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Anterior cruciate ligament injuries Primary prevention strategies in practice: Australian Football

Australian Football (AF) Injury Prevention (IP)

FootyFirst^(Finch, Inj Prev 2016)

- \sqrt{knee} injuries 50%
- \checkmark lower limb injuries 22%

*Male community level



What's happening in the real world?

Australian ACL injuries are \uparrow

- 147% 10-14 year olds in last decade in Victoria^(Shaw, Int J Env Res Public Health 2017)
- AF highest incidence after skiing (Janssen, Scand J Med Sci Sports 2012)

Elite data:

- Male AFL average 0.7 (range 0.6-1.0) per club (23 week season)

- Female AFL average 1.0 per club (8 week season)



Figure 1. Created from freely available MBS Data ACLR in Australia 1994 – 2016. *Likely to underestimate

What's happening in the AF community level landscape?

- Participation is increasing
- Under implementation of IP programs and barriers (Donaldson Inj Prev 2017)
 - Coaches- knowledge, skills,
 beliefs
 - Volunteer nature of community level (coaches & sports medicine)



Figure 2. AFL Annual Report 2016 (freely available)

What can we do as health care professionals?



 Education to coaches, players and parents

• Assist with practical implementation

Provide feedback

1. Education: Use FootyFirst Resources

Why your team should use FootyFirst

Lower limb injuries—particularly hamstring and groin muscle strains/lears and knee and ankle ligament sprains/lears—are the most common types of injuries in Australian football. Not only do they occur most frequently, they are often the cause of players being unable to complete games, missing training and being unavailable for selection for matches. Treatment for these injuries can also be costly for players and the long term consequences, such as instability or osteoarthrist of the knee and ankle, can be very debilitating.

What the research evidence says:

Injury prevention

A review of seven high-quality studies of neuromuscular training programs like FootyFirst in sports with similar movement patterns and lower limb injury profiles to Australian football (basketball, volleyball, soccer, team handball, hockey and floorball) found a:

- 39% reduction in the risk of lower limb injuries
- 54% reduction in the risk of acute knee injuries and
- 50% reduction in the risk of ankle sprain injuries.¹

A trial of a neuromuscular training program (PAFIX) that underpinned many of the FootyFirst exercises found that community Australian football players who participated in the program:

- reduced the rate of knee injuries by 50%
- reduced the rate of lower limb injuries by 22%²

Research evidence indicates that participating in neuromuscular training programs like FootyFirst can protect against both acute and overuse or gradual onset injuries, and reduce the severity of the injuries that are sustained. These programs are more effective in preventing injuries with players with a history of sports injuries.

A trial of the Nordic hamstring exercise program — the same exercise that is included in FootyFirst — among professional and amateur soccer players, found a:

- 70% reduction in acute hamstring injuries (new injuries and re-injuries)
- 85% reduction in re-injuries alone.²

The relationship between reducing injuries and improving team performance A study in European domestic and champions' league football (soccer) showed that injuries had a significant influence on team performance with:

- Lower injury burden and higher match availability associated with higher end of season league ranking, and increased points per league match.
- Teams with both decreased injury rates and injury severity compared with the preceding season more likely to improve team performance.³

A study in Qatar first-division football (soccer) found that clubs with lower injury incidence showed a strong correlation with:

More games won

- A higher league position (and total league points)
- More goals scored (and a greater goal differential)⁴

How to implement FootyFirst at your club

Having access to the program is only the first step in getting the benefits from FootyFirst. The biggest challenge is getting players to do the exercise regularly and properly. Many football clubs and coaches have introduced FootyFirst but every club and coach is different and some have been more successful than others in implementing FootyFirst. Our experience shows that the keys to successful ymbenenting FootyFirst are:

