.	- Quadriceps and Hamstring strength: 90-100% of the non-injured side. - Q:H ratio: 0.7-0.8:1.	- Plyometric Bounding (multi-directional): - Lateral Box Jumps: - Depth Jumps (from 30 cm box, increasing to 45 cm): - Agility Drills (Y-drill, T-test, sport-specific drills): - Sport-Specific Training (gradual integration of sprints, cutting, pivoting):	- Pass hop tests and agility tests with 90-100% symmetry. - Isokinetic testing shows strength ≥90% of non-injured side. - Good neuromuscular control during sport-specific drills.	- Return to Sport Training: - Patient begins sports-specific training with team (non-contact) if tests and drills show biomechanical and neuromuscular control.
24 WEEKS +	- Achieve full readiness for sports participation. - Ensure no residual strength deficits or movement compensations.	- Quadriceps and Hamstring strength: 100% of the non-injured side. - Q:H ratio: 0.8:1. - Full dynamic control during high-speed sports drills.	- High-Intensity Plyometrics (sport-specific): - Reaction-Based Agility Drills: - Complex Cutting Drills (with reactive perturbations): - Scrimmage Participation: 50-75% effort initially, progressing to full engagement.	- All strength and hop tests show 95-100% symmetry. - Completion of cutting and pivoting drills without compensations. - Return-to-play tests (e.g., agility, hop, and psychological readiness tests) passed with high confidence.	- Return to Play: - Full return to competition once all strength, neuromuscular, and psychological criteria are met.

IMPORTANCE OF NEUROLOGIAL SCREENING

WHAT IS THE SOMATOSENSORY SYSTEM & WHAT DOES IT DO?



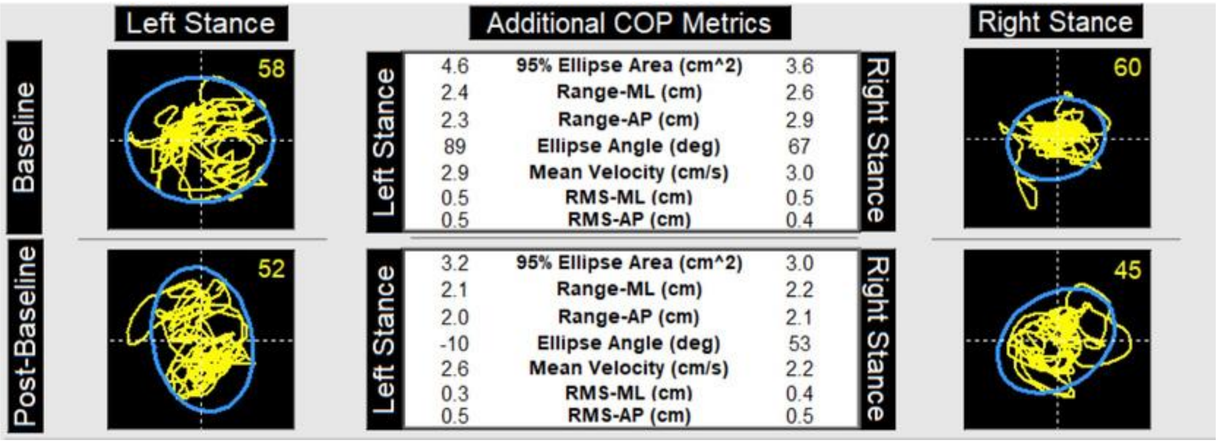
B TRACK S:

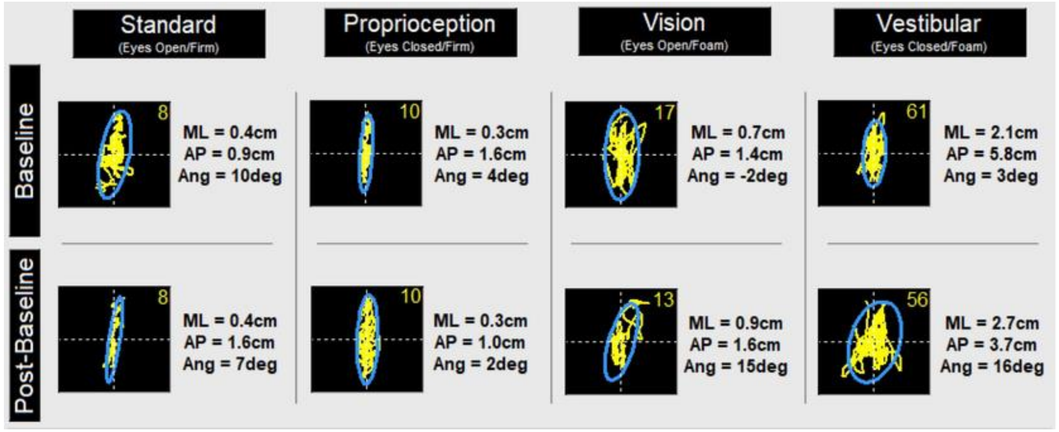
Force plate that assists in identifying control pathways that require rehabilitation

