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The Metabolic Demands of Loaded Movement Training

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OBJECTIVES

- Introduce the scientific process
- Present the Loaded Movement Training study findings
- Provide a research summary of how LMT compares to traditional training methods
- Have attendees experience the LMT training protocol

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SCIENCE

- Defined:
  - Systematic knowledge of the physical and material world gained through observation and experimentation

Science = UNDERSTANDING

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RESEARCH

- Defined:
  - The process of performing a methodological study in order to support a hypothesis or answer a specific question, with the overall purpose to enhance understanding in a particular area of interest

Research = UNDERSTANDING

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SCIENTIFIC RESEARCH

- **The point of scientific research is NOT to PROVE TRUTH, but instead to FALSIFY a hypothesis**
  - Falsification means the hypothesis can be conflicted by observation
    - E.g., "ViPR workouts burn lots of calories!"
      - NOT FALSIFIABLE
    - E.g., "ViPR workouts can burn more calories than a treadmill run at equivalent intensity as measured by heart rate"
      - FALSIFIABLE

Scientific Research = Falsification of a Specific Proposition

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SCIENTIFIC RESEARCH

- Validity
  - The degree to which a test or test item measures what it is supposed to measure

- Reliability
  - The degree to which a test produces consistent or dependable results
    - Test-retest: does the same test produce the same result each time it's administered?
    - Parallel forms: do the different versions of a test designed to measure the same thing produce the same results?
    - Inter-rater: does the same test produce the same result with different assessors?

SCIENTIFIC RESEARCH

- Control
  - The degree to which a test can be "identically" replicated (which effects *reliability*)
    - Nutrition (high CHO? Paleo? Stimulants?)
    - Sleep status (tired? rested?)
    - Environment (inside v. outside? equipment type? shoes? music? encouragement?)
    - Time of day (morning? afternoon? evening?)

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YOU & ME

- As practitioners and HWF professionals, what we do on a daily basis is an extrapolation & interpretation of scientific research

Science = UNDERSTANDING

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LOADED MOVEMENT TRAINING STUDY

- Loaded movement training (LMT) has come to the fore of our industry, amid claims of improved body composition, higher caloric expenditure, increased EPOC, and improved cardiovascular capacity, muscle strength and movement function.

- Problem: there is no direct scientific research to support these claims…

LOADED MOVEMENT TRAINING STUDY

- Problem: there is no direct scientific research to support these claims.
    - Problem: many health and fitness professionals have speculatively assumed the metabolic demands of functional exercise to be similar to free-weight circuit resistance training (FWCRT)
        - Problem: LMT does not equal FWCRT

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LOADED MOVEMENT TRAINING STUDY

- Loaded Movement Training: Multidirectional, task-oriented resistance exercise, where there are at least 2 primary movement directions and outside resistance is applied to the body

- Loaded Linear Training: Resistance training exercises, where movement is primarily uniplanar and outside resistance is applied to the body

4Q Model

Loaded

Loaded Linear Training

Loaded Movement Training

Linear Movement (Recurrent)

Transitional Movement - 3D (Variable)

Unloaded Linear Training

Unloaded Movement Training

UnLoaded

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4Q Model

Loaded

Loaded Linear Training

Bench Press
Deadlift
Hang Clean
Bicep Curl
Cycling / Rowing
Etc.

Loaded Movement Training

Warding Patterns

Linear Movement (Recurrent)

Transitional Movement - 3D (Variable)

Unloaded Linear Training

Skill Development Training
Weak Link Activation
Therapeutic Rehab
Running / Swimming etc.
Restful Poses

Unloaded Movement Training

SAQ Training
Interactive Movement
Functional Rehab
Tai Chi
Ground to Standing Drills
Dowel Rod Movement Prep

UnLoaded

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LOADED MOVEMENT TRAINING STUDY

- Opportunity: understanding the metabolic demands of LMT could provide practical information for strength coaches and personal trainers to effectively prescribe and apply LMT

LOADED MOVEMENT TRAINING STUDY

- The purpose of this study was to determine the oxygen cost, heart rate response, and energy expenditure associated with an intermittent LMT workout both during and after exercise.