- Get senior coach "buy-in" to the program. Unless the senior coach supports the program and cares whether or not it is done regularly and properly, it is unlikely to become a regular part of training. The senior coach does not need to actually deliver the program themselves, but they must support it and provide the time needed to do it (about 15–20 minutes like most other warmups).
- 2. Find someone with the interest, knowledge and skills needed to lead the program. This could be the senior coach if they are interested, a respected player with an interest in fitness, the fitness, strength and conditioning or high performance coach, a sports trainer or the club physio (if your club has these personnel). It is crucial that a respected person at your club who knows what they are doing (or is willing to learn) leads the program and is responsible for the program.
- Persist. It will take time to get any new program or change embedded in your club or team. Have a plan about what to do when:
- a. New players join the team or you have players at many different fitness levels.
- b. Players return to training after a break (e.g. over the Christmas and New Year period).
- . Transitioning from pre-season training to trial games and into the playing season.
- The person leading the program is away for an extended period.
- More time needs to be devoted to other things like game plan development and skill development.
- f. The weather is poor.
- 4. Establish FootyFirst as your 'standard' warm up. FootyFirst has been designed to replace existing warm-ups and become part of every training session. Set expectations that players will do the program consistently and properly make it mandatory and enforce it for all players. Ensure all coaches endorse this at all times.
- 5. Explain to the players, coaches and support staff why FootyFirst is being introduced. Promote FootyFirst because it:
- a. Has the potential to provide the team and club with a competitive advantage less injuries means more players available for selection which can lead to better team performance and ultimately more wins.
- b. Has the potential to also improve the football performance of individual players better core strength, better landing technique and better cutting and changing direction technique makes for better football players.
- c. Is better, more efficient and more effective than your current warm-up if you are not already doing FootyFirst if players are going to do something they might as well do something that has a specific purpose and you know will work.
- 6. Get senior player support. Make sure a couple of respected players (e.g. the club captain) are on board who will participate enthusiastically and get everyone else committed to FootyFirst.
- 7. Explain to the players what each FootyFirst exercise is designed to achieve. Players are more likely to do the FootyFirst exercises regularly and properly if they understand what the exercises are meant to be doing and how they will help them. Your coaching team is important here.
- Get the playing group to take ownership of the program. Even if the FootyFirst 'leader' is not there, players should still do the exercises anyway. This can be done by getting:



If coaches, clubs, players or support staff are interested in how FootyFirst could be implemented or adapted for their own communities contact Alex Donaldson directly at a.donaldson@federation.edu.au or phone 0409 082 892.

Why your team should use FootyFirst

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Give handout to coaches, parents, trainers

Why?

What's the evidence?

Provide a presentation (example slides of what I use on LASEM website)

Available on ACL section of LASEM website www. semrc.latrobe.edu.au

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- Get the playing group to take ownership of the program. Even if the FootyFirst 'leader' is not there, players should still do the exercises anyway. This can be done by getting:

For sports medicine professionals:

Get coach buy in (education) Find someone to lead the program Get playing group to take ownership

Available on ACL section of LASEM website www. semrc.latrobe.edu.au

WHY IS ACL INJURY PREVENTION IMPORTANT?

ACL Injuries are on the rise

- \uparrow 147% 10-14 year olds in last decade^(Shaw 2017)
- AF highest incidence after skiing (Janssen, Scand J Med Sci Sports 2012)
- AF participation is increasing

Why does it matter?



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Australian Football (AF) Injury Prevention (IP)

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*Male community level



WHAT ARE THEY?



WHAT ARE THEY?



SELLING POINT #1: DO THEY WORK?



↓ 30-70% all injuries^(Barengo 2014 – Systematic Review)



✓ 50% knee injuries ↓ 22% lower limb injuries*(Finch et al., 2016)



↓74-88% ACL injuries^(Mandelbaum et al., 2005)

SELLING POINT #2: WHAT ELSE DO THEY DO?

↑Performance

- I.e. Vertical jump, speed (Myer 2005)
- Availability of players^(Hagglund 2013)



HOW DO THEY WORK?

Programs tend to address all *modifiable* risk factors

(Alentorn et al., 2009a)

Don't know

menty of task with some crossover

Blanket referral of all aspects I.e. Strength training improves strength^(Lephart 2005, Hewett 1999)

> I.e. Plyometrics improved hamstring strength • (Lephart 2005, Hewett 1999)

What does this mean? Screening?

