Bridging The Gap From Injury To Performance in a Football Athlete Using a Functional Movement Systems Approach

Alternative Physiotherapy Strategies For Calf Injuries

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Key principle:

Rehabilitating a ***person*** with an injury is not the same as rehabilitating the injured tissue.

Rehabilitating the injured tissue ***does not guarantee*** that contributing factors, causative factors and complicating factors are addressed.

Rehabilitating the person ***does guarantee*** that this occurs, in addition to the injured tissue being treated.

Left calf muscle tear

+

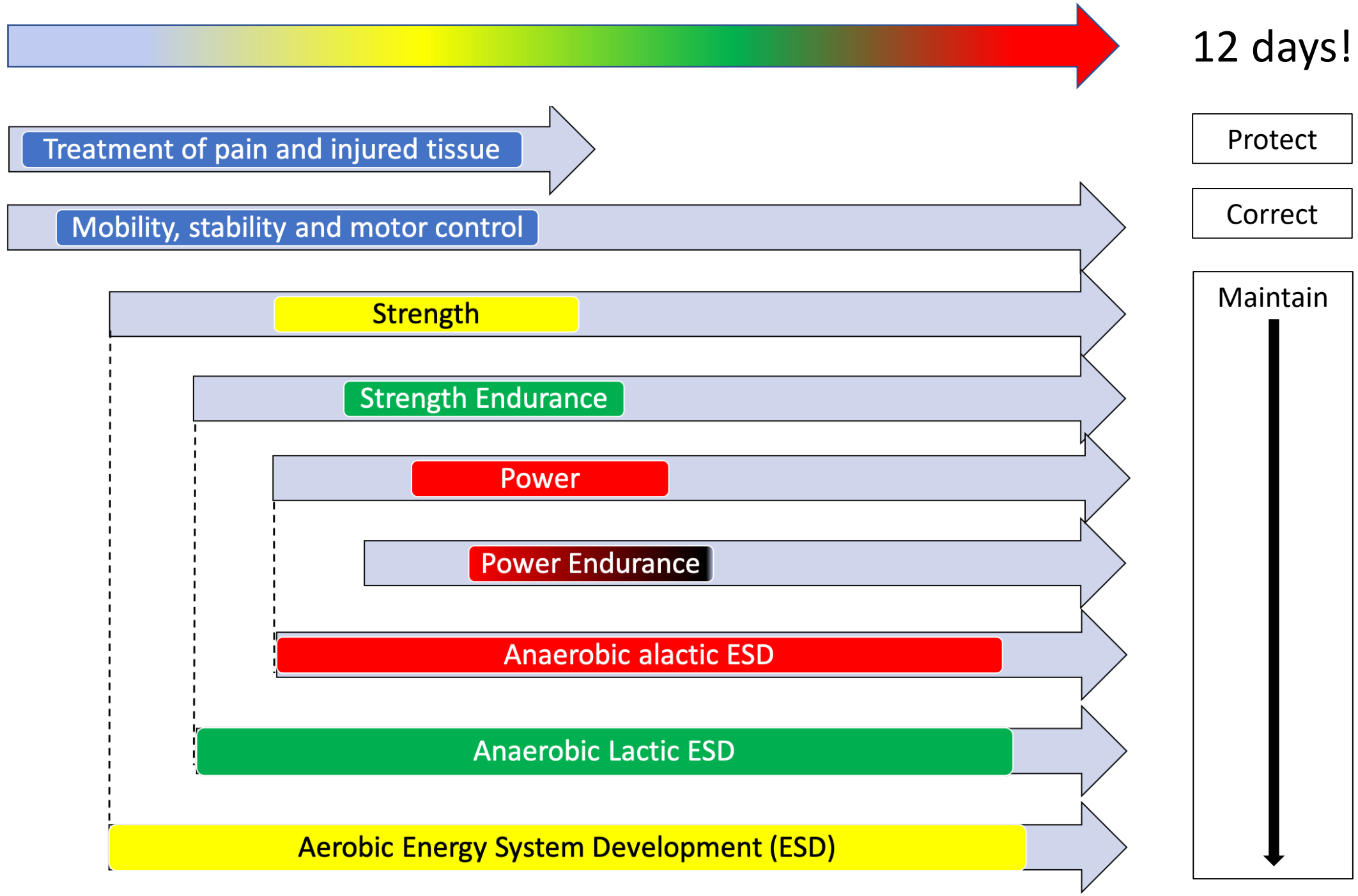
Pain

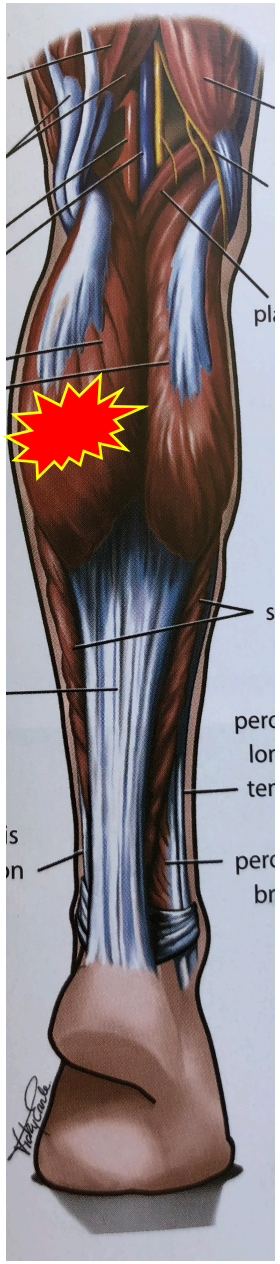
+

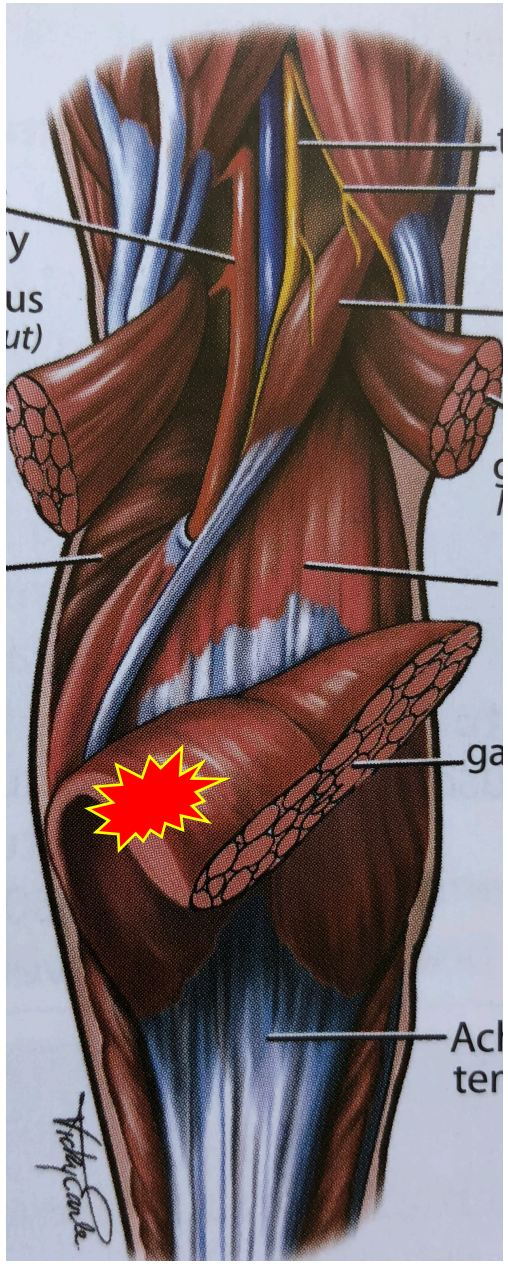
