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EVOLUTION
ELITE PERFORMANCE THERAPY

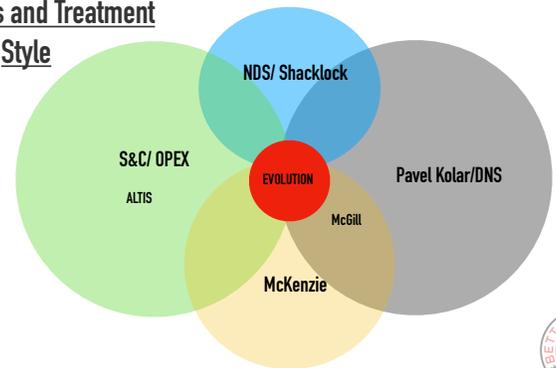
Dr. Jeffrey Beran, PT, DPT, ATC
Dr. Frank Tardi, PT, DPT, CSCS



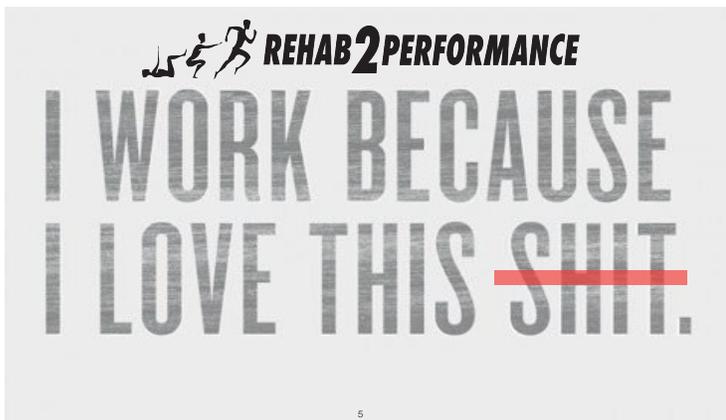
OPEX

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Influences and Treatment Style



REHAB2PERFORMANCE



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Objectives

- Understanding the client or Athlete and what they bring to the table.
- Understanding the skill acquisition, application and strengthening.
- How to progress movement patterns through and skill continuum
- How to build skill into capacity
- How to prescribe tempo
- How to calculate Time Under Tension (TUT)
- How to implement this process into your practice.



REHAB2PERFORMANCE

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Who is this for?



Old School Rehab



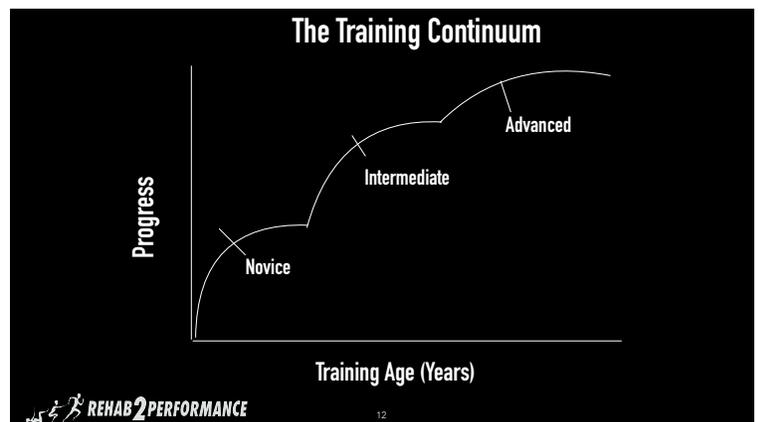
“Historical” Therapy and Rehab and my opinions

- Script for 4–6 weeks, 3 visits per week per script from MD–
- Addressing motor control?
- Chronically under loaded patients leads to rehab purgatory
- What are typical progressions in rehab?
 - ▶ 2x10 to 3x10 to 3x15?
 - ▶ SO WHAT THEN?