HOW DO THEY WORK?

↑ Performance (motor and neuromuscular) ^{(Alentron-Geli} 2009b)

Improved movement patterns

I.e. Decreased hip internal rotation & adduction, increased hip knee flexion on landing (Pollard 2006, Lephart 2005, Paterno 2004, Myer 2005)

Increased function

I.e. Star excursion and jumping performance^(Steffen 2013, Myer 2005)

- Increased muscle strength^(Lephart 2005, Hewett 1999)
- Improved muscle activation patterns

I.e. increased preparatory hip abductor and adductor activation landing^(Chimera 2004, Lephart 2005)

• Decreased impact forces(Hewett 1999)

What can we do as health care professionals?



 Education to coaches, players and parents

• Assist with practical implementation

Provide feedback

Consider AF & ACL injury mechanisms (Cochrane 2007)



Landing on extended knee

56% non-contact Sidestepping, deceleration Change of direction





NON CONTACT

Change of direction and deceleration in response to opponent

Foot outside base of support

Body (trunk, and lower limb pointing away from intended direction of travel)

2NDWESTERN BULLDOGS1000:27COLLINGWOOD7





NON CONTACT

Deceleration

Trunk twisted away from direction of travel to reach for ball

Change of direction

Knee Valgus



CONTACT

Knee Extended

Lateral contact

Knee Valgus

PRACTICAL IMPLEMENTATION: WARM UP



Activity over the 20 m course 1. Jog 2. Side-to-side run 3. Carioca/Grapevine with high knees

Group warm-up exercises



4. Backward running with high feet

(2 reps)



5. Butt kicks 6. Hands to ground



Coaches, injured players with ball/skill at end cones

Dynamic stretches

Exercise

Leg swings

A: Forward (6 reps each leg)





B: Across body (6 reps each leg)



Walking lunge 8 lunges in total



Teaching Cues

A:

- → a) Swing one leg back behind the body and then forward (like a kicking action but with the leg as straight as possible the whole time).
- Swing the leg with control and reach a height so that a stretch is felt in the hamstrings (back of the thigh) without pain.

B:

- Swing the leg to the side and then across the front of the body.
- Swing the leg with control and reach a height so that a stretch is felt in the groin (inside of the thigh) without pain.

- → While taking large walking steps, allow the body to drop until the back knee is just off the ground. Keep the trunk vertical and the heel of the front foot on the ground during the lunge. Control the lunge. The knee should finish over the toes (see photo).
- ➔ Lunge forward with alternating legs until the 8 reps are completed.

Dynamic stretches

Exercise	Teaching Cues
Calf stretch (Straight leg) 5 reps each leg Salti Salti Salt	 → Slowly straighten one leg until the heel touches the ground. As soon as the stretched position is reached, bend the knee to release the stretch and at the same time straighten the other leg. → If the player cannot get his heels to touch the ground, lower the heels as far as possible without pain. → This exercise can also be done leaning against a fence or partner for support.
Calf stretch (Bent knee) 5 reps each leg	 → The same as the stretch above but when the heel is pushed down, always keep the knee in a bent position. → This exercise can also be done leaning against a fence or partner for support.
Hip rotation 4 reps each leg	 → While standing, lift the right leg up with knee bent in front of the body (photo A). Then slowly move the leg outward making a big circle with the knee (photo B). Repeat to a total of 4 repetitions. → Repeat with the left leg.

