

Rehabilitation of Ankle Injuries in Elite Sport



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Rehabilitation Objectives

Restoration of:

Joint alignment, stability, mobility & function

Fascial integrity

Sensorimotor functional integration

MT strength/power/work capacity

Sports specific function & capabilities

Objective Markers

Triceps Surae

Single leg calf raises

- i) Straight leg
- ii) Bent leg

Hip Extension Strength

Hand held dynamometer

Objective Markers

Hip Adductor Strength

Add Longus: Aids hip flexion; stabiliser in w/b single leg stance & decelerates hip into extension

Add Brevis: assists hip abductors to stabilise pelvis during stance phase

Objective Markers

Hip Abductor Strength

Assess strength with hand held dynamometer in short & long lever positions

Establish the ratio between abd/add strength

Objective Markers

Lower Abdominal Strength

Double leg lowers

Oblique Strength

Side plank holds to fatigue

Objective Markers

Triple Hop Test

Measuring distance as an indicator of strength & power

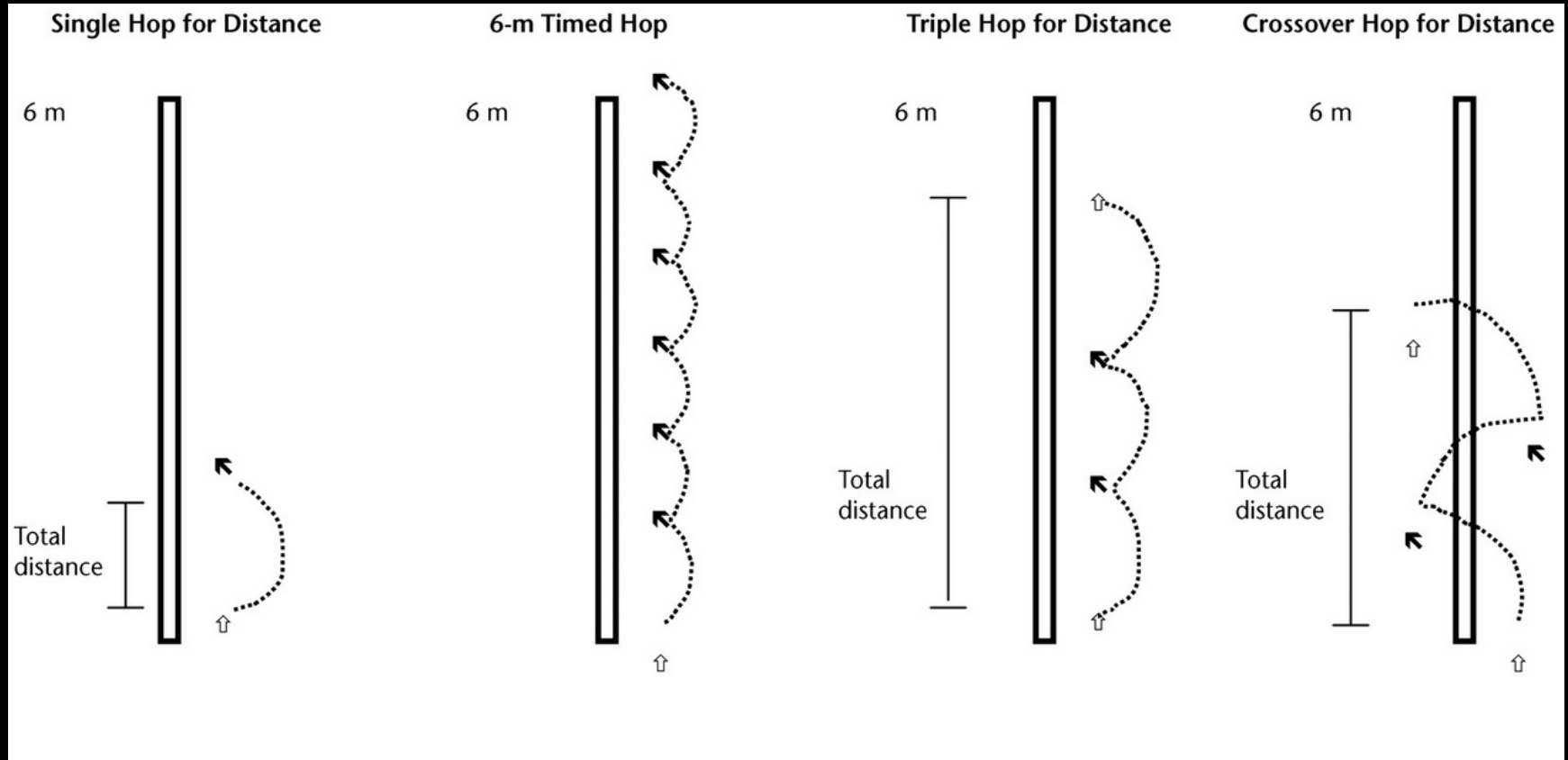
Hamilton et al (2008); Reid et al (2007)