“It’s easy to believe an ineffective treatment is working when the patient is getting better regardless”
–Gifford, PT

Who is the client/patient/athlete?
What does this person bring to the table?



What are demands of the sport?



Skill and Performance

Skill Acquisition



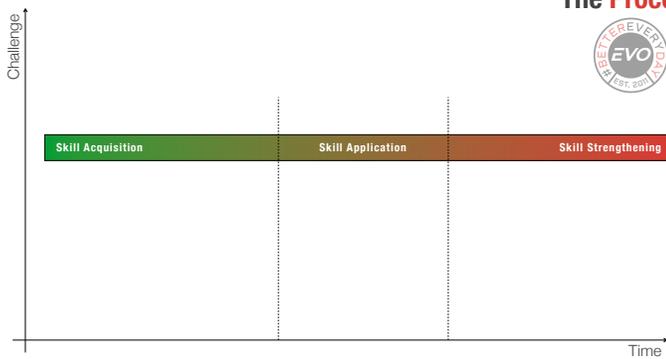
Skill Application



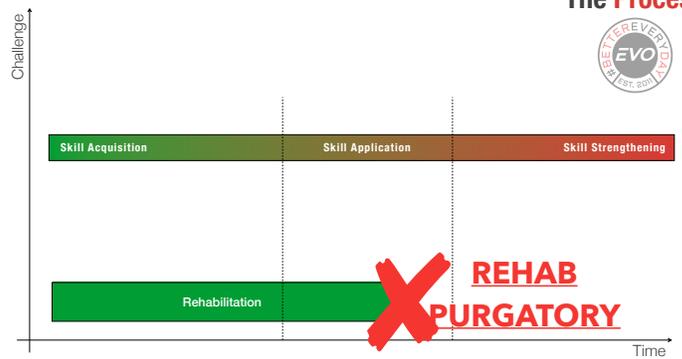
Skill Strengthening



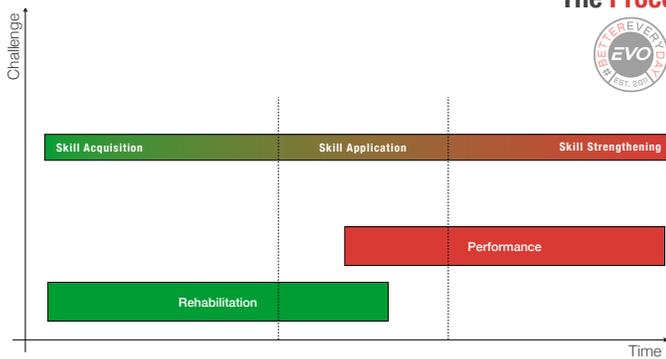
The Process



The Process



The Process



Stressors within Training

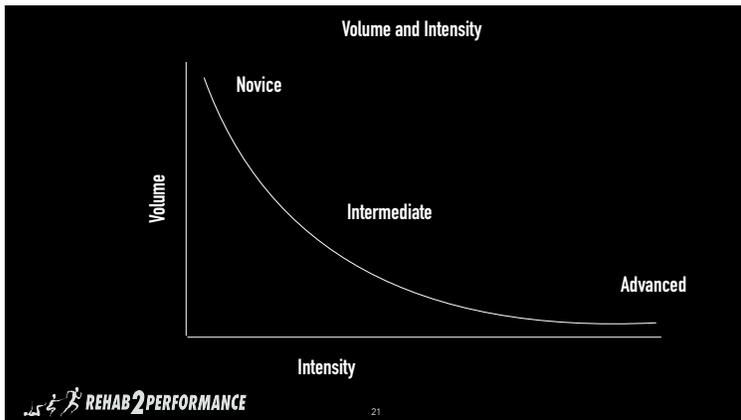


STRESSORS

Load
Speed
Duration
Metabolic demands (aerobic, anaerobic, etc)



General Physical Preparedness (GPP)



Rx GOAL

... determining the optimal balance between training VOLUME, INTENSITY AND DURATION that will provide maximum adaptation for a given athlete without exceeding the individuals capacity for adaptation



Dose Response

1. The relationship between the quantity or intensity of a treatment regimen and its effect on living cells, tissues, or organisms.
2. The relationship between the intensity of an exposure, e.g., to an infectious pathogen, physical stressor, or a toxin, and its effect on living organisms

*Clinical Pearl: Programming through rehab needs to be enough of a stimulus to mitigate complete loss of baseline fitness upon discharge.