- We hypothesized that the LMT protocol would meet the ASCM recommendations for improving cardiovascular fitness (46-90% VO_2max, or 64-95% HRmax) and energy expenditure (150-400 $kcal \cdot day^{-1}$)

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LOADED MOVEMENT TRAINING STUDY

- Methods:
  - **Ten subjects** (5 male and 5 female, currently physically active with a self-reported history of moderate-to-high intensity exercise for a minimum of three months) **completed baseline anthropometric, RMR, a treadmill maximal oxygen uptake test, and an LMT familiarization trial**
  - **After 48 hours rest, subjects completed a 19 minute LMT protocol using ViPR, consisting of 10 x 60-second work intervals (5 exercises in circuit format x 2 sets) at maximum volitional intensity followed by 60-seconds of rest.** Men used a 10 kg ViPR, and women used a 6 kg ViPR. **VO_2**, **HR**, **RER**, and **EE were measured continuously during the LMT protocol** using a portable metabolic cart. RPE were also collected.
  - To determine EPOC, **VO_2, HR, RER and EE were measured post-exercise for 60 minutes and compared with RMR data.**

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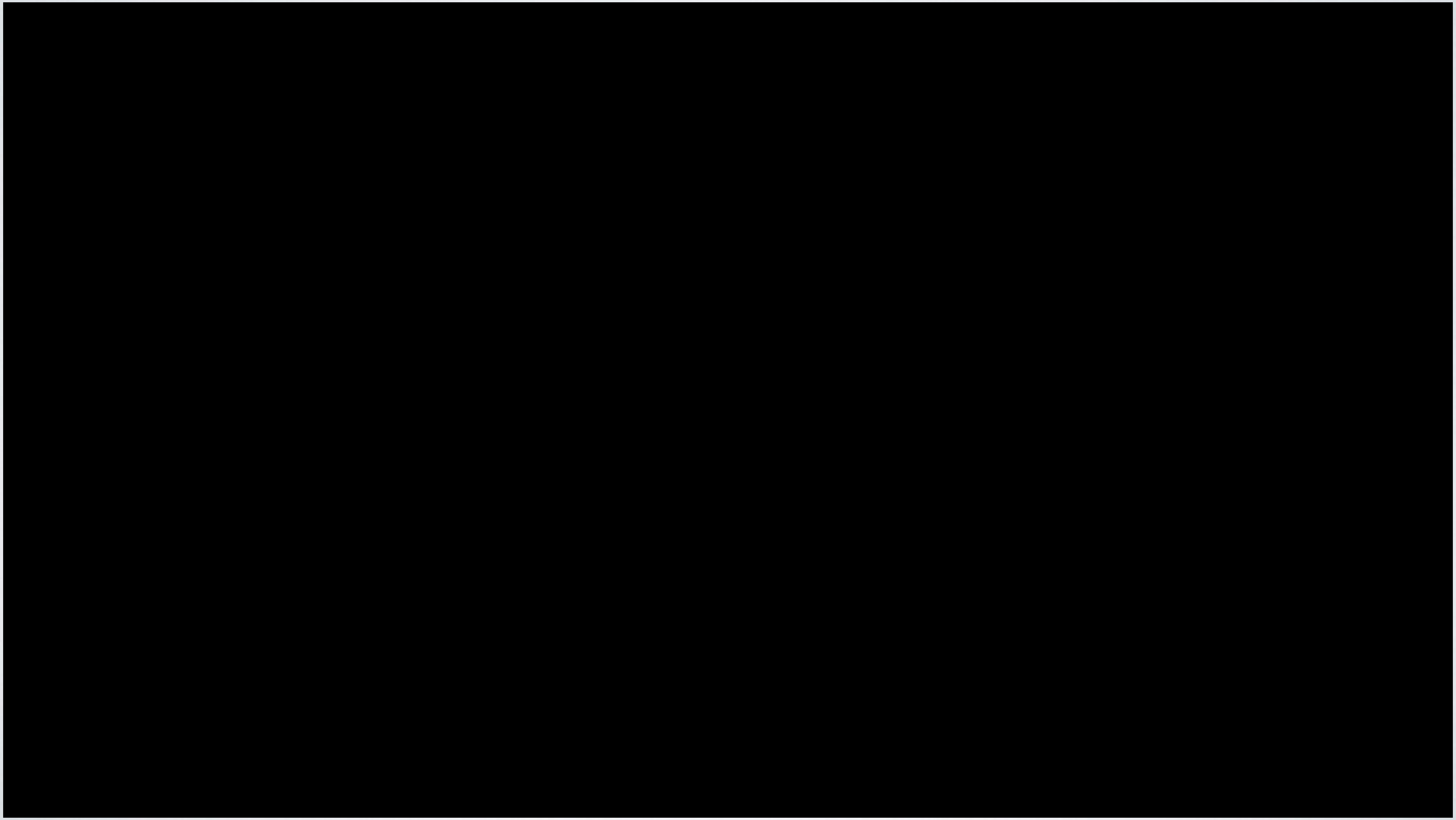