STRENGTH AND MOVEMENT TRAINING COMPONENT

Community level Complete before training No increase in injury risk



Elite level

- Shouldn't replace gym program
- Movement quality training components completed as part of warm up
- More advanced movements/strength

STRENGTH AND MOVEMENT TRAINING COMPONENT

FootyFirst designed FOR MALE COMMUNITY LEVEL

Female specific adjustments:

- Differences in baseline strength
- ↑ non-contact injuries (Beynonn Am J Sports Med 2014)
- "Biomechanical" differences (Hewett Am J Sports Med 2005)





Do FootyFirst Warm Up exercises first





To get back to the start position, bush up with the hands rather than using the hamstrings



- → Lie on the back with the knees bent at 90⁴
 → Place a ball between the knees and squeeze as if trying to squash the ball
 → Tempor -2-2-2 (2 scond contraction, 2 second nois, 2 second release)
 → Do 3 repetitions with 3 second rest between repetitions
- Repeat with the legs straight and the bail between the knees





- Lie on the side with one leg on top of the other; distribute the body weight evenly over the forearm
 Raise the hips and the top arm simultaneous
- to achieve a straight body
- Exercise Tempo 2-2-2 (2 seconds to raise,



- Perform 12 handbails, alternating hands (6 right hand, 6 left hand)
- -> Repeat while balancing on the other leg



- Two players stand about 1 m apart both balancing on one leg with one hand on each other's shoulder; both perform shallow (>90°) single leg squats
- Move about 3 m apart, balance on one leg and
- perform single leg squat
 Balance on one leg, facing each other, and do a single
- leg squat after receiving a handball from their partner
- + 6 handballs, alternating hands (3 right and 3 left)
- → Repeat on the other leg



? Nordic assisted with theraband or hamstring bridge/slide if female unable

STRENGTH



"MOVEMENT"









WEEKS 5-8



FOOTY

Do FootyFirst Warm Up exercises first







push up with the hands rather than using the hamstrings

Side lying leg lift

Side plank lift and lower hips

lump and land on

leg

one



point, then lower it slowly to the ground

- Lie on the side with one leg on top of the other; distribute the body weight evenly over the forearm
- Slowly lift the hips to achieve a straight body - Slowly lower the hips to the ground
- → Exercise Tempo 2-2 (2 seconds to lift and 2 seconds
- to lower] -> 5 repetitions
- Repeat on the other side
- 2 sets on each side, with a 5 second rest between sets







-> Stand on the right foot, jump forward and land on the left foot

- Start with a small jump and slowly increase jumping distance while maintaining control and landing technique
- -> Emphasise 'sticking' the landing with balance and control
- -+ After a brief pause, stand on the left foot, jump forward and land on the right foot
- -> Do 20 jumps (10 from each leg). alternating takeoff and landing legs









WEEKS 5-8

Progression may vary depending on individual variety of baseline abilities of group





2

Side plank side-to-side

99

Single

Run forward,

ump



Hamstring lower - see Level 1 for details

- Stand on one leg with one arm raised above the head (photo A)
- -> Keep the heel on the ground; do not let the other foot
- -> Squat, while keeping the heel on the ground
- -> Lower the raised arm so both arms are down (photo B)
- -> Rise from the squat and raise the other arm over head (photo C)
- -> Exercise Tempo 2-2 (2 seconds down 2 seconds up)
- -> Continue squatting on the same leg while alternating
- arms for 15 repetitions
- -> Repeat on the other leg
- -+ Complete 2 sets of 15 repetitions on each leg; rest for 10 seconds between each set
- -> To increase the challenge, when ready, perform the movements faster, while still concentrating on balance
- Start in a front plank position with the weight resting evenly on the forearms (photo A); hold for 1 second
- Roll to the side position (photo B); hold for 1 second - Roll again back to the front
- (photo C); hold for 1 second - Roll to the other side
- (photo D); hold for 1 second -> One repetition is completed when each of these four
- positions has been held for 1 second
- -> Stand on the right foot, jump forward and land on the left foot
- -> Raise arms as if taking a mark 8
- -> Start with a small jump and slowly increase jumping distance
- -> Jump back and land on the right foot
- Again raise arms as if taking a mark
- Using a 3-step run-up, jump off one leg directly ahead, as if mimicking marking and land a ball, and land on the other leg → 20 jumps (10 each leg) alternating legs
 - -> To increase the challenge, have a partner handball slightly to either side
 - - 10 jumps each leg