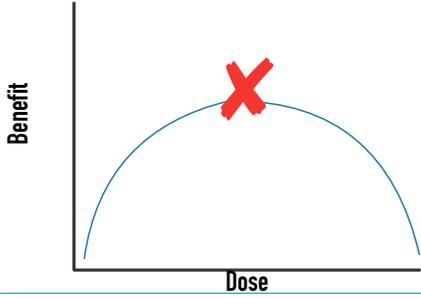
Dose Effect

Minimal Effective Dose
Ensures a safe starting point
Identifies lowest threshold needed to induce a clinically significant change
Creates a process of trust
Used in early phases of rehab or training
Graded exposure

Maximal Effective Dose
Identify Endpoints
Set Thresholds
Push limits of the system to adapt to the higher end needs of the patient



Dose Response



Dose Response
= Perception
Intent
Ex Rx
N=1



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Adaptations to Training Neurological vs Structural



Neurological Adaptations to Training

- Increased Muscle Synergy
- Increased ACH synapse/junction
- Improved muscular recruitment patterns
- Inhibition or reduced activation of antagonist
- Inhibition of Golgi Tendon reflex = increased tension into muscle
- Increased myelination



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Structural Adaptations to Training

- Muscular hypertrophy
- Increased capillary density
- Increase cortical bone density
- Increased mitochondrial density
- Increase in size of boney attachment sites
- Increase in tensile strength of myofascial unit/tendon
- Increased cardiac stroke volume

- Neuro-structural
- Creation of inter-neuron
- Increased myelination of axons



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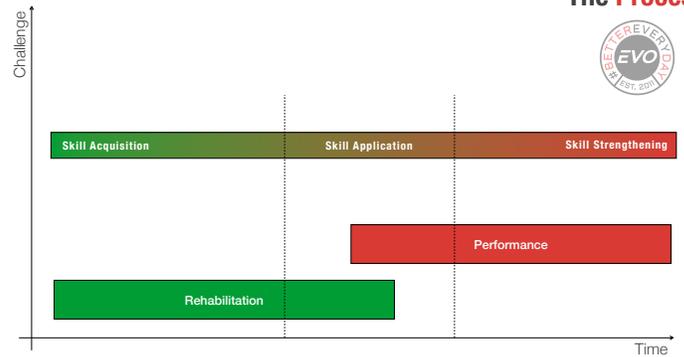
Program Design

“Program design is all about manipulating volume and intensity and is training age dependent”



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The Process



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“For a skill, you must practice. To acquire capacity, you must train.”

-Me



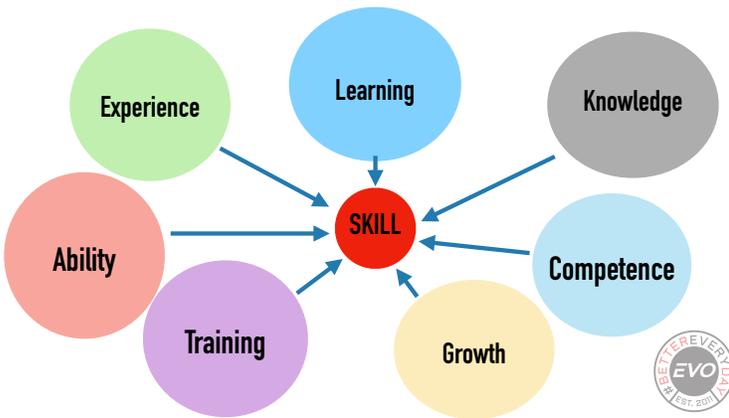
Skill

Vs.