LOADED MOVEMENT TRAINING STUDY

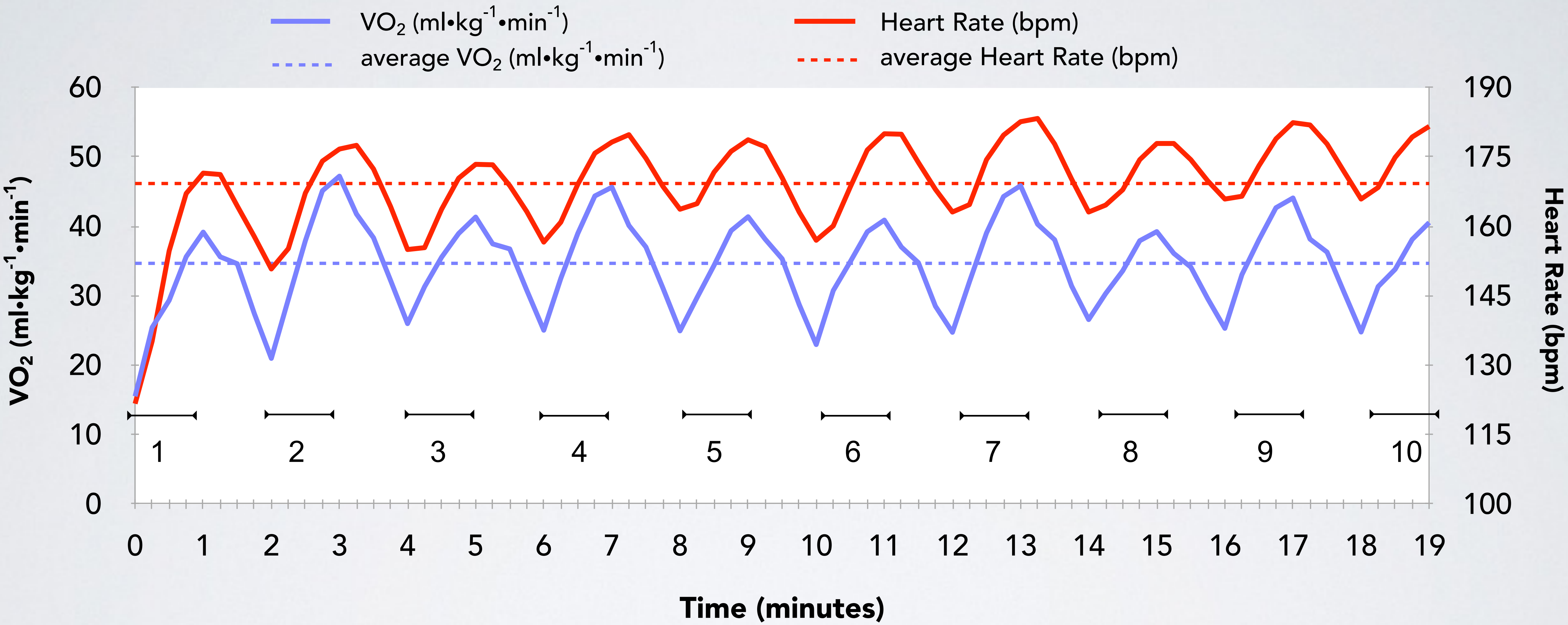

Figure 1: Mean values for VO$_2$ & HR response during a 19 minute LMT protocol (Work Intervals are represented by the numbers 1-10)

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	Work Interval (WI)	Rest Interval (RI)	**Protocol (WI + RI)**
VO	37.3 ± 4.6	32.3 ± 3.5	**34.7 ± 3.9**
% VO	70.1 ± 4.9	60.7 ± 4.2	**65.3 ± 4.1**
HR (bpm)	170.4 ± 8.1	169.3 ± 8.8	**169.7 ± 8.3**