21% asymmetry in single-leg “calf-raise” strength test

+

12 days until championship match


12 days!
Treatment of pain and injured tissue
Mobility, stability and motor control
Strength
Strength Endurance
Power
Power Endurance
Anaerobic alactic ESD
Anaerobic Lactic ESD
Aerobic Energy System Development (ESD)
Protect
Correct
Maintain





Body part	Energy return available	Subtotal
Feet ligaments and tendons	17%	17%
Achilles Tendon	35%	52%

Treatment of pain and injured tissue

Painful area

Limited mobility

Limited mobility

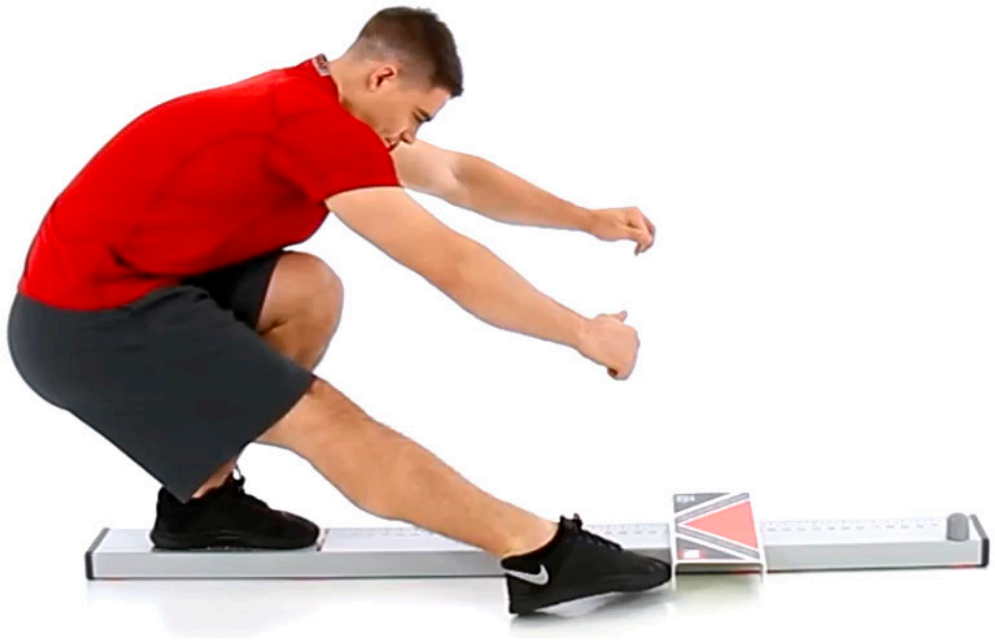
Altered motor control

It is not an isolated calf problem, it is a multiple-pattern person problem noticed primarily by the person as a calf pain.