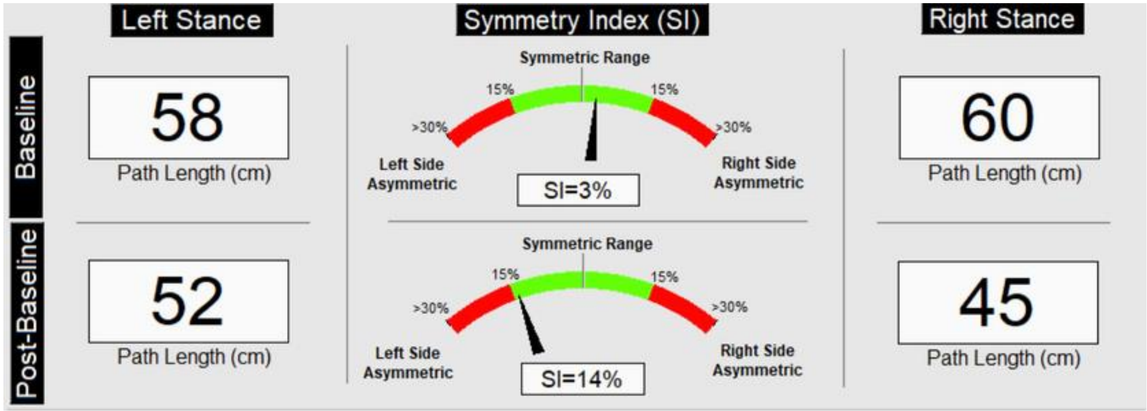
- Standard test
- Vestibular test
- Visual Test
- Proprioception Test

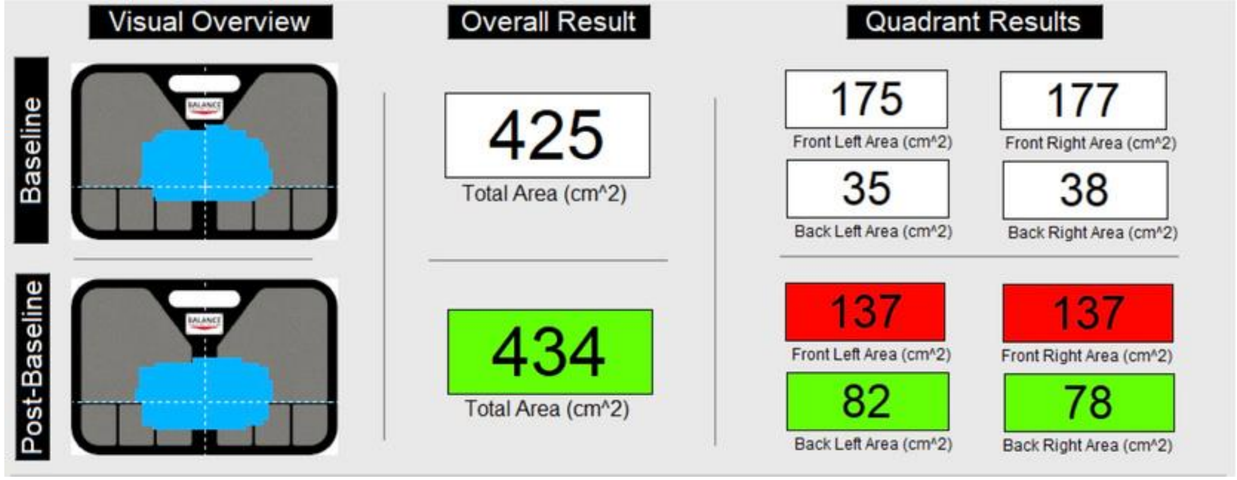
- Other tests/retraining

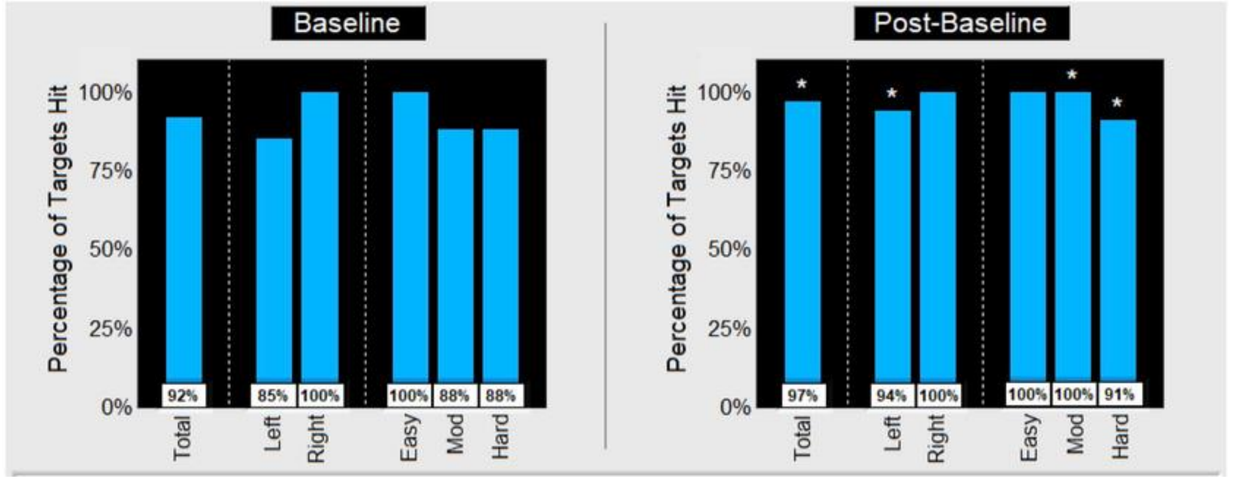
BTRACKS DATA:











BESS:

Standard

- 70% P, 20% Ve, 10% Vi
- Eyes open on firm surface

Proprioceptive System

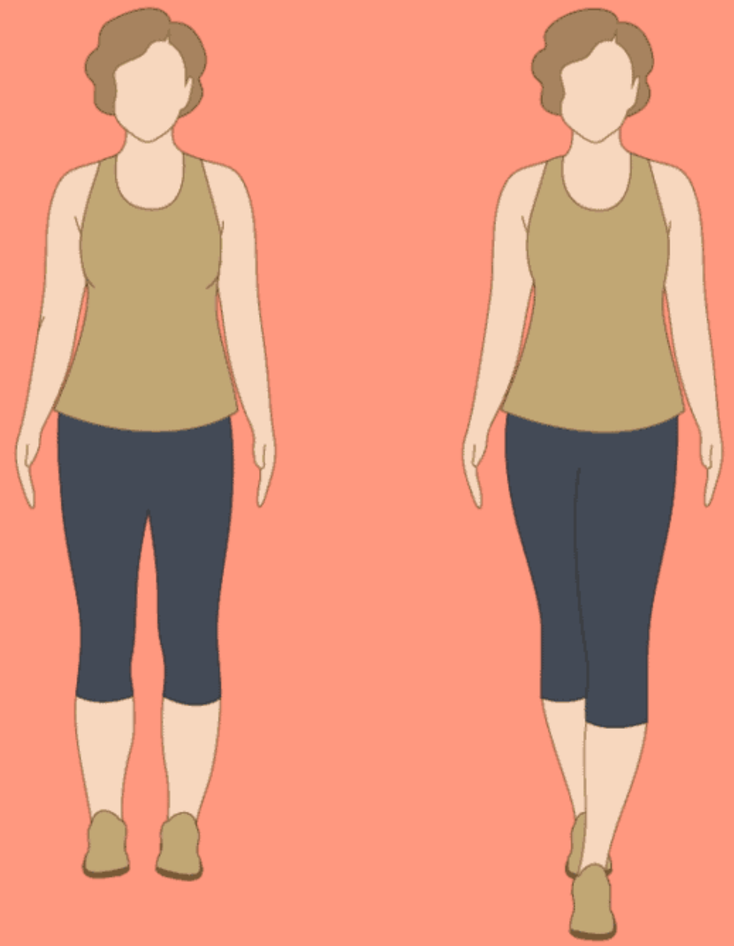
- Eyes closed on firm surface

Visual System

- Eyes open on foam
- 70% Ve, 20% Vi, 10% P

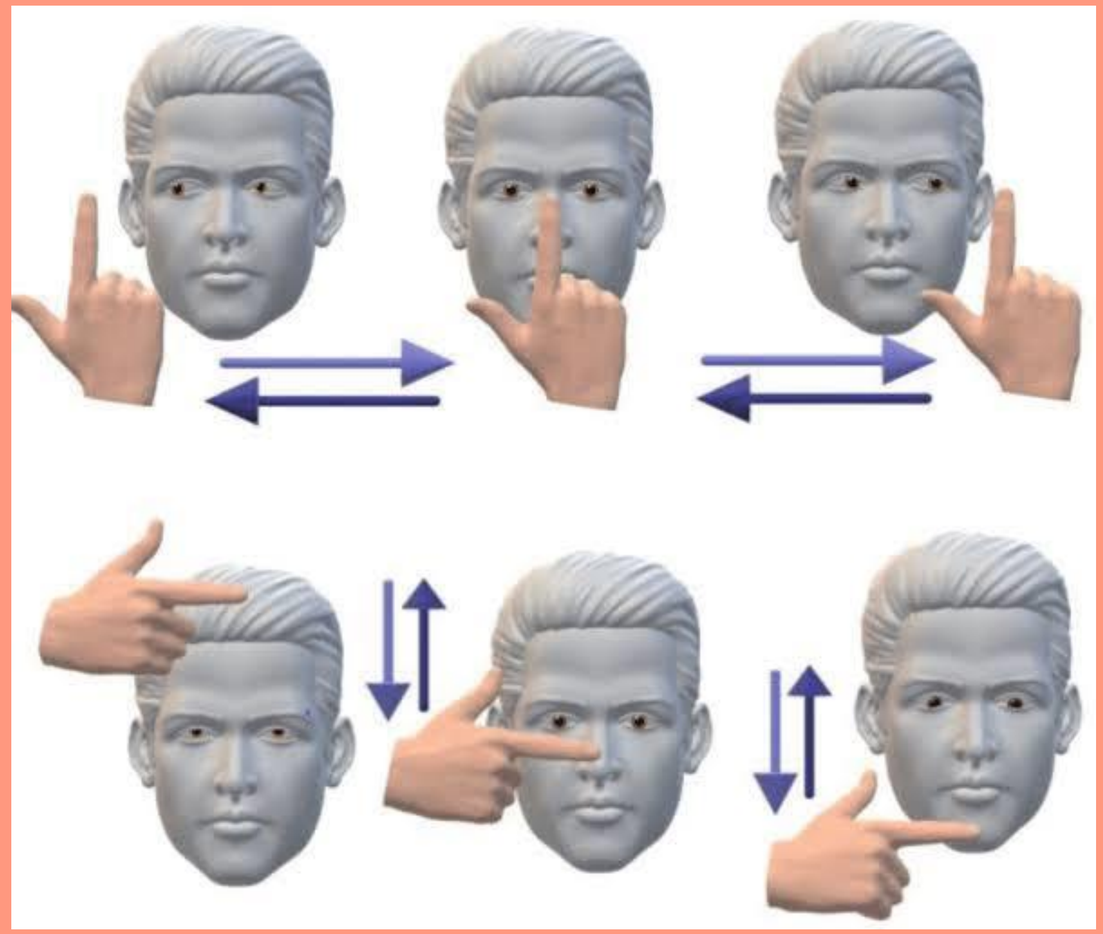
Vestibular System

- Eyes closed on foam



VOMS

- Tool to assess the vestibular system
- Tasks include tracking and focusing on objects
- Look for changes in symptoms to jerky eye movement