% HRmax	92.1 ± 3.8	91.5 ± 4.3	**91.8 ± 4.0**
RER	1.02 ± 0.05	1.10 ± 0.07	**1.06 ± 0.06**
EE (kcal	13.8 ± 3.2	12.2 ± 2.9	**13.0 ± 3.0**
EE (kcal	0.188 ± 0.024	0.166 ± 0.020	**0.176 ± 0.021**
Overall EE (kcal)	-	-	**246.8 ± 56.7**
Overall RPE	-	-	**17.3 ± 1.6**

Table 1: Metabolic responses (mean ± SD) to a 19 minute LMT protocol

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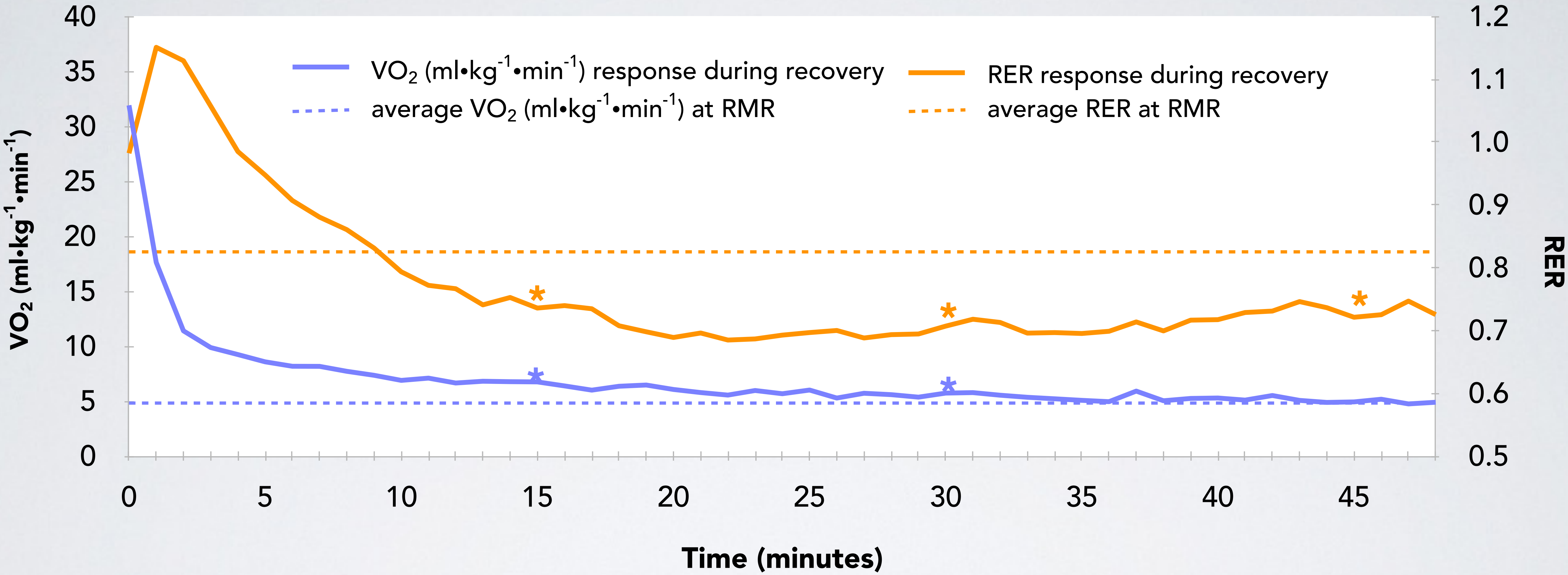