Lower Body Motor Control Screen

Evaluation of neuromuscular control at the limits of stability

Foot length with shoes on = 30.5cm
Target minimum reach distance = 61cm
Target maximum asymmetry < 4cm



Day 1	*Left foot reach = 50.5cm* *Right foot reach = 63cm*	*20% asym*
Day 4	*Left foot reach = 64cm* *Right foot reach = 68cm*	*6% asym*
Day 11	*Left foot reach = 65cm* *Right foot reach = 66cm*	*1.5% asym*

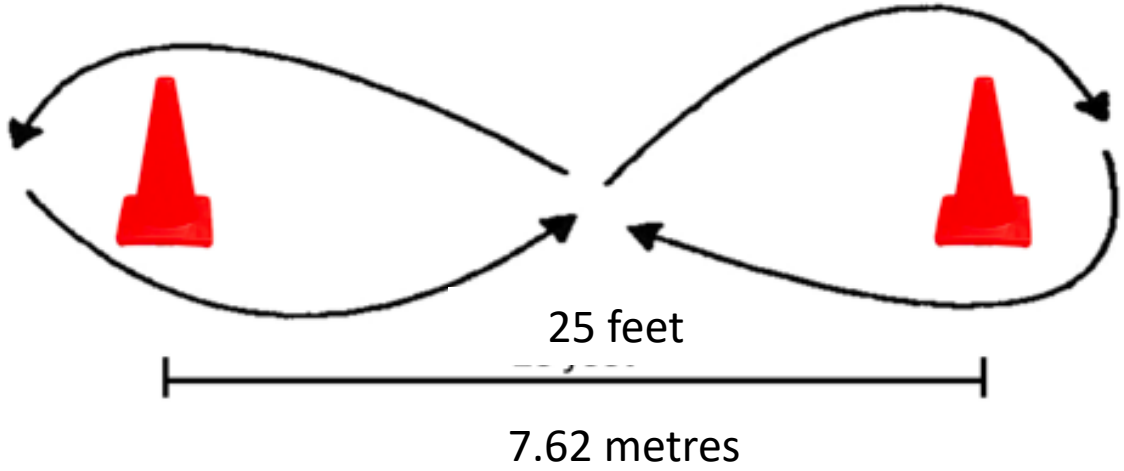
Upper Body Motor Control Screen

Evaluation of neuromuscular control at the limits of stability

Foot length = 30.5cm
Target minimum reach distance = 61cm
Target maximum asymmetry < 4cm

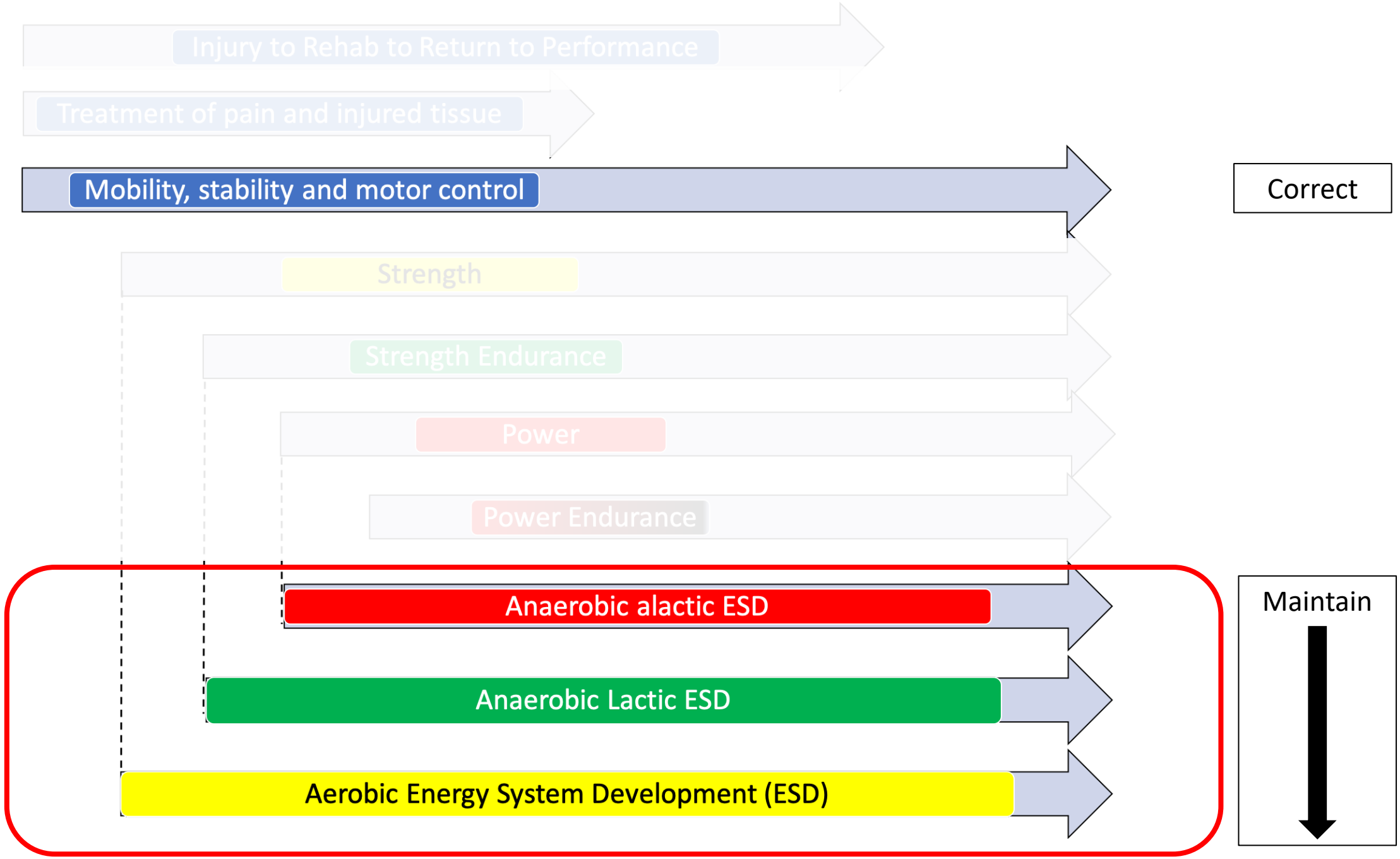
Day 1	*Left hand reach = 58* *Right hand reach = 47*	*19% asym*
Day 4	*Left hand reach = 63cm* *Right hand reach = 59cm*	*6% asym*
Day 11	*Left hand reach = 65cm* *Right hand reach = 65cm*	*0% asym*