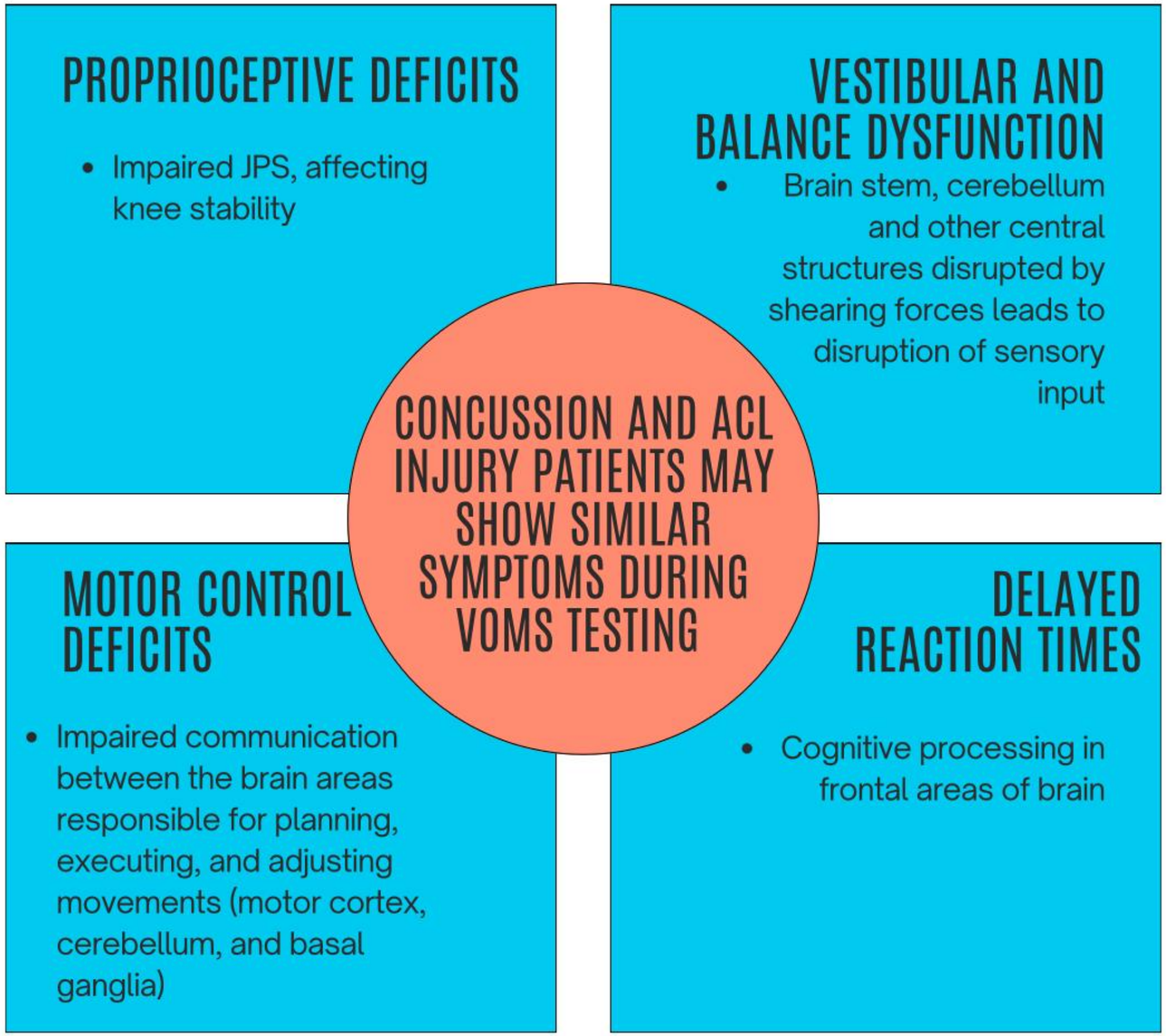


WHY ARE THERE CHANGES?