Figure 2: Mean values for the VO_2 & RER response at RMR and during post-exercise recovery
* Significant difference ($p < 0.05$) between RMR & post-exercise recovery

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	RMR	15 minutes	30 minutes	45 minutes
VO	4.83 ± 0.61	**6.68 ± 1.30***	**5.64 ± 1.00***	5.12 ± 0.62
HR (bpm)	61.4 ± 8.1	**104.2 ± 9.8***	**94.0 ± 10.1***	**87.9 ± 10.7***
RER	0.83 ± 0.05	**0.75 ± 0.06***	**0.70 ± 0.05***	**0.73 ± 0.05***
EE (kcal	0.022 ± 0.003	**0.031 ± 0.006***	0.026 ± 0.005	0.024 ± 0.003

Table 2: Metabolic responses (mean ± SD) throughout 45 minutes of post-exercise recovery
* Significant difference ($p < 0.05$) between RMR & post-exercise recovery

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- Discussion:
  - **The metabolic responses of LMT meet all recommendations proposed by the ACSM to improve cardiovascular fitness and improve body composition.**
  - The LMT protocol studied resulted in greater relative VO_2, HR, and EE values than previous studies on continuous functional exercise and FWCRT.
  - The post-exercise metabolic responses from LMT showed an increase in excess post-exercise oxygen consumption (7.9L), overall energy expenditure (41 kcal), and fat oxidation (100%) compared with RMR.
  - LMT can be a useful conditioning methodology for strength coaches and personal trainers working with healthy individuals.

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COMPARING LMT DURING EXERCISE

- Numerous studies exists that explore metabolic demands of FWCRT
    - VO_{2peak} = 20-34 **(vs. 65%)**
    - %HRmax = 76-93% **(vs. 92%)**
    - EE (kcal•min^{-1})= 7.3-13.0 **(vs. 13.0)**

- Only 1 study exists that explores metabolic demands of LMT
  - Continuous (vs. Interval)
    - %VO_{2peak} = 51% **(vs. 65%)**
    - %HRmax = 83% **(vs. 92%)**
    - RER = 0.91 **(vs. 1.06)**
    - EE (kcal•min^{-1})= 10.2 **(vs. 13.0)**

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COMPARING LMT FOLLOWING EXERCISE

- NO study exists that explores metabolic demands of LMT

- Training protocols that have elicited a similar EPOC as the LMT protocol (7.9 L)
  - 80-min of cycling @ 50% VO_2peak
  - 60-min of cycling @ 60% VO_2peak
  - 30-min of treadmill running @ 70% VO_2peak
  - 7 x 2-min of treadmill running @ 90% VO_2peak w/ 2-min rest
  - 14 sets of 12 reps at 75% 1RM with 3.5 minutes rest
  - 16 sets of 20 reps at 75% of 20RM with 1 minute rest
  - 30 sets of 10 reps at 70% 1RM with 1 minute rest
  - 60 sets of 8-12 reps at 70% 1RM with 3 minutes rest
  - 25-min of treadmill running @ 70% VO_2peak prior to 21 sets of 10 reps at 70% 1RM resistance exercise with 105 second rest)