Test of postural integrity under load.



Carry weight = 75% Body weight
Minimum carry distance = 250 feet or 76.2 metres
Minimum carry time = 90 seconds

Day 1	*80m in 70 seconds with 70kg = 1.14m/s*	**Carry distance – 112%**
Day 6	*140m in 101 seconds with 70kg = 1.39m/s*	**Carry time – 90%**
Day 11	*170m in 134 seconds with 70kg = 1.27m/s*	**Carry speed – 11%**


Injury to Rehab to Return to Performance
Treatment of pain and injured tissue
Mobility, stability and motor control
Correct
Strength
Strength Endurance
Power
Power Endurance
Anaerobic alactic ESD
Anaerobic Lactic ESD
Aerobic Energy System Development (ESD)
Maintain

Low impact conditioning and motor control training at *below* bodyweight

- Traction with hip external rotation
- Pelvic orientation to open hip joint space
- Dynamic trunk motor control
- Static lower body motor control

Low impact conditioning and motor control training at *below* bodyweight

- Static lower body motor control
- Dynamic trunk control

Low impact motor control training at *below* bodyweight

Pre-Running Conditioning
Energy System Development (ESD)
or Energy System Maintenance (ESM)

Body weight (kg)	Body weight (lb)	Extra Load (kg)	Extra Load (lb)	Speed (mph/kmh)	Incline (%)	Watts
86	190			3mph/4.8kmh	0	200W
				3mph/4.8kmh	5	400W
				3mph/4.8kmh	10	650W
				3mph/4.8kmh	15	967W
86	190	4.5	10	3mph/4.8kmh	15	1004W
86	190	9	20	3mph/4.8kmh	15	1067
86	190	13.5	30	3mph/4.8kmh	15	1104
86	190			5mph/8kph	3	916
86	190			6mph/9.6kph	0	916
86	190			8mph/12.8kph	0	1209

Day 1 – Treatment + Protected Early Exercise
Pool session - 30-45 minutes

Day 2	
HR within T1	Option A - incline walking, possible weight vest added. Option B - walk/jog depending on whether the calf is tolerating it.
Movement preparation	Aerobic calf conditioning
Up to 20 minutes	30-60 minutes

Training Zone	Description	Blood La Threshold Relationship	Percent HRmax	Actual HR		Percent VO2max	Critical Duration
T1	Light Aerobic	Below LT1	60-75	**120**	**150**	<60	>3 hours

TABLE 6.7 Sample Endurance Training Zone Classifications Used in Australian Sports

Sport	Training zone descriptor	Endurance training zones
Cycling	Endurance	E1, E2, E3, E4
Kayaking	Aerobic	A1, A2, A3, A4, A5, A6
Rowing	Utilization	U3, U2, U1, AT, Transport
Running	Aerobic	A1, A2, A3, A4, A5, $\dot{V}O_2$max
Triathlon*	Training Zone	T1, T2, T3, T4, T5, T6

*Note different definition for training zone determination applied.