Capacity

1. Skill is performed without failure
2. Build competency and increase volume over time
3. Add variable movement patterns and loading parameters to improve skill or multiple skills together

1. Capacity is used to find threshold
2. Train threshold and push it higher



Graded Skill Exposure

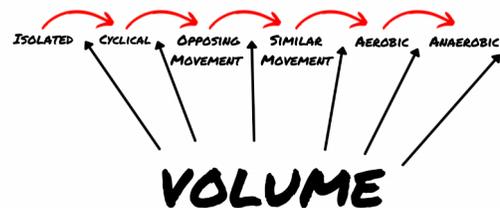
- Cyclical/Locomotion >
- Cyclical + Isometrics >
- Cyclical + Varied Contractions >
- Cyclical + Load + Varied Contractions >
- Cyclical + Load + Dynamic Contractions



Skill Progression Map



Skill Progression Map





Testing & KPI

Functional Testing vs. Performance Testing



Functional Testing vs. Performance Testing

Functional Testing (Clinic)

ROM
MMT
Neurodynamics
Stabilization/Motor Control

Performance Testing (Gym)

Rep Maxes
Aerobic Testing
Anaerobic Testing



Testing vs Training

If all you're doing is competing for the leaderboard, you're not training... You're testing!!



TESTING

Use ALL your resources and take yourself to a "supramaximal" level

Testing NOT Repeatable
Diminishing returns
NO skill development

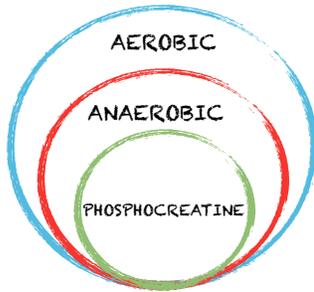


TRAINING

- Accumulating skills and/or physiologic adaptations over time
- Break tasks into constituents and work backwards
- MOTOR CONTROL
- Training = Repeatable Process
 - Foundation
 - Long Term Progression
 - Acquired Intensity
 - REPEATABILITY = VALIDITY