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LOADED MOVEMENT TRAINING STUDY

- Summary:
  - LMT can be a useful conditioning methodology for strength coaches and personal trainers working with healthy individuals to improve cardiovascular fitness and improve body composition

THE LMT PROTOCOL!

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IoM Error Detection

Screening

Adequate Motion Observed ?

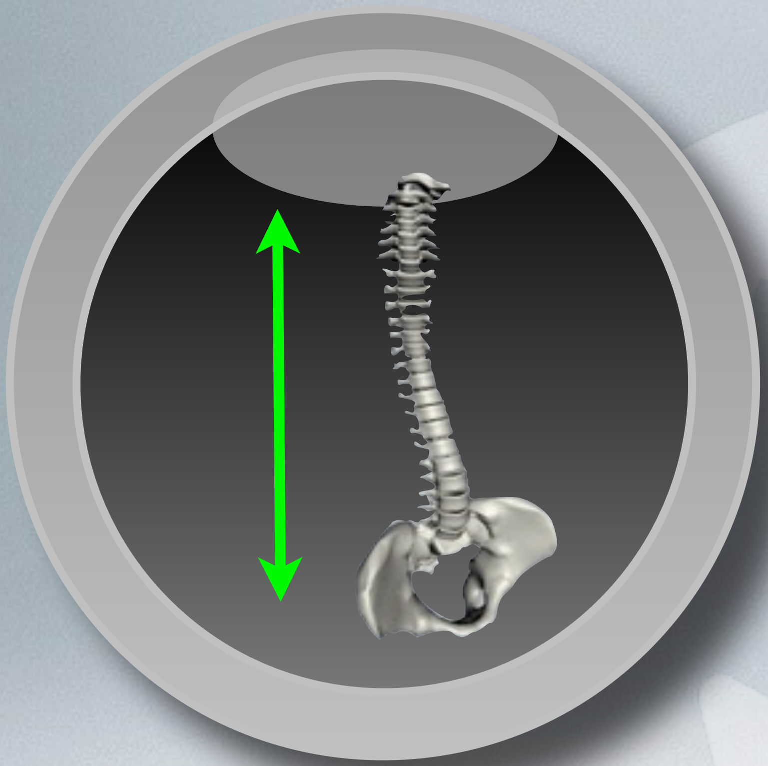
Foot / Ankle Complex