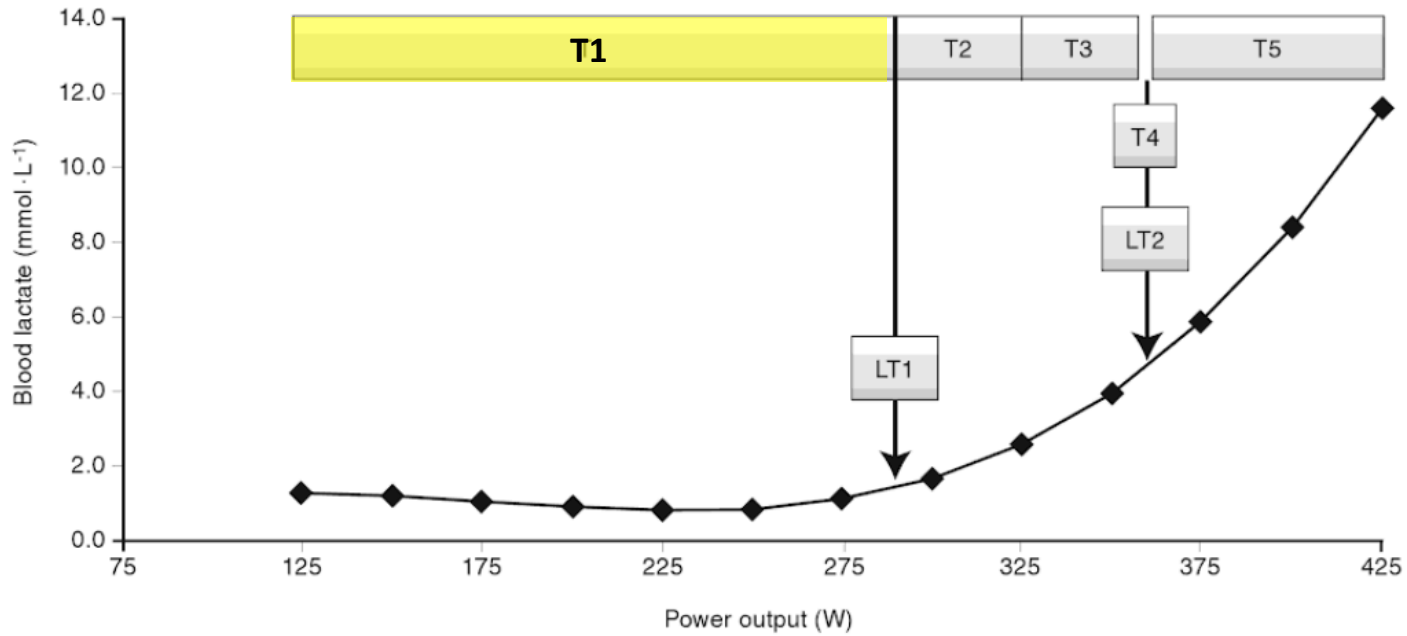
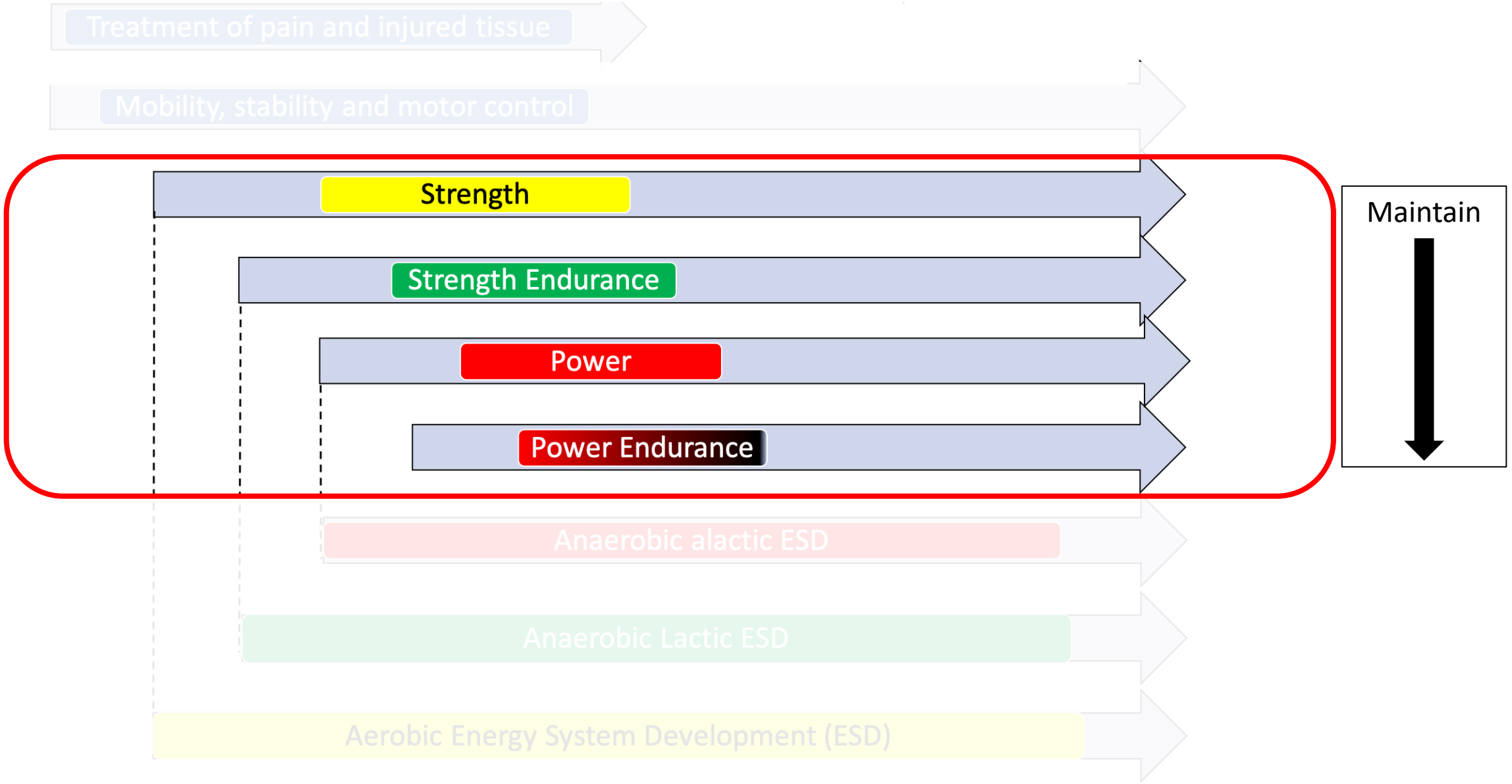