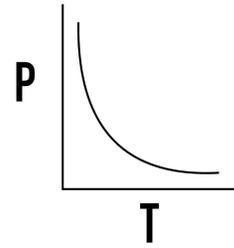
3 Main Energy Systems



Ref: OPEX

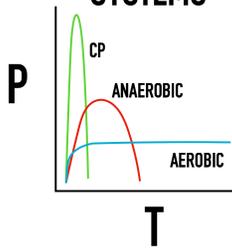


Power Time Curve



- CP
- Anaerobic Alactic
- Anaerobic Lactic
- Aerobic

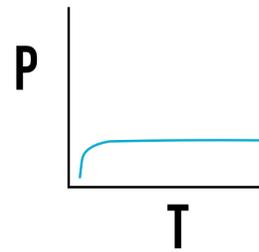
ENERGY SYSTEMS



Ref: OPEX



AEROBIC



Ref: OPEX

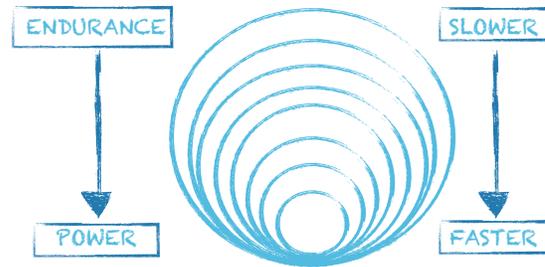


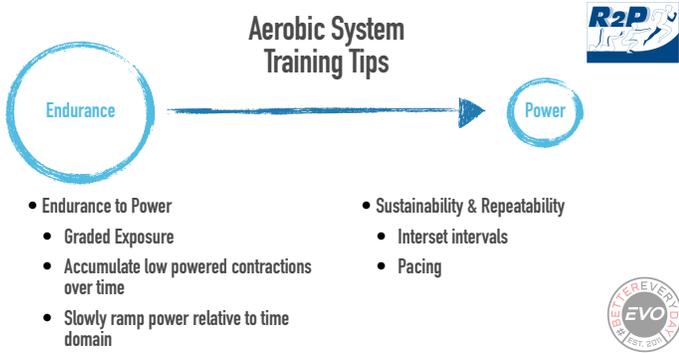
Aerobic System Definitions

- MAXIMUM AEROBIC POWER (VO2 Max)
 - Max O2 utilized by muscles during exercise
 - Affected by mass of active muscles
 - Magnitude will vary with different modes of exercise
- AEROBIC CAPACITY
 - Maximum aerobic development in allotted time frame before fatigue
 - Training increases both VO2 max as well as capacity to tolerate and sustain exercise at higher intensities (%VO2 Max)



Aerobic System Progression





Tale of Two Athletes

Time	Notes
1. 3:57	
2. 7:50 → 3:57	
3. 11:38 → 3:48	
4. 15:56 → 4:14	
5. 20:24 → 4:28	
6. 25:34 → 5:10	
7. 30:45 → 5:45	
1. 3:50	CS Sustained Pace
2. 7:25 → 3:35	7 CA Rows
3. 11:00 → 3:35	7 BSSD
4. 14:24 → 3:26	7 Push Up
5. 17:53 → 3:29	7 CA FNB
6. 21:44 → 3:51	7 Wave Box
7. 25:14 → 3:30	7 AMB3
	7 V-Up
	X 7 Sets



Anaerobic System Overview

- Who needs this for function?
- Why Anaerobic Work?
- Compensations develop HERE
- Touches for the average person is OKAY
- Caveat... Prerequisite = STRENGTH!!

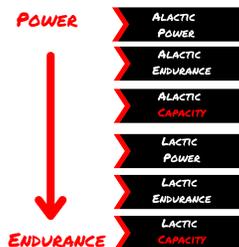


Anaerobic System Training Tips & Effects

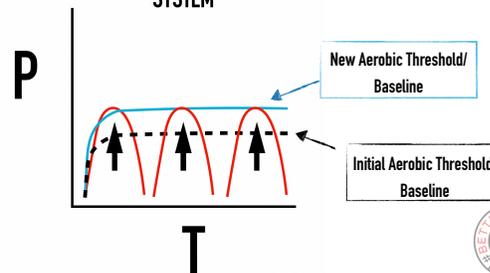
- Training Aerobic & Anaerobic = BAD
 - Anaerobic training impairs aerobic enzymatic activity.
- Decreases endurance capacity and may take 24-96 hours for blood pH to return to normal
- Decreases VO2 Max
 - Slow stuff = hard
- Decreases nutrient uptake and absorption
- Dampen CNS
- Destroy capillary beds



ANAEROBIC PROGRESSION

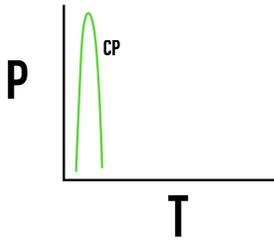


ANAEROBIC SYSTEM



Phosphocreatine

- CLASSICAL STRENGTH TRAINING
- OLYMPIC WEIGHTLIFTING
- BODYBUILDING
- POWER LIFTING
- GYMNASTICS

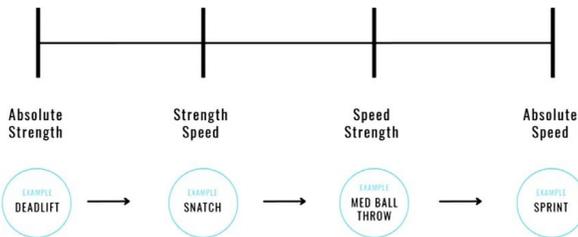


Absolute strength is arguably one of the first adaptations humans experience in the development of movement... Stand before you step, step before you can walk. In order to move something more than once you have to be able to move it once.