Hip Complex

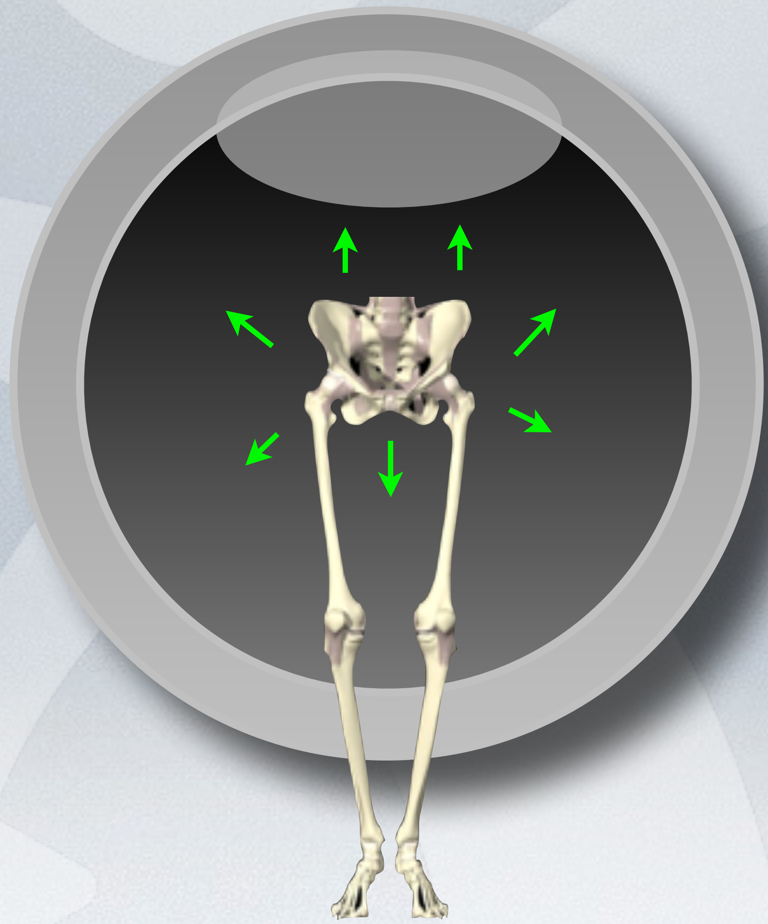
Thoracic Spine

Coaching Cues

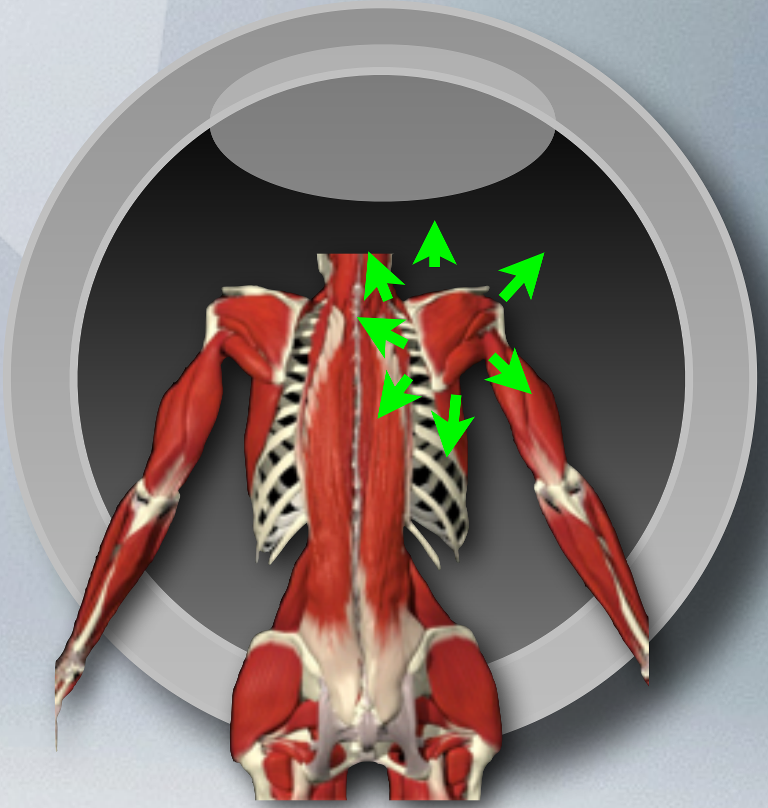
(Adapted from Chuck Wolf, MS)



1. Maintain Length in the Spine



2. Initiate Movement with the Hips



3. Reach with the Scapula

Vandenbrink, DN, Petrella, NP, and MacLennan, DP.

Metabolic responses during and following intermittent functional exercise.

Applied Physiology, Nutrition and Metabolism, September 2013, Vol. 38(S1), pg 1086.