WEEKS 9-12



WEEKS 9-12

2 mm x 15 on each le



- -> Perform continuously with no pause
- -> Complete 20 jumps (10 forward, 10 backward)
- Repeat, starting on the left foot, jumping forward and landing on the right foot





WEEKS 13-16

- 똨 with leg 90⁴ angles

Hamstring lower - see Level 1 for details

- -> Squeeze knees as if trying to squash the ball
- 2 second hold, 2 second release)
- -> Do 3 repetitions; rest for 3 seconds between repetitions
- -> Increased challenge: Do the same exercise with the legs straight. Place the ball between the knees and the feet about % m off the ground. Use the abdominal muscles to prevent the lower back arching excessively.





Squeeze



- -> Lie on the side with one leg on top of the other; distribute the body weight evenly over the forearm
- -+ Lift the hips to achieve a straight body and raise the arm at the same time
- -> Raise the top leg about % m and hold for 5 seconds - Lower the top leg, hips and arm
- -> Complete 3 repetitions; rest for 3 seconds between repetitions -> Repeat on the other side
- Using a 3-step run-up, jump off the right leg to the left side (about 43° to line of the run-up) and land on the left
- -> Start with a small jump and slowly increase jumping distance while maintaining control and good landing technique

jump to the -> Perform 10 jumps

- -> Repeat off the left leg to the right side, and land on the right leg
- 6
- Increase the challenge: Lengthen the run-up and jump further (continue to emphasise control and correct landing technique)
- -> Have a partner handball a ball so that the player has to mark the ball in the air (see diagram in manual page 31)
- -> Have a partner handball the ball slightly to either side

-> A group of players line up facing a stationary person about 10 m away The first player in the line runs toward the stationary person and when about 2 m away,

5

Run.

- performs a side-step or 'cut' to the left and continues running between the cones about 3 m away (2 cones about 1 m apart). The new running direction should be about 43° from the original forward run. (See diagram in manual page 33) -> Each player performs 20 side-steps in total,
- alternating between cutting to the left and the right



reps each side







WEEKS 17+

-Lie on side

- Lift top leg up to partner (about ½ m),
- + Lift bottom leg sightly off the ground 2 seconds)
- Body -> Raise hips about 10 cm off the ground
 - using the muscles on the inside of the top leg to push down against partner's hands (2 seconds) D 3 repetitions on one leg with a 1 second rest between reps,

 - -> Lower hips and bottom leg (2 seconds)







Side plank side-to-side with leg lift

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Unantic

- Lie on side

5 seconds



-Raise the hips to a side plank

-+ Lift the top leg; hold for



-> Lower the top leg, roll to a front plank position supported by both forearms; hold for 5 seconds -> Roll to the other side

-+ Raise the top leg; hold for 3 seconds One repetition is completed. when each of these 3 positions has been held for 5 seconds

- -> Using a 3-3 step run-up, jump off one leg and land on the other leg -> Run straight ahead for about 5 m after landing 2 Start with a small jump and slowly increase jumping distance while maintaining control and good landing technique 2
- 2 -> Each player should follow after the previous player has completed a jump to cover avoid spending time standing still
- -> After all players have completed two jumps, the coach hand passes
- a ball so the player has to mark it out in front of his body while in the air
- -> Each player performs 16 jumps in total alternating takeoff and landing legs (8 jumps landing on the right and 8 landing on the left)
- -> See diagram on page 40 of manual for increased challenge
- -> Two players stand facing about 10 m apart and run towards each other; after 1-3 steps, the 'attacker'
- (carrying a ball) side-steps to left or right (as if trying to evade an opponent)
- directi -> The 'defender' reacts by side-stepping to the same side (as if pursuing the attacker)
- The 'attacker' continues to run about 2-3 m in the new B direction before gradually stopping
- -> Focus on the change of 'defender's' direction movement
- Gub -> The 'attacker' should perform 8 changes of direction to
- both the left and right in a random order 6
- -> Change roles so that both players perform 16 side-steps as the 'defender







