Assessment & Rehabilitation of FAI in Elite Track & Field

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Subjective Assessment

- **History of:**
  - pain & swelling (esp. post-exercise, persistent)
  - giving way
  - recurrence (inversion - tibiotalar/subtalar instability)

- **Difficulty:**
  - walking on unstable surfaces
  - decelerating
  - going down slope/stairs
  - change of direction (potential medial instability)

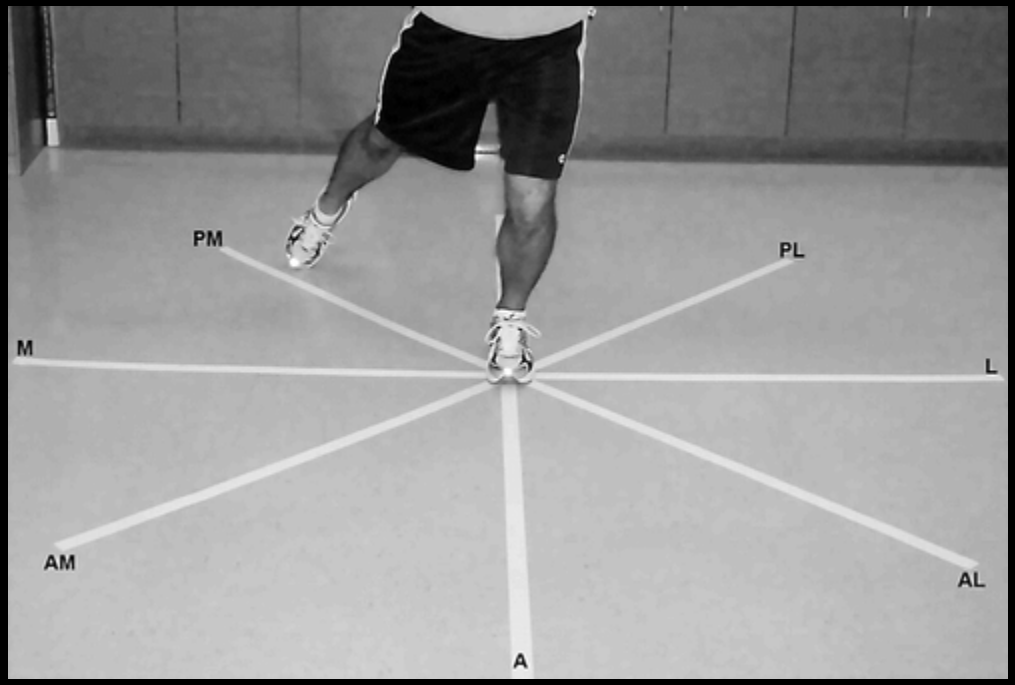
Pain on Deceleration

Objective Assessment:

Observations

- Postural alignment & muscle atrophy
- Joint effusion
- Hind foot position & first ray position
- Arch integrity (pes cavus or foot flat deformity resolving on double heel raise – medial instability)
- Fibular position/posterior malleolar space
- Talar position
- Fascial restrictions
- Proprioception (Romberg, sharpened Romberg, 1 leg stand, star excursion)
- Gait

Star Excursion Test



Objective Assessment: Tests

- Palpation (scar tissue/capsular thickening)
- Anterior drawer test (lateral instability)
- Stress inversion test (lateral instability)
- Stress eversion or ext rotation test (medial instability)
- Talar tilt test
- Syndesmosis test
- Tendon function & strength (peroneal tendon pathology [subluxation], tears/ruptures may lead to lateral instability, tib post tendon pathology may lead to medial instability)
- Muscle testing (arthrogenic inhibition) of intrinsics, tib ant, tib post, peroneii, soleus, gastrocnemius
- Joint ROM

Peroneii

- Arthrogenic inhibition of the peroneii & reduced activation is common following lateral ankle sprain
- ? a direct effect on FAI
- Deficits in eccentric invertor strength likely to contribute because of a reduced ability to assist in control of lateral displacement of shank over the weight-bearing foot

Triceps Surae

- Reduced eccentric plantar-flexor torque demonstrated in cohort of patients with FAI

- Potentially occurs either:

  i) at time of injury (trauma occurring at gastroc/soleus complex as it crosses talo-crural jt)

  ii) post-injury due to reduced motor unit excitability & subsequent arthrogenic inhibition of soleus

Tibialis Posterior

- Can be a victim of arthrogenic inhibition
- Inhibition affects tarsal stabilisation & role in balance
- Can cause functional foot flat deformity (resolves on double heel lift)

Tibialis Anterior

- Important role in talar stabilisation

- Inhibition causes decreased dorsiflexion, which can result in external rotation of lower limb in swing phase (tib post/altered Achilles tendon loading)