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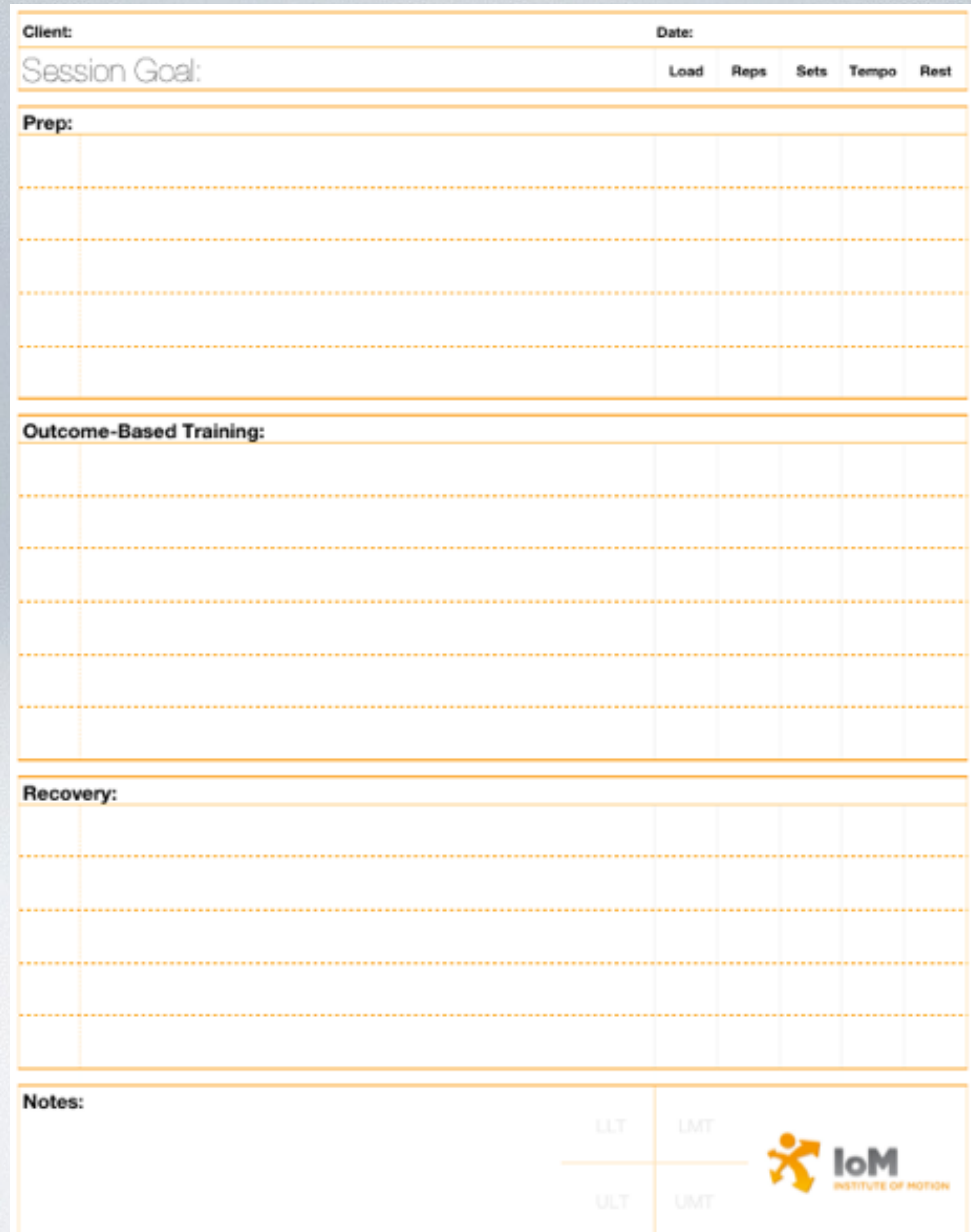
LMT IN YOUR PROGRAMS



Client:	Date:				
Session Goal:	Load	Reps	Sets	Tempo	Rest

Prep:

Outcome-Based Training:

Recovery:

Notes:

LLT	LMT
ULT	UMT

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Thank You!!

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