FIGURE 6.7 Relationship of the five endurance training zones to the blood lactate–incremental exercise response curve. Subject is a male cyclist. (Data were collected during routine physiological assessments in the SASI exercise physiology laboratory.)


Treatment of pain and injured tissue
Mobility, stability and motor control
Strength
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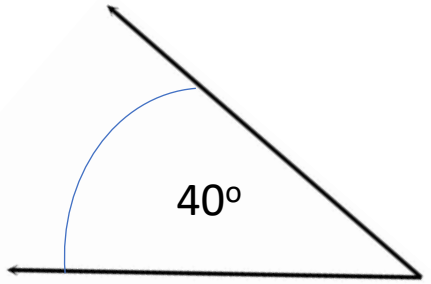
Aerobic Energy System Development (ESD)

Strength

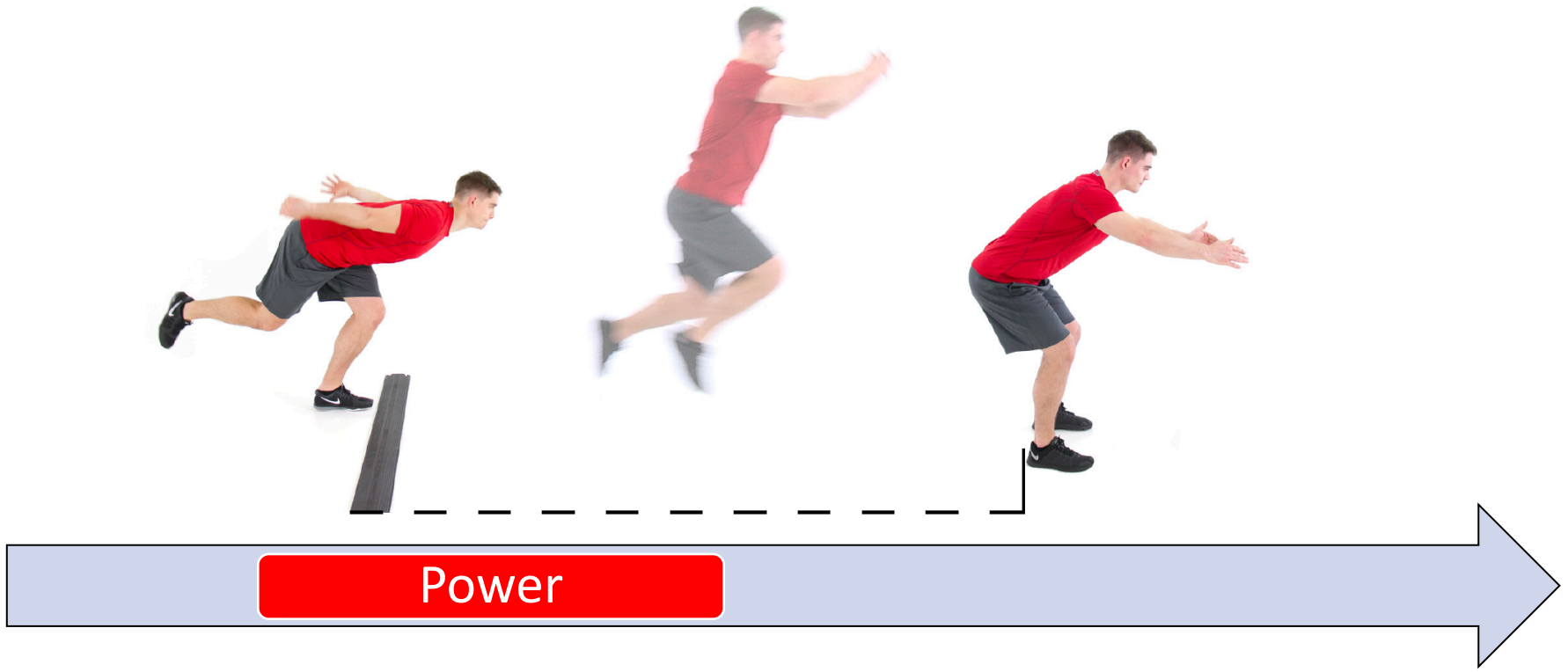
x 1 repetition, to 40 degrees plantarflexion



Strength Endurance

x maximum repetitions

Day 1	*Left foot = 28* *Right foot = 22*	*21% asym*
Day 11	*Left foot = 36* *Right foot = 35*	*3% asym*