- Brain receives inaccurate signals from vestibular system
- Inner ear - eye connection in disrupted

	PATIENT POSITION	VISUAL TOOL	STARTING DISTANCE	MOVING DISTANCE	PACE	REPS
HORIZONTAL & VERTICAL SMOOTH PURSUITS Ability to follow a slowly moving target	Seated	1 Clinician finger (Eyes tracking)	3 ft	1.5 ft from midline	2 sec side to side	2
HORIZONTAL SACCADES Ability of the eyes to move quickly between targets	Seated	2 Clinician fingers (Eyes move)	3 ft	1.5 ft left/right	As quickly as possible	10
VERTICAL SACCADES Ability of the eyes to move quickly between targets	Seated	2 Clinician fingers (Eyes move)	3 ft	1.5 ft up/down	As quickly as possible	10
HORIZONTAL VOR Ability to stabalize vision as the head moves	Seated	Popsicle stick 14 pt font (Head moves)	3 ft	20 degrees left/right	180 beats/min Use metronome	10
VERTICAL VOR Ability to stabalize vision as the head moves	Seated	Popsicle stick 14 pt font (Head moves)	3 ft	20 degrees up/down	180 beats/min Use metronome	10
VISION MOTION SENSITIVITY Ability to inhibit vestibular-induced eye movements	Standing Shoulder-width Facing busy clinic	Patient thumb (Body moves)	Patient's arm length	80 degrees left/right	50 beats/min Use metronome	5

CONCUSSION TODAY, ACL TOMORROW?



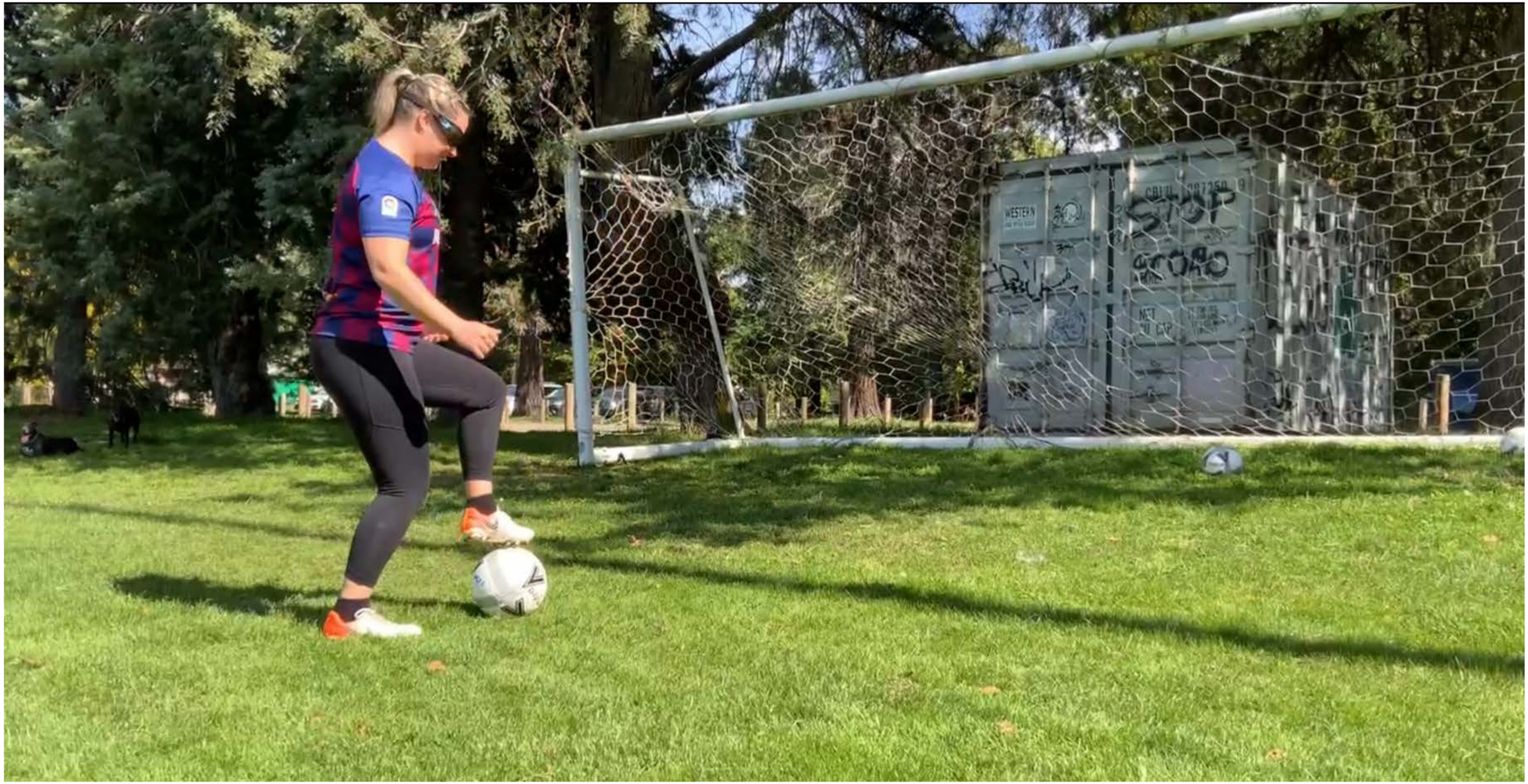
1.6-3.5 X RISK

REHABILITATION

HOW MUCH IS ENOUGH & HOW TO PROGRESS?

CUES?

MEMORY FORMATION?


WESTERN

KNOW WHAT YOU ARE TARGETING

- Proprioceptive system
- Visual system
- Vestibular system

KNOW YOUR TECH:

- Will it enhance your rehabilitation?
- How?
- When would you use each tool?