Joint Alignment

- Posterior fibular position post sprain injury
- Anterior talar position in incidences of decreased tib anterior activation
- Cuboid plantiflexion
- 1st MTP hypomobility

Fascia

- Important proprioceptive role (Ruffini & Pacini corpsucles in fascia)

  (Stecco)
- Pain – limits movement – fascial fibrosis – altered proprio – pain

  (Langevin)
- Remote symptoms - adhesions alter distribution of force thru fascia, leading to hyperstimulation of mechano-receptors & symptoms remote to pathological tissue
- Force transmission (70% of muscle tension transmission is directed in series thru tendons)

  (Huijing)

Scar Tissue & Capsular Thickening

- Alters afferent fibre functioning within the joint – affects proprioception
- Affects joint ROM
- May lead to:

  - sinus tarsi syndrome

  - anterolateral impingement syndrome
- May contribute to FAI

Neuromuscular Deficits

- Impaired balance
- Reduced joint position sense
- Slower firing of peroneal muscles to inversion perturbation of the ankle
- Slowed nerve conduction velocity
- Impaired cutaneous sensation
- Strength deficits

Assessment Pit Falls

Comparison between uninjured & injured sides (strength, power & proprioception)

Cross-over effect will influence ipsilateral & contralateral joints respectively & influence joints far more proximal than the ankle

Limitations of Research

- Much of the research has been done considering walking gait as opposed to running gait

- Therefore can’t be directly applied to the athletic performance population with regards sport-specific task performance

Rehabilitation Objectives

- Restoration of:
  - joint alignment
  - fascial integrity
  - neuromuscular function & movement control
  - MT strength/power/work capacity
  - sports specific function & capabilities

Restore Joint Mobility, Stability & Functional Integration

Objective Markers

Triple Hop Test

Measuring distance as an indicator of strength & power

Star Excursion Balance Test

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

Joint Alignment & ROM

- Joint manipulation
- Joint mobilisation
- Joint stabilisation
- Myofascial release (pain mediated by neurofibres at a superficial level)
- Scar tissue mobilisation/manipulation
- Tissue loading (mechanical strain – cell proliferation, orientation, matrix synthesis & maturation)
- Passive, AA, active & resisted ROM exercises

Fascial Integrity

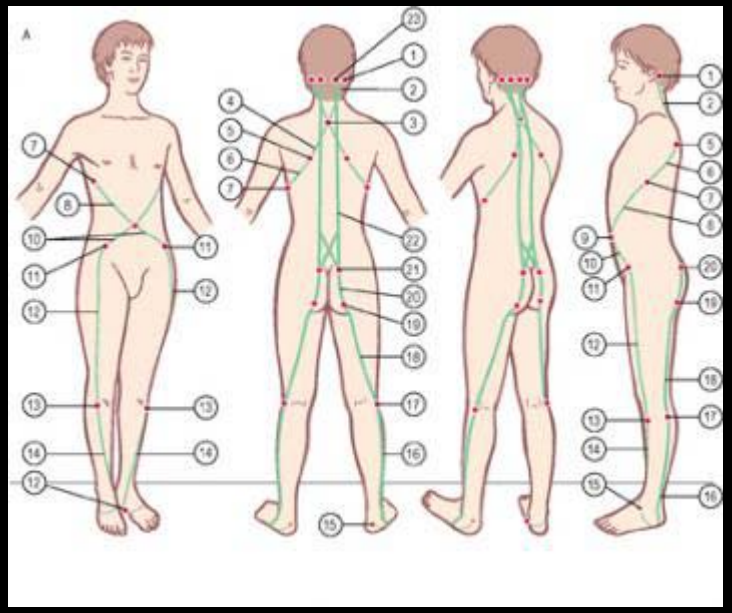
- Important role in proprioception, functional chain stabilisation & movement, force transfer, arthrogenic function & tissue nutrition

- MFR thru full body chains:
  - passive with associated movement
  - active with specific exercise patterns

Spiral Line

Below the ASIS:

- **TFL**
- **Anterior ITB**
- **Tibial Condyle**
- **Tib Ant**
- **Medial Arch**
- **Tib Ant/Peroneus L**
- **Peroneus L**
- **Biceps Fem**