Ref: OPEX

Expressions of Contractions



NOT ALL REPS ARE CREATED EQUAL

*** MEANS NOTHING WITHOUT TEMPO ***



TEMPO/TUT

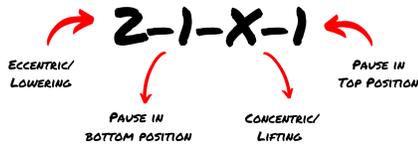
■ Definition: The rate or speed of motion or activity; pace.

Why?

- Safety
- Control & Validity
- Expose Weaknesses
- Specific Dose Response

TUT: Time Under Tension

- Promotes Learning
- INCREASED MOTOR CONTROL
 - Motor units, rate coding, muscle spindles, GTOs, mechanoreceptors
- COGNITIVE AWARENESS



Time Under Tension

- Using TUT as a guide for dose response
- Load Dependent
- Notice similarities btwn time domains and those from the chart
 - 0-20 Alactic
 - 20-40 Lactic Power
 - >40 Lactic Endurance

TUT	System	Dose Response
0-20 sec	CNS	Strength
20-40 sec	CNS + Cellular Based	Strength + Hypertrophy
40-70 sec	Metabolic + Cellular Based	Hypertrophy



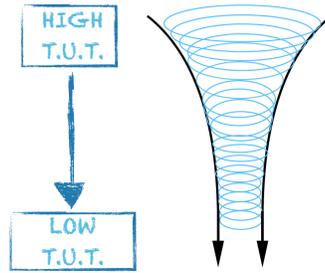
Time Under Tension

- Basic guide to training each level athlete
- These are **NOT** rules
- Identifies where they would likely benefit the most

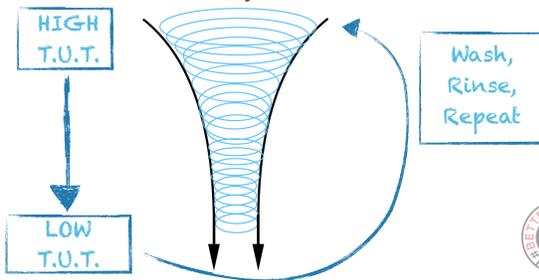
Level	High	Low
Beginner	40-120 sec	40-60 sec
Intermediate	40-60 sec	20-40 sec
Advance	10-25 sec	0-10 sec



Time Under Tension Life Cycle



Time Under Tension Life Cycle



Calculating TUT

BACK SQUAT x 4-5 reps x 5 sets @ 33X1

Calculation:

1 Rep = 3+3+1+1 sec = 8 sec/rep

4 reps = 8 sec/rep x 4 reps = 32 sec Time Under Tension

5 Reps = 8 sec/rep x 5 reps = 40 sec Time Under Tension

One set should take 32-40 sec for appropriate dose response



Work Shop

Work Shop

1. Neuromuscular Efficiency Testing
2. FWB A/Lactic Power Intervals
3. Skill —> Capacity Training



Neuromuscular Efficiency Testing

Work Up to 1RM Back Squat
Rest 5-10 mins
Perform AMRAP @ 85-90% 1RM



Neuromuscular Efficiency Testing

Findings:
High NME: 2-4 reps
Low NME: 6-12 reps



Skill —> Capacity

TEST:	EMOM x 6	EMOM x 8	EMOM x 10
Max Rep Push Ups = 60 reps	12 push ups	12 push ups	12 Push Ups
Improve battery @ submaximal efforts: Take 20-50% of max reps	Total = 72	Total = 96	Total = 120