6m Timed Hop

Measuring time as an indicator of strength & power

Hamilton et al (2008); Reid et al (2007)

Objective Markers



Objective Markers

One Legged Hop for Distance

Measuring distance as an indicator of strength & power

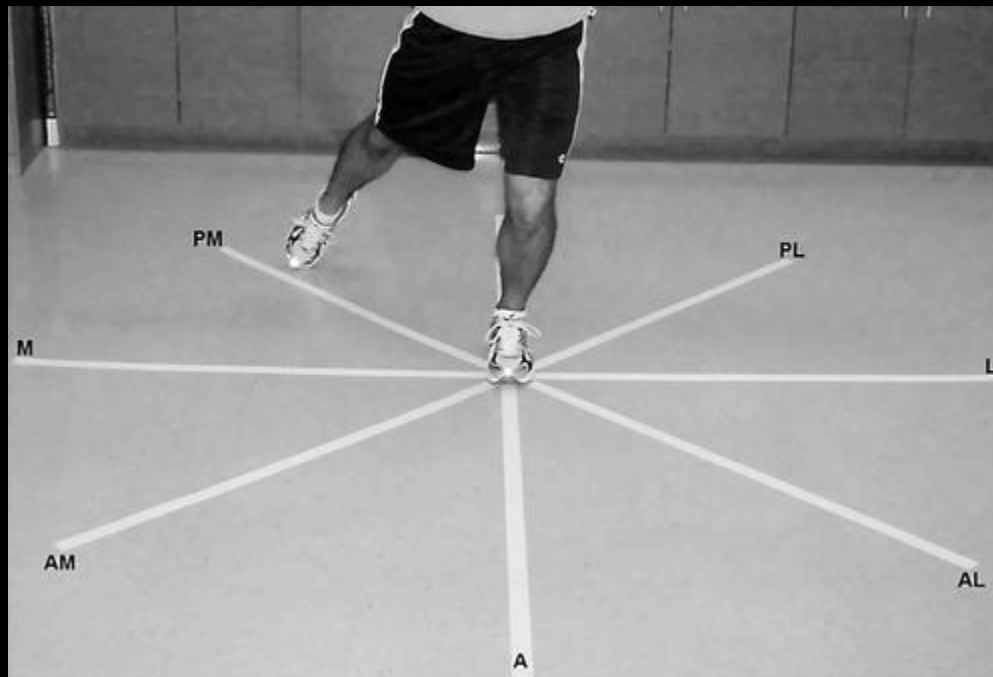
Hamilton et al (2008); Reid et al (2007)

Star Excursion Balance Test

Measuring distance of excursion as an indicator of balance & functional stability

Olmsted et al (2002); Kinzey & Armstrong (1998); Sabin (2011)

Star Excursion Test



Olmsted et al (2002); Kinzey & Armstrong (1998); Sabin (2011)

Objective Markers



Neuromuscular Function & Motor Control

Neural/myofascial mobilisation & muscle protein synthesis – acupuncture, Thai massage

Burd et al (2010)

Re-education of joint position sense

(mechanoreceptor afferent response to end range ligament tension – efferent response to slow or reverse direction of joint movement – PNF)

Silvers & Mandelbaum (2007)

Proximal–Distal proprio challenges & drills

Zazulak et al (2007)

Re-education of normal movement

Fascial Integrity

Role in proprioception, functional chain stabilisation/movement, force transfer, arthrogenic function & tissue nutrition

Stecco et al (2009)

MFR thru full body chains:

- passive with associated movement
- active with specific exercise patterns

Myers (2009)

Fascial Integrity

Scar tissue mobilisation/manipulation

Tissue loading (mechanical strain – cell proliferation, orientation, matrix synthesis & maturation)

Khan (2009); Drew et al (2012)

Myofascial release (pain mediated by neurofibres at a superficial level)

Stecco & Day (2010); Langevin (2008)