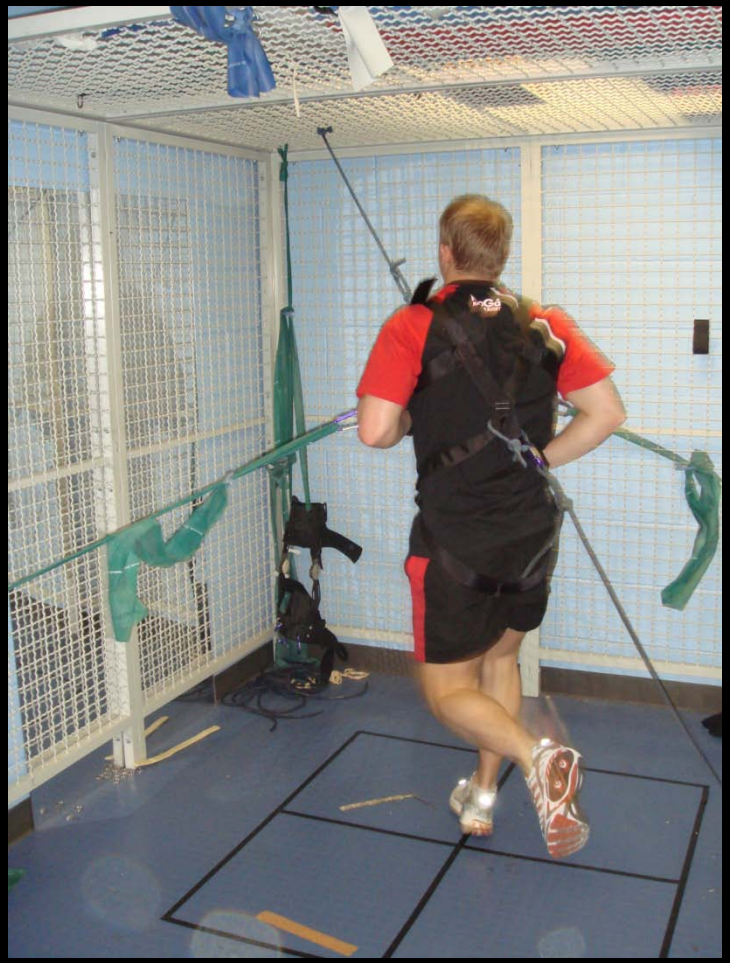


(Myers)

Neuromuscular Function & Motor Control

- Neural & myofascial mobilisation
- Re-education of normal movement
- 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
- Proximal–Distal proprioceptive challenges & athletics drills

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)	➢ 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	➢ Acute potentiation of Type I ➢ Coordination of joint increases ➢ Reflexive low force change ➢ Reversal of pain inhibition ➢ Atrophy (if enough volume)
Muscle Adaptation	➢ Low force level control ➢ Slow twitch stiffness ➢ Slow twitch hypertrophy if high volume ➢ Increased length if through full AROM
Typical Exercise	➢ Pilates ➢ Drills ➢ Movement pattern exercises

Motor Control - FAI 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 - FAI 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

Strength, Power & Endurance

- Address neural/arthrogenic muscle inhibition & resultant muscle atrophy

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

Compex

- Muscle Atrophy programme to gain hypertrophy & achieve DOMS
- Capillarisation programme as warm up
- Potentiation programme as warm up for power or plyometric exercises
- Recovery Plus programme to incorporate the decontracture, endorphinic & capillarisation components after hard sessions

Compex

Maximal Strength

Physiological Goal	Performance enhancement – general physical capacity
Intensity	>80% RM or MVC – explosive intention – trying to accelerate the load applied
Volume (Rest)	➢ 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	➢ Increased muscle unit activation ➢ Reduced spinal inhibition mechanisms
Muscle Adaptation	➢ 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	➢ 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

Power

Physiological Goal	Performance enhancement – conversion of specific strength
Intensity	Maximal power or acceleration for target load or movement
Volume (Rest)	➢ 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	➢ Increased muscle unit activation & intermuscular coordination ➢ Reduced inhibition on ground contact
Muscle Adaptation	➢ Fast twitch hypertrophy ➢ Some tendon hypertrophy & increased passive stiffness if high volume ➢ Power work may maintain tendon adaptation
Typical Exercise	➢ 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

Work Capacity

Physiological Goal	➢ **Strength endurance** ➢ **Hypertrophy** ➢ **General strength – promotes muscle balance**
Intensity	60 – 80% RM of MVC
Volume (Rest)	➢ 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	➢ Strength endurance ➢ Hypertrophy ➢ General strength – promotes muscle balance
Neural Adaptation	None
Muscle Adaptation	➢ Whole muscle hypertrophy ➢ 5% increase in tendon hypertrophy at each end
Typical Exercise	➢ Any exercise that you can load ➢ Stabilise adjacent joints ➢ Work muscle through length ➢ e.g. Nordic Curl

Work Capacity - Intrinsics 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

Sport Specific Function & Capability

- Work with coaches to ensure that end stage rehabilitation & return to training is a seamless transition
- Ensure that the coach & athlete are educated as to how to incorporate specific warm-up, maintenance & sufficient recovery components into the training programme to ensure that risk of recurrence is reduced

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Thank You!!!

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