RE-TEST:
Max Rep Push Ups = 77 reps

When it becomes unsustainable, you have reached capacity training... here you will find compensatory mechanisms and expose motor control deficiencies under high fatigue



Skill Progression

1. Perform Skill In Isolation (Non-Fatigue)

Coach's Notes:

- Perform deadlifts with proper tempo
- 1-2 x per week
- Gradually increase load each session
- Maintain IAP
- Keep tension in bottom position
- Work on overcoming inertia

Dead Stop Deadlift: 4 x 4-6 reps:
21X1; Rest 90-120 seconds



Skill Progression

1. Perform Skill In Isolation (Non-Fatigue)
2. ADD VOLUME

TnG Deadlift: 6 x 6-8 reps:
20X1; Rest 90 sec

Coach's Notes:

- Perform deadlifts with proper tempo
- 1-2 x per week
- Submaximal Loads
- Work on SEC/Stretch Reflex



Skill Progression

3. Skill + Cyclical (Low Fatigue/Inc Resp)

Alt EMOM x 12 mins
Min 1: 10 Cal Assault Bike
Min 2: 10 TnG Deadlift

Coach's Notes:

- Adding low respiratory Rate
- Keeping fatigue levels low
- Starting to challenge a new environment



Skill Progression

3. Skill + Cyclical (Low Fatigue/Inc Resp)
4. ADD VOLUME

EMOM x 15 mins
Min 1: 12 GHDBE @ 21X1
Min 2: 12 cal Assault Bike
Min 3: 10m Suitcase Carry each

Coach's Notes:

- Keeping Low Respiratory Rate
- Keeping fatigue levels low
- Continue to challenge movement pattern in adverse environment



Skill Progression

5. Skill + Opposite Movement (Low Fatigue)

Perform...
5 Deadlift
10 Cal ski
15 DB Push Press
Rest 90 seconds
x 4 sets

Coach's Notes:

- Keeping low respiratory rate
- Keeping fatigue levels low
- Implementing other skills/patterns that do not hinder the current skill/pattern we are improving upon



Skill Progression

5. Skill + Opposite Movement (Low Fatigue)
6. ADD VOLUME

Perform...
25 RKBS
10 Cal Bike
25 DU
10 Cal Bike
Rest 90 seconds
X 3-5 sets

Coach's Notes:

- Keeping low respiratory rate
- Keeping fatigue levels low
- Adding pattern volume with other skills/patterns that do not hinder the current skill/pattern we are improving upon
- Pushing respiratory rates but keeping away from threshold



Skill Progression

7. Skill + Similar Movement (Low Fatigue)

Every 2 mins perform...
5 deadlift TnG
7 KBS @ mod tough
9 burpee
x 3-4 sets

Coach's Notes:

- Keeping Low Respiratory Rate
- Keeping fatigue levels low
- Implementing other skills/patterns that are similar to begin challenging the volume, duration and intensity of the current skill/pattern we are training



Skill Progression

7. Skill + Similar Movement (Low Fatigue)
8. ADD VOLUME

Every 2:30 min perform...
10 TnG Deadlift
10 Box Jump Step Down
10 KBS
X 3-5 sets

Coach's Notes:

- Keeping Low Respiratory Rate
- Keeping fatigue levels low
- Implementing other skills/patterns that are similar to begin challenging the volume, duration and intensity of the current skill/pattern we are training



Aerobic Interval Implementation

9. Skill + Aerobic Intervals

AMRAP 6
7 cal row
14 TnG Deadlift
21 KBS
+
Rest Walk 2 min
+
AMRAP 6
5 Burpee Box Jump
10 TnG Deadlift
60 DU
+
2 min rest walk
X 2 sets

Coach's Notes:

- Perform @ Sustainable pace, 70-75% effort
- Interset Intervals: (+/-) 3 seconds per round
- Weight: Choose appropriate load based on function
- Increased respiratory rate
- Increased fatigue
- Keeping below threshold levels



If you have questions . . . Reach out

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