Fascial Integrity



Thai Massage



IASTM

Fascial Integrity

Spiral Line – below ASIS

TFL

Anterior ITB

Tibial Condyle

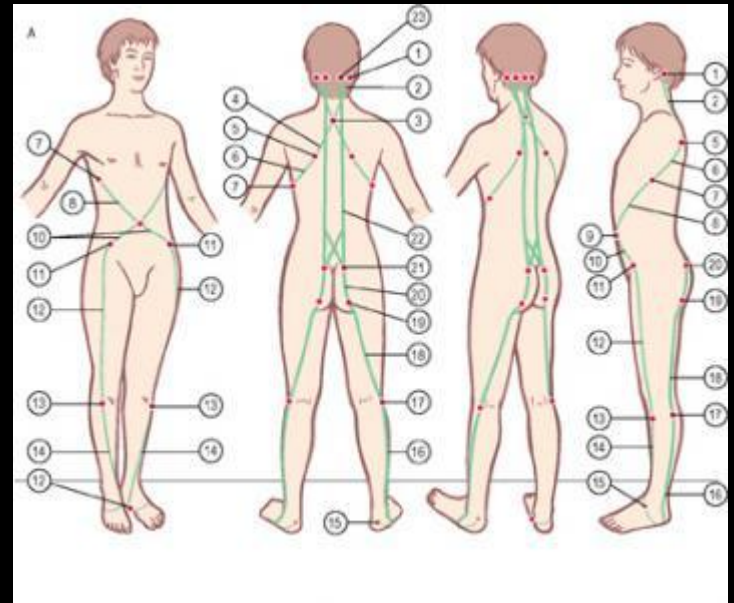
Tib Ant

Medial Arch

Tib Ant/Peroneus L

Peroneus L

Biceps Fem



Myers (2009)

Joint Alignment & ROM

Joint manips, mobs & stabilisation

Identify where the joint is with altered afferent input using the manual muscle testing technique – then treat

Sandstrom (2012)

Passive, AA, active & resisted ROM exercises

If All Else Fails

If the more conventional approaches to overcoming neural inhibition fail, consider the unconventional

TMJ alignment

Piercings

Proximal-Distal Proprioceptive Challenges

Condition the proximal segment immediately

Planks

Side Planks

Bridges

Etc. etc. etc. etc. 5 minute circuits

Proximal-Distal Proprioceptive Challenges



Motor Control

Physiological Goal	Correct inhibited muscle or dysfunctional movement pattern
Intensity	Low <30% RM or MVC – Low to moderate load to perform well
Volume (Rest)	<ul style="list-style-type: none"> ➤ 3 – 5 sets x 20 reps (< 60 seconds) ➤ 3 – 5 sets x 30 – 60 seconds if isometrics
Frequency	3 – 7 x per week (2 x daily if practical)
Fatigue	Not necessary BUT should get an active muscle sensation
Gains	Improvement in movement only
Neural Adaptation	<ul style="list-style-type: none"> ➤ Acute potentiation of Type I ➤ Coordination of joint increases ➤ Reflexive low force change ➤ Reversal of pain inhibition ➤ Atrophy (if enough volume)
Muscle Adaptation	<ul style="list-style-type: none"> ➤ Low force level control ➤ Slow twitch stiffness ➤ Slow twitch hypertrophy if high volume ➤ Increased length if through full AROM
Typical Exercise	<ul style="list-style-type: none"> ➤ Pilates ➤ Drills ➤ Movement pattern exercises

Motor Control - Stabilisation Example

Green Theraband Daily (Motor Control)

Circuit 1 - 20 reps slow & controlled

Alternated with

Circuit 2 - 20 reps fast

C 1 - C 2 - C 1 - C 2 - C 1 (2 min recovery)

Motor Control - Stabilisation

Example

Set A - theraband around foot

- 1) Diagonal down & out to up & in, with theraband applying resistance away from body
- 2) Diagonal down & out to up & in, with theraband applying resistance towards body
- 3) Diagonal down & in to up & out, with theraband applying resistance away from body
- 4) Diagonal down & in to up & out, with theraband applying resistance towards body
- 5) Straight up & down, with theraband applying resistance away from body
- 6) Straight up & down, with theraband applying resistance towards body

Set B - theraband around big toe

- 1) Straight up & down, with theraband applying resistance away from body
- 2) Straight up & down, with theraband applying resistance towards body

Set C - theraband around other toes

- 1) Straight up & down, with theraband applying resistance away from body
- 2) Straight up & down, with theraband applying resistance towards body