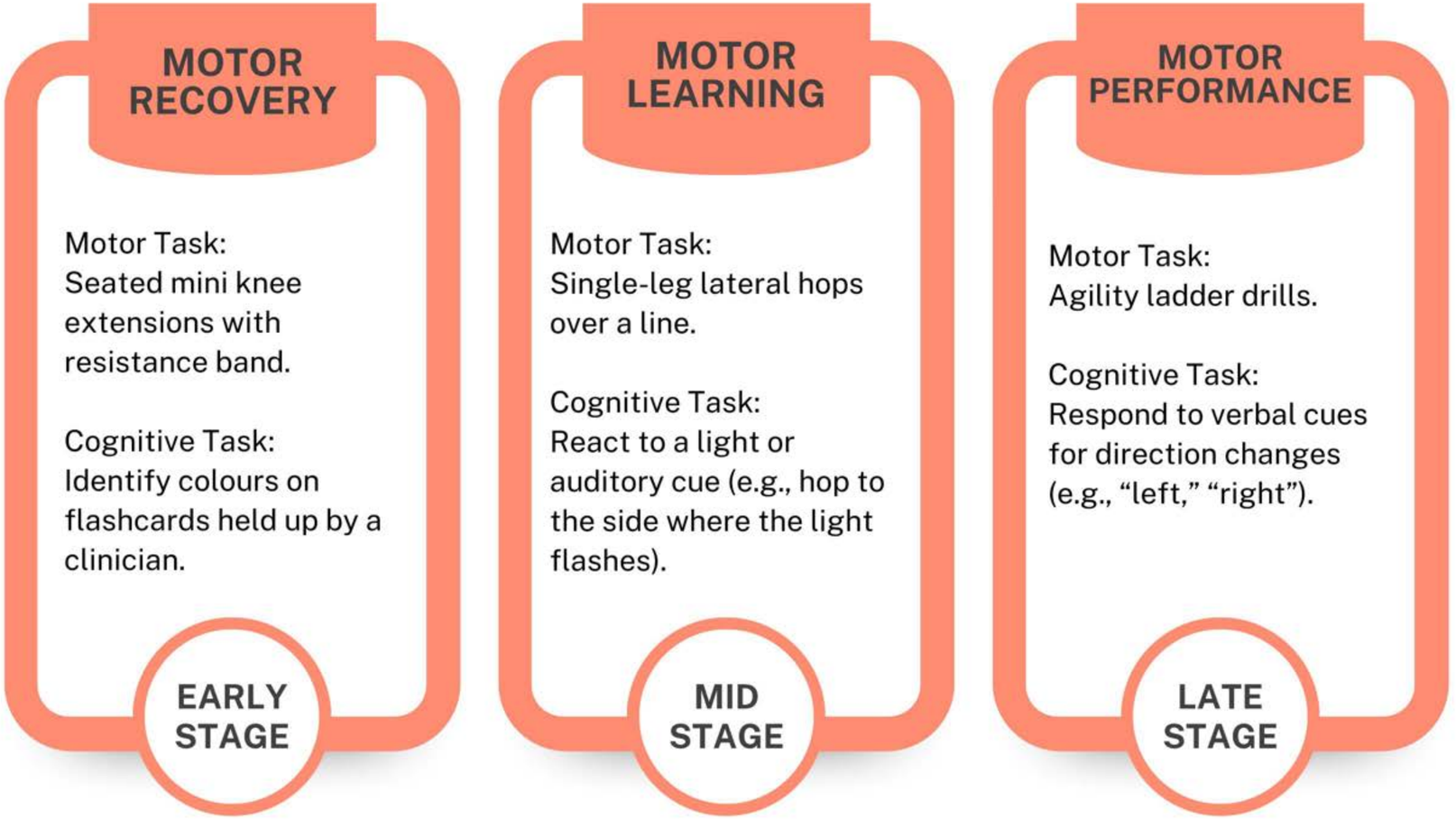
DUAL TASKING:

Performing two tasks simultaneously

Simulates real-world demands where athletes must balance motor and cognitive tasks under time pressure.