Movement, stability, balance and plyometric training should be a priority

Based on injury mechanisms



Reductions in voluntary activation times and times to peak torque, which may decrease muscle response times so players are more able to perform rapid and unexpected sports maneuvers (Lloyd, J Orthop Sports Phys Ther 2001) Technique and transferability is important and difficult Use FootyFirst resources <u>https://footyfirstaustralia.wordpress.com</u> Use of partner smartphone video in education session



Run, jump and land with ball

Advanced additions: with perturbation

Technique and transferability is important

Use FootyFirst resources https://footyfirstaustralia.wordpress.com



Level 4 Anticipated change of direction

> Level 5 Unanticipated

Resources- for coaches, players and sports medicine



FootyFirst (https://footyfirstaustralia.wordpress.com)



"Mick Hughes .Physio" YouTube^{AU} channel

- PATIENT HANDOUT -

MOVEMENT RETRAINING: Cutting

Changing direction (or "cutting") in a non-contact situation is a common component of most sports and required for successful performance, however this movement is also associated with ACL injuries. The following components have been identified as key elements to address, to reduce the specific elements of joint movement that have been associated with increased ACL strain and injury risk



What can we do as health care professionals?



 Education to coaches, players and parents

• Assist with practical implementation

• Provide feedback

3. Providing feedback

- Injury prevalence
- Adherence
- Functional performance measures
 - Increased function

I.e. Star excursion and jumping performance^(Steffen 2013, Myer 2005)



Mick Hughes .Physio YouTube^{AU} channel

TAKE HOME MESSAGES

- 1. AF Injury prevention programs do work at community level (research male only)
- 2. Address identified barriers and framework for quality implementation



References

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Get in contact if you want the slides or copies of resources

Perfor	mance objectives (DOs)	Inter								
Perfo	mance chiestines (DOs)	Internal (personal) determinants							rnal determinants	
	Performance objectives (POs)		Knowledge		Skills		Beliefs		Environment	
PO 6	Coaches incorporate FootyFirst into regular warm-up for all training sessions	K7 K8	Know what to do when implementing FootyFirst regularly and properly Know how to implement FootyFirst regularly and properly	S4	Have skills to implement FootyFirst regularly and properly	B11 B12	Believe that players need to do FootyFirst regularly and properly to receive benefits Believe that incorporating FootyFirst into warm-up will lead to players performing	E9 E10	Receive external praise and encouragement for incorporating FootyFirst into regular warm-up Receive external support to incorporate FootyFirst into regular warm-up	
					B13	FootyFirst regularly Believe that other coaches will incorporate FootyFirst into warm-up	E11	Receive external feedback that players participating in FootyFirst regularly and properly is leading to relevan benefits		
						B14	Believe players will support FootyFirst being incorporated into regular warm-up	d		
PO 7	Coaches ensure players do FootyFirst with fidelity (ie, appropriate volume, technique and intensity)	K9	Know what is required to do FootyFirst with fidelity	S 5	Have skills to assess player performance of FootyFirst	B15	Believe that players need to do FootyFirst with fidelity to receive injury prevention and performance benefits	E12	Receive praise and encouragement from club, league for players doing FootyFirst with fidelity	
				S6	Have skills to correct poor performance of FootyFirst by players	B16	Believe that correcting poor performance of FootyFirst by players will lead to players performing FootyFirst with fidelity	E13	Receive support from club, league, etc, for players to do FootyFirst with fidelity	
PO 8	Coaches progress players through FootyFirst levels as appropriate	aches progressK10Know when toS7Have skills to assesayers throughprogress players toplayer readiness tootyFirst levels asnext FootyFirst levelprogress to next levelpropriateof FootyFirst	Have skills to assess player readiness to progress to next level of FootyFirst	B17	Believe that player progression through levels of FootyFirst is required to maximise injury prevention and performance benefits	E14	Receive praise and encouragement from club, league for progressing players through FootyFirst levels			
		K11	Know how to progress players to next FootyFirst level	58	Have skills to implement all levels of FootyFirst			E15	Receive feedback from players that they are happy to progress through FootyFirst levels	