Set D - track based footwork drills

A Skips – B Skips – Lateral Side Shuffle A – Lateral Side Shuffle B – Lateral Side Shuffle C – Backward Walks –
Straight Knee Scissors – Bent Knee Scissors – Over Ankle Dribbles – Over Calf Dribbles – Over Knee Dribbles

Track-Based Footwork Drills



Track-Based Footwork Drills



Strength, Power & Endurance

Address neural/arthrogenic muscle inhibition & resultant muscle atrophy

Assess where the functional chain is breaking down – address first in isolation, then progress to multi-joint, functional movements recruiting through kinetic chain

Compex

Muscle Atrophy - hypertrophy & DOMS

Capillarisation - warm up

Potentialisation - power/plyometric task warm up

Recovery Plus - incorporates endorphinic decontracture & capillarisation components

Complex



Maximal Strength

Physiological Goal	Performance enhancement – general physical capacity
Intensity	>80% RM or MVC – explosive intention – trying to accelerate the load applied
Volume (Rest)	<ul style="list-style-type: none"> ➤ 3 – 6 sets x 5 reps ➤ 3 – 5 sets x 5 reps x 5 second holds if isometric (2 – 3 minutes rest)
Frequency	1 – 3 x per week
Fatigue	
Gains	Strength
Neural Adaptation	<ul style="list-style-type: none"> ➤ Increased muscle unit activation ➤ Reduced spinal inhibition mechanisms
Muscle Adaptation	<ul style="list-style-type: none"> ➤ Fast twitch hypertrophy IIx – IIa in a few weeks ➤ Reversal of detraining ➤ Tendon hypertrophy of 5% at each end ➤ Increase in passive stiffness & stress strain capabilities
Typical Exercise	<ul style="list-style-type: none"> ➤ Barbell squat > body weight on bar ➤ Step up 0.5 x body weight ➤ Leg press > 2 x body weight DL & 1 – 1.5 x SL

Maximal Strength - Triceps Surae

Example

Exercise	Reps & sets	%age 1RM
Stiff legged walks with overhead weight	10 x 3-5	N/A
Straight leg, leg press calf raises	5 x 3-5	60-70-80-80-80
Med Ball Squeeze Bridges	10 x 3-5	N/A
Seated calf raises	8 x 3-5	60-70-80-80-80
Heel raise back squats	5 x 3-5	60-70-80-80-80
4 Way Standing Theraband Hip Work	10 x 3-5	N/A
Barbell loaded heel lowers off step	5 x 3-5	60-70-80-80-80
High Pulls	5 x 3-5	60-70-80-80-80
Side lying adductor cycles	10 x 3-5	N/A
Bent leg, leg press heel lowers	5 x 3-5	60-70-80-80-80
Step up & drive on box	5 x 3-5	60-70-80-80-80

The Load Factor

Without load, tendons lose function, with degradation occurring in the matrix & cells

Overload leads to tendinopathy

Therefore the aspects of load are critical

The Load Factor

If the tendon is healthy & the load is appropriate, the tendon will be strengthened

If there has been significant unloading, followed by an episode of heavy loading, then the response will be significant (no stimulus for protein production/structure)

The Load Factor



The Load Factor

Get strong

Static slow tendon loads early

Progress speed of loading

Progress volume of functional activities

Introduce elastic load

The Load Factor

Any activity requiring a tendon to store & release energy (stretch-shorten cycle) can be considered a high tensile load for a tendon

Anything else (high weight, eccentric activity) is easy

Long thin springs are vulnerable to overload in the middle – Achilles

Short thick springs are vulnerable to overload at the insertions – Patella

Power

Physiological Goal	Performance enhancement – conversion of specific strength
Intensity	Maximal power or acceleration for target load or movement
Volume (Rest)	<ul style="list-style-type: none"> ➤ 3 – 6 sets x 2 – 3 reps for weights ➤ 3 – 6 sets x 5 – 10 reps for jumps or throws
Frequency	
Fatigue	No fatigue
Gains	Power
Neural Adaptation	<ul style="list-style-type: none"> ➤ Increased muscle unit activation & intermuscular coordination ➤ Reduced inhibition on ground contact
Muscle Adaptation	<ul style="list-style-type: none"> ➤ Fast twitch hypertrophy ➤ Some tendon hypertrophy & increased passive stiffness if high volume ➤ Power work may maintain tendon adaptation
Typical Exercise	<ul style="list-style-type: none"> ➤ Multi-joint explosive lifts ➤ Jumps ➤ Plyometrics ➤ Throws