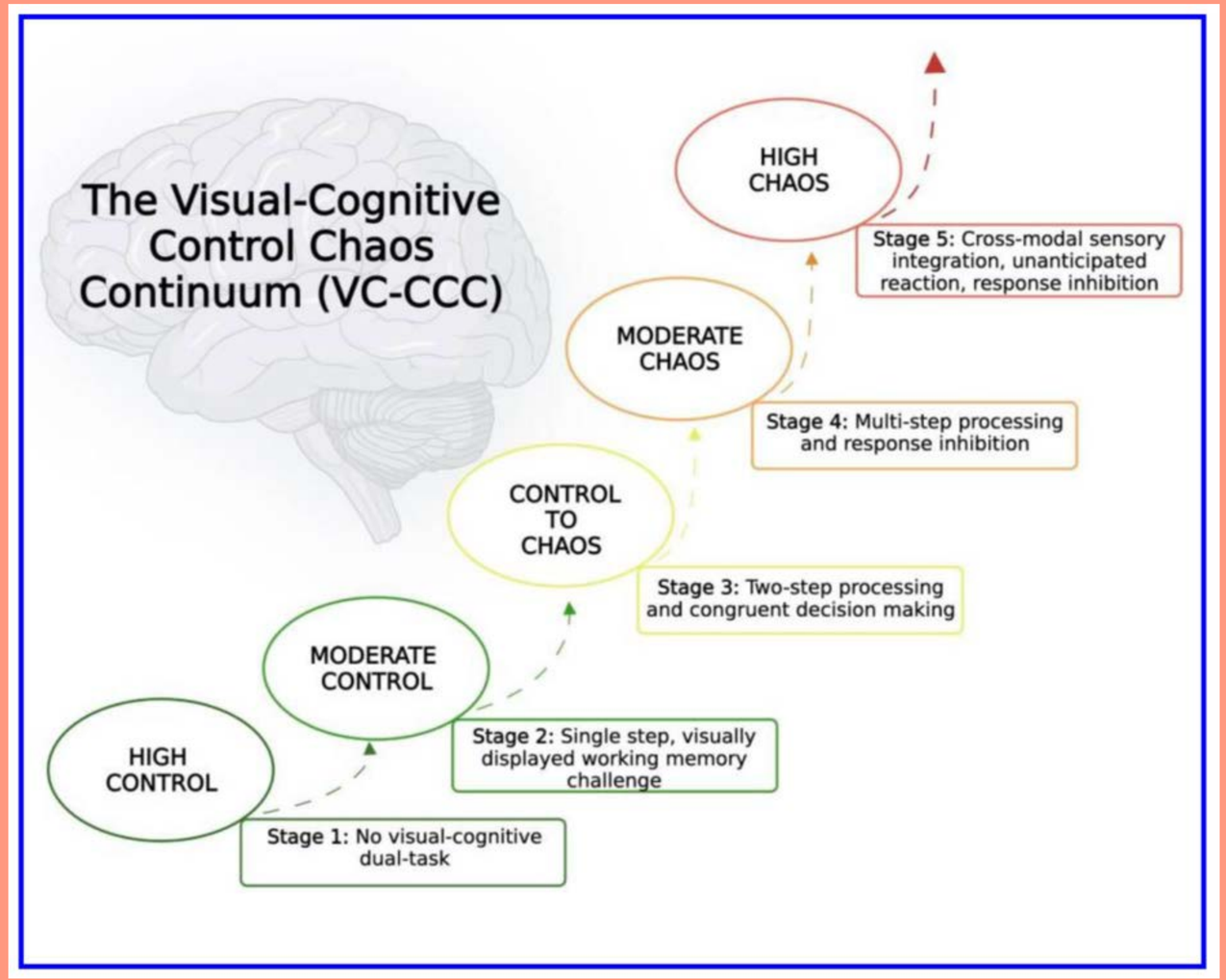
Builds capacity to react to unpredictable situations (e.g., opponents in sport).

MAKE IT AS SPORT-SPECIFIC AS POSSIBLE



VC-CCC:

- Progression from predictable to unpredictable environments
- Incorporates visual processing, attention and decision-making under increasing levels of complexity
- Aims to decrease reinjury rates



LUNGE PROGRESSIONS

- Lunge to targets
- Sport-Specific action = dig
- Can add strobe glasses
    - Self-Paced
    - Motor Recovery Phase

LUNGE PROGRESSIONS

- Lunge (Dig) to targets
- Can add ball catch/dig
  - Variable Metronome (out on one beat, back on second)
  - Low tone = left leg
  - High tone = right leg

**(This is an auditory example - Not exactly VC-CCC)*

LUNGE PROGRESSIONS

- Lunge to targets
- Can add sport-specific action
- Can add strobe glasses

  - Variable Slide Deck

  - Left = Yellow
  - Right = Purple
  - No-Go = Green

LUNGE PROGRESSIONS

- Double-Limb Jump (block jump)

  OR

- Forward Lunge (Dig)

- Simple Math Slide Deck
  - Even = Jump
  - Odd = Lunge

EVEN = JUMP

ODD = LUNGE

LUNGE PROGRESSIONS

- Double-Limb Jump (Block)

  OR

- Forward Lunge (Dig)

- Coloured Maths Slide Deck
  - Even = Jump
  - Odd = Lunge
  - Green background = No-Go

LUNGE PROGRESSIONS

- Four Corner Drill

- Slide Deck with colours
- Turn and step/run to colour
- Perform number of jumps at cone as directed
- Add sport-specific action at return (Dig Ball)
- Can add strobe glasses