Day 11

Left foot SL leap = 197cm
Right foot SL leap = 193cm

2% asym

Power – Energy Storage

Take one large step back

Start on 2 and Jump to 1

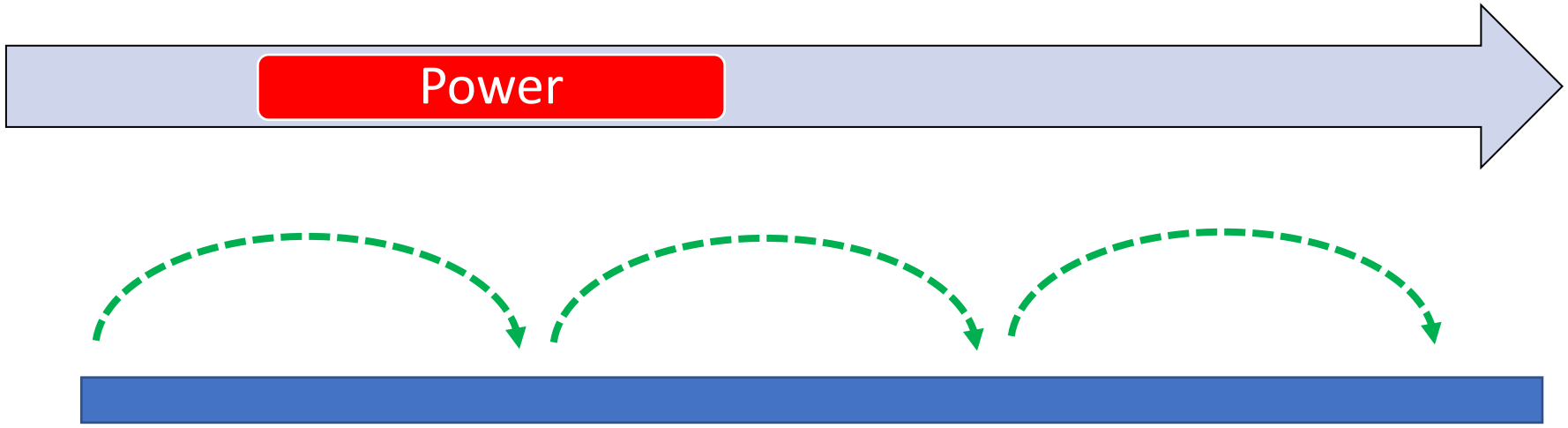
Land on 1 behind the line and explode on to 2

Land on 2 and measure distance

Day 11

Left foot 2:1:2 = 220 cm
Right foot 2:1:2 = 219 cm

12% energy storage-return
13% energy storage-return



Day 11

Left foot triple hop = 430cm
Right foot triple hop = 449cm

4% asym

1. Progressive loading of calf within whole-body movement patterns
2. Maintenance of aerobic conditioning
3. Progression of load and anaerobic conditioning

Progressive loading of calf within whole-body movement patterns

Lower limb motor control (MC)
Calf low load tolerance
Calf strength endurance
Calf power

Non-impact conditioning options (nil or below bodyweight)	Low impact conditioning options (below or at bodyweight)
All half kneeling pushes (MC)	Elliptical trainer
All half kneeling pulls (MC)	Rowing Machine (PWB)
All half kneeling rotations (MC)	Resisted crawling (MC)
Swimming	Prowler push (MC)
Treading water	VersaClimber (MC)
Cycling continuous steady state	Stair climbs (MC)
Cycling intervals	Wall lift and load (MC)
Cycling hills/big gear	Walking flat surface +/- weighted vest (MC)
Shallow water side walking-push (MC)	Interval farmers carries (MC)
Shallow water side walking-skip (MC)	Wall march (MC)
Shallow water carioca/grapevine (MC)	Alter G (MC)
Shallow water running (MC)	

Day 3

	HR within zones T1-T4 15s work 15s rest 8 reps		HR within zones T1-T4 15s work 15s rest 8 reps		HR within zones T1-T4 15s work 15s rest 8 reps	
T1		**T1**		**T1**		**T1**
Movement prep	Low impact intervals		Low impact intervals		Low impact intervals	Recovery
	4 minutes	**2 minutes recovery**	**4 minutes**	**2 minutes recovery**	**4 minutes**	**2 minutes recovery**

Repeat the 16 minutes work and recoveries based on how the calf tolerates the load that day.
Reduce the workload to keep HR in zone 2 without burning out the legs.

Training Zone	Description	Blood La Threshold Relationship	Percent HRmax	Actual HR		Percent VO2max	Critical Duration
T1	**Light Aerobic**	**Below LT1**	**60-75**	**120**	**150**	**<60**	**>3 hours**
T2	Moderate Aerobic	Lower half b/w LT1 & LT2	75-82	**150**	**164**	60-72	1 - 3 hours
T3	Heavy Aerobic	Upper half b/w LT1 & LT2	82-88	**164**	**176**	70-82	30 - 90 min
T4	Threshold	LT2	88-92	**176**	**184**	80-85	20 - 60 min