Power



Power - Posterior Chain Example

Exercise	Reps & sets	%age 1RM
Plank	60 secs x 3-5	N/A
High Pulls	3 x 3-5	70-80-90-100-100
Small box step offs to jumps	15 x 3-5	N/A
4 Way Standing Theraband Hip Work	10 x 3-5	N/A
Hang Cleans	3 x 3-5	70-80-90-100-100
Box Jumps	3 x 3-5	N/A
Backward Theraband Crucifix Walks	60 secs x 3-5	N/A
Split Jerk	3 x 3-5	70-80-90-100-100
Med Ball Throws (High)	3 x 3-5	N/A
Barbell Roll-Outs	10 x 3-5	N/A
Snatch	3 x 3-5	70-80-90-100-100
Med Ball Throws (Long)	3 x 3-5	N/A

Plyometrics - Load Management

Load needs to be increased gradually & heavy tendon loading days every 3 days initially

Plyometrics

Plyometric progressions are quality triggered, not time dependant. Exercises should be led with an active arm drive & landings should be quiet

Single exercises: recovery in between repetitions should be sufficient to enable an optimal quality of execution

Stage	Vertical Plyometric Exercise Double Leg	Sets/Reps	Horizontal Plyometric Exercise	Sets/Reps
1	Box Jumps – Singles	5 x 10		
2	Box Jumps – Continuous	5 x 10		
3	Place Jumps – Singles	5 x 10		
4	Place Jumps – Continuous	5 x 10		
5	Tuck Jumps – Singles	5 x 10		
6	Tuck Jumps – Continuous	5 x 10		
7	Split Lunge Jumps – Singles	5 x 10		
8	Split Lunge Jumps – Continuous	5 x 10		

Plyometrics

Single Leg Progressions

Stage	Vertical Plyometric Exercise Single Leg	Sets/Reps	Horizontal Plyometric Exercise	Sets/Reps
1	Forward Hop Box Jumps – Singles	5 x 10		
2	Forward Hop Box Jumps – Continuous	5 x 10		
3	Lateral Hop Box Jumps – Singles	2 x 10	Skips	2 x 30m
4	Lateral Hop Box Jumps – Continuous	2 x 10	Skips for Distance	4 x 30m
5	Backward Hop Box Jumps – Singles	2 x 10	Skips for Height	1 x 30m
6	Backward Hop Box Jumps – Continuous	2 x 10	Indian Skips	2 x 30m
7	Forward Small Hurdle Hops – Continuous	2 x 10	Bounds	3 x 30m
8	Backward Small Hurdle Hops – Continuous	5 x 10		

Work Capacity

Physiological Goal	<ul style="list-style-type: none"> ➤ Strength endurance ➤ Hypertrophy ➤ General strength – promotes muscle balance
Intensity	60 – 80% RM of MVC
Volume (Rest)	<ul style="list-style-type: none"> ➤ 3 – 5 sets x 5 – 12 reps for weights ➤ 3 – 5 sets x 30 – 60 seconds for isometrics (1 – 2 minutes rest)
Frequency	2 – 3 x per week
Fatigue	Necessary
Gains	<ul style="list-style-type: none"> ➤ Strength endurance ➤ Hypertrophy ➤ General strength – promotes muscle balance
Neural Adaptation	None
Muscle Adaptation	<ul style="list-style-type: none"> ➤ Whole muscle hypertrophy ➤ 5% increase in tendon hypertrophy at each end
Typical Exercise	<ul style="list-style-type: none"> ➤ Any exercise that you can load ➤ Stabilise adjacent joints ➤ Work muscle through length ➤ e.g. Nordic Curl

Work Capacity - Intrinsic Example

Exercise	Reps & sets	%age 1RM
Standing on tip toes	60 secs x 3-5	N/A
Standing on pointe	60 secs x 3-5	N/A
Toe towel curls	60 secs x 3-5	N/A
Arch raises with extended toes	60 secs x 3-5	N/A

Work Capacity Progressions



Work Capacity Progressions



Sport Specific Function & Capability

Work with coaches to ensure end stage rehab & RTT is a seamless transition

Ensure that coach & athlete are educated as to how to incorporate specific warm-up, maintenance & sufficient recovery components into training programme to ensure that risk of recurrence is reduced

Sport Specific Function & Capability



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Thank You!!!

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