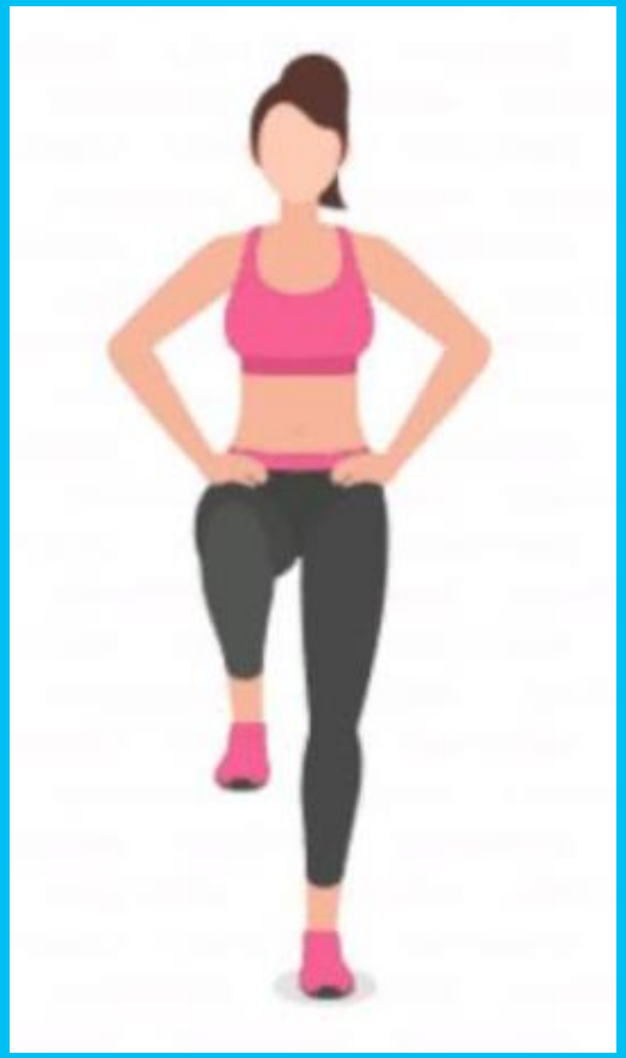
RETURN TO PLAY

COOPER HUGHES VESTIBULAR BALANCE TEST:

- 15 Reps
- Head and eyes move together
- 60BPM
- Horizontal: 70-90°
- Vertical: Floor to ceiling

TASK:

CH-VBT



STRENGTH SYMMETRY:

- Quad Strength
- Calf Strength
- Max Single-Leg Sit-to-Stand
- Max Calf Raise

<u>90% Symmetry</u>

TASK:

MAX CALF RAISE

HOP TEST SERIES:

- Single Hop Test
- Triple Hop Test
- Triple Cross Over Hop
- 6m Hop for Time

TASK:

TRIPLE HOP TEST
V
WITH WORKING MEMORY

JUMP TESTS:

- Single Leg Vertical Jump
- Single Leg Drop Jump
- 3x Max Height Hop

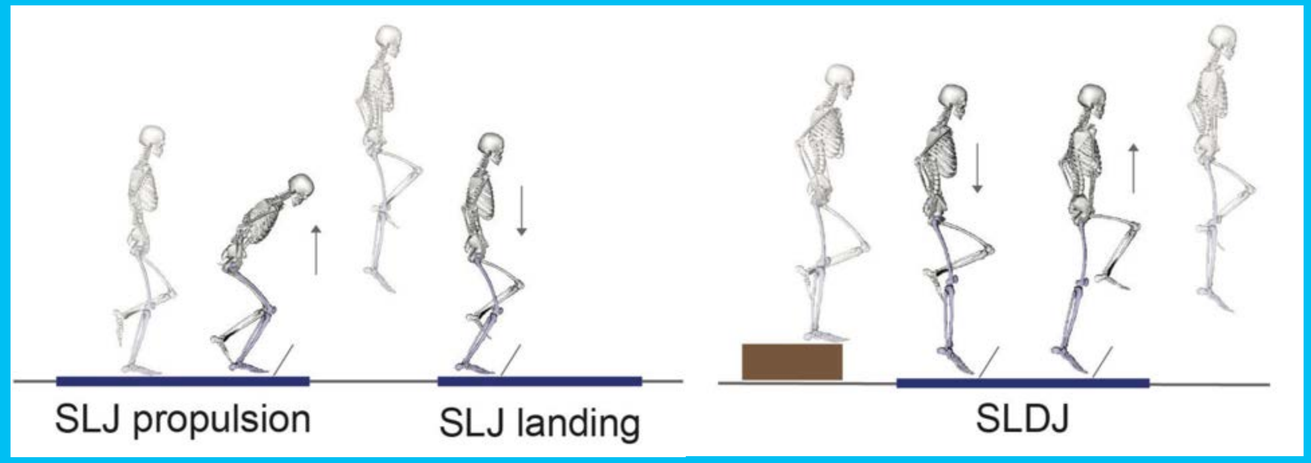
**Jump Height LSI:*

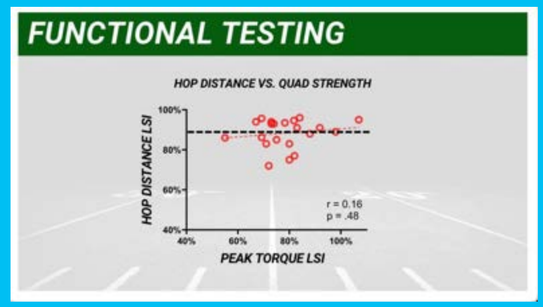
SLJ: 83%

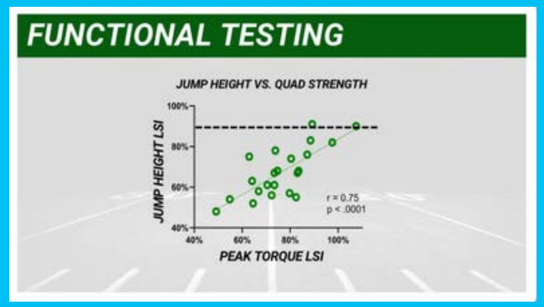
SLDJ: 77%

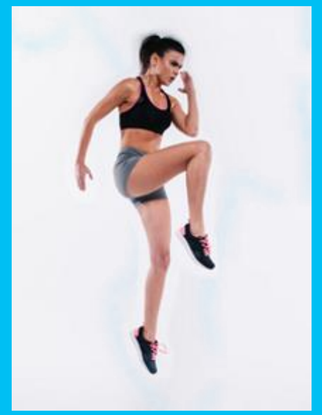
TASK:

MAX HEIGHT HOP TEST
EYES OPEN V EYES CLOSED









QUESTIONS & PLAY TIME

(OR TIME TO GET READY FOR DINNER)