Low impact conditioning and motor control training *at* bodyweight

Low impact conditioning and motor control training *at* bodyweight

Low impact conditioning and motor control training *at* bodyweight

Low impact conditioning and motor control training *at* bodyweight

Low impact conditioning and motor control training at *above* bodyweight

Low impact conditioning and motor control training at *above* bodyweight

Low impact conditioning and motor control training at *above* bodyweight

Low impact conditioning and motor control training at *above* bodyweight

Day 4	
HR within T1	**HR within T1. Repeat of incline walking, or walk/jog.**
Movement preparation	Aerobic calf conditioning
Up to 20 minutes	30-60 minutes

Day 5

	HR within zones T1-T4 15s work 15s rest 10 reps		HR within zones T1-T4 15s work 15s rest 10 reps		HR within zones T1-T4 15s work 15s rest 10 reps	
T1		**T1**		**T1**		**T1**
Movement prep	Running intervals		Running intervals		Running intervals	Recovery
	5 minutes	**1 minute recovery**	**5 minutes**	**1 minute recovery**	**5 minutes**	**2 minutes recovery**

Repeat the 17 minutes work and recoveries based on how the calf tolerates the load that day.
Reduce the workload to keep HR in zone 2 without burning out the legs.

Day 6	
HR within T1	**HR within T1. Repeat of incline walking, or walk/jog.**
Movement preparation	Aerobic calf conditioning
Up to 20 minutes	30-60 minutes

Progressive loading of calf within whole-body movement patterns

Calf strength endurance

Calf power

Calf power endurance

Medium impact conditioning options (above bodyweight)	Normal impact conditioning options (above bodyweight)	High impact conditioning options (above bodyweight)
Downhill Walking	Continuous running (MC)	Accelerations & Decelerations (MC)
Side skipping (MC)	Interval running (MC)	Sprinting (MC)
Carioca/grapevine (MC)	Downhill running	Jumping (MC)
Fwd-bwd moving laterally (MC)		Hopping (MC)
Forward skipping (MC)		Bounding (MC)
A march & skip (MC)		
B march & skip (MC)		
Stiff ankle bounds (MC)		
Wall march doubles (MC)		
Wall march triples (MC)		

Day 7

	HR within zones T1-T4 15s work 15s rest 2 reps	HR within zone T5 15s work/15s rest 4 reps	HR within zones T1-T4 15s work/ 5s rest 4 reps	
HR 117 - 146 Movement prep	146 - 179 Running intervals with football	179 - 195	146 - 179 Running intervals with football	117 - 146 Recovery
See below	**1 minute**	**2 minutes**	**2 minute**	**2 minutes recovery**

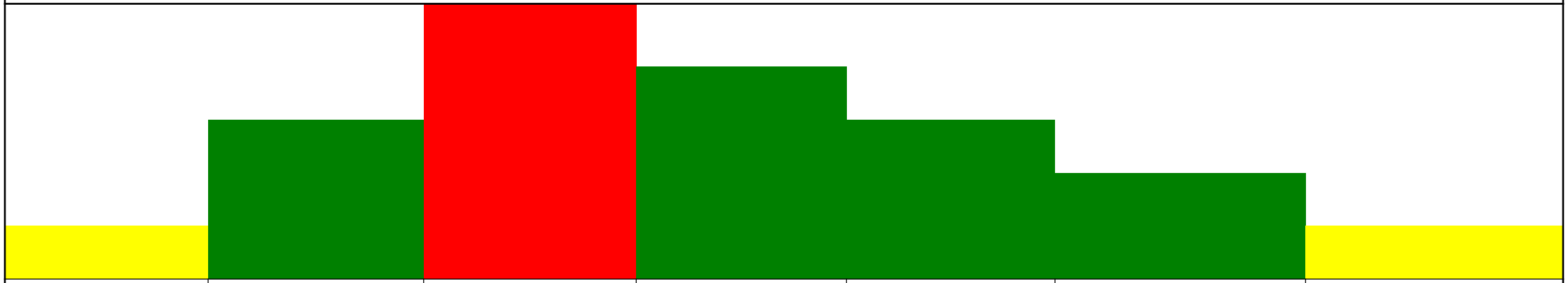
Repeat the 5 minutes work and recoveries based on how the calf tolerates the load that day.
Reduce the workload to keep HR in zone 2 without burning out the legs.

Training Zone	Description	Blood La Threshold Relationship	Percent HRmax	Actual HR		Percent VO2max	Critical Duration
T5	**Maximal Aerobic**	**Above LT2**	**92-100**	**184**	**200**	**85-100**	**2 - 12 min**

Day 8

Pool session - 30-45 minutes

Day 9



Movement prep	football drills	football drills	football drills	football drills	football drills	Recovery
	1 minute	**2 minutes**	**1 minute**	**30 seconds**	**30 seconds**	**2 minutes recovery**

Repeat the 5 minutes work and recoveries based on how the calf tolerates the load that day.

Reduce workload as required to keep HR in zone 2 without burning out the legs.

Day 10

Non-training day

Day 11

Match day

Summary

- Manual therapy and other treatment modalities to restore lost mobility as per assessment findings
- Corrective exercises to restore ***control*** of mobility, below bodyweight, at bodyweight, above bodyweight.
- Progressive loading of calf within whole-body movement patterns
- Maintenance of aerobic conditioning
- Progression of load and anaerobic conditioning
- Use outcome measures of competency and capacity.