

Injury Prevention Strategies for Schools

Dr Mike Marshall

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- Knowledge of injuries in school athletes
- General injury prevention programs
- Specific injury prevention programs
- The role of the coach

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Incidence of sports injuries at school

- 65% of all sports, recreation and exercise-related injury consultations at US emergency departments (4.3 million in 2000 and 2001) were sustained by individuals 19 years old or younger.

Centers for Disease Control and Prevention Morbidity and Mortality Weekly Report. Non-fatal sports- and recreation-related injuries treated in emergency departments, United States, July 2000–June 2001

- Sports, recreation and exercise-related injuries were the most common cause of paediatric injuries - 19–29% of all paediatric injuries.

Burt CW, Overpeck MD. Emergency visits for sports-related injuries. *Ann Emerg Med.* 2001;37:301–8

Simon TD, Publitz MS, Hambidge SJ. External causes of pediatric injury-related emergency department visits in the United States. *Acad Emerg. Med.* 2004;11:1042–8

Increasing injuries in youth sport

- Increased number of participants (esp. girls)
- Increased duration and intensity of training
- Year-round training
- Early specialization
- Increased difficulty of skills expected & practised
- Increased participation in “extreme sports” such as skate boarding, BMX, mountain biking, rock climbing, etc.



Risks for injury in younger athletes

- Sports code, level of sport participation, contact vs. non-contact sport, weekly training time, etc.
- Greater surface area : mass
- Proportionally bigger head
- Developing brain
- “Female” (wrt ACL injuries)
- Various psychosocial factors (incl. peer pressure, domineering coach, etc.)



Risks for injury in younger athletes

- Open growth plates
- More porous bones
- More susceptible cartilage
- Imbalance between muscle strength and flexibility
- Immature coordination, skills and perception
- Less endurance
- Greater impulsiveness and recklessness



Negative effects of sports injuries

- Time away from sport
- Increased pressure to participate
- Time away from school
- Substantial medical costs
- Later sequelae:
 - Musculo-skeletal dysfunction
 - Inactive life-style

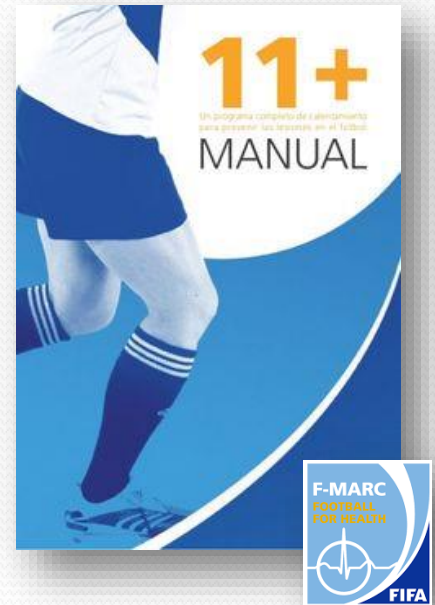


Injury prevention strategies for schools

- Knowledge of injuries in school athletes
- **General injury prevention programs**
- Specific injury prevention programs
- The role of the coach

FIFA 11+

- Comprehensive warm-up program (2006):
 - Comprises:
 - Running exercises (start & end)
 - Specific preventative exercises:
 - Core and leg strength, balance and agility
 - Three levels of increasing difficulty (variation & progression)
 - ≤ 20 min to complete
 - Minimal equipment (cones and balls)



The 11+

PART 1 RUNNING EXERCISES · 8 MINUTES



1 RUNNING STRAIGHT AHEAD
This exercise is played for 10 minutes at all times, approx. 1.4 m apart. Two players start at the same time from the first pair of cones. Jog together until they reach the last pair of cones. On the way back, you can increase your speed progressively as you warm up. 2 sets



4 RUNNING CIRCLING PARTNER
Run towards one partner in the first set of cones. Shuffle clockwise by 90 degrees to meet on the outside. Shuffle an arm's circle around one other and then return back to the cones. Repeat for each pair of cones. Remember to stay on your toes and keep your centre of gravity low by bending your hips and knees. 2 sets



2 RUNNING HIP OUT
Walk in two lines, staggered such that you are to the left and right of your partner's hip-shoulders. Alternate between left and right legs at successive cones. 2 sets



5 RUNNING SHOULDER CONTACT
Run towards one partner in the first set of cones. Shuffle clockwise by 90 degrees to meet in the middle then jump sideways towards each other to make shoulder-to-shoulder contact. Repeat for each pair of cones. Remember to stay on your toes and land on both feet with your hips and knees bent. Do not let your knees touch the ground. Make a full jump and synchronise your timing with your partner as you jump and land. 2 sets



3 RUNNING HIP IN
Walk in two lines, staggered such that you are to the left and right of your partner's hip-shoulders. Alternate between left and right legs at successive cones. 2 sets



6 RUNNING QUICK FORWARDS & BACKWARDS
As a pair, you can switch the second set of cones from one half to the other to do a first pair of cones keeping your hips and knees slightly bent. Keep repeating the drill, moving the cones forwards and then back twice. Remember to take small, quick steps. 2 sets

PART 2 STRENGTH · PLYOMETRICS · BALANCE · 10 MINUTES

LEVEL 1



7 THE BENCH STATIC
Starting position: Lie on your front, supporting yourself on your forearms and feet. Your elbows should be directly under your shoulders.
Exercise: Lift your right arm and pull your shoulder up to your ear, and hold the position for 20-30 sec. Your body should be in a straight line. Try not to sag or arch your back. 3 sets



8 SIDWAYS BENCH STATIC
Starting position: Lie on your side with the lines of your front-to-back hand to 90 degrees. Support your upper arm by resting your forearm on the floor and hold the position for 20-30 sec. Your body should be in a straight line. Hold the position for 20-30 sec. Take a short break, change sides and repeat. 3 sets on each side.



9 HAMSTRINGS BEGINNER
Starting position: Lie on a soft surface. Ask your partner to hold your ankles down firmly. Exercise: Your body should be completely straight from the shoulder to the toes. Lift your right leg and hold it straight up as far as you can, considering the movement with your hamstring and your gluteal muscle. When you can't longer hold the position, gently pull your weight on your hands. Carry this pull-up position. Complete a minimum of 3 · 5 repetitions and/or 60 sec. 1 set



10 SINGLE-LEG STANCE HOLD THE BALL
Starting position: Stand on one leg. Exercise: Balance on one leg whilst holding the ball with both hands. Keep your feet close to the ground. Hold for 30 sec. Change legs and repeat. The exercise can be made difficult by passing the ball across your waist and/or under your other knee. 2 sets



11 SQUATS WITH TOE RAISE
Starting position: Stand with your feet hip-width apart. Place your hands on your hips. Exercise: Imagine that you are about to sit down on a chair. Return to squat by bending your hips and knees to 90 degrees. Go on to lift your knees back to the ground. Repeat this 10 times or until you are tired. When your legs are completely straight, lift your right foot then slowly lower down again. Repeat this exercise for 30 sec. 2 sets



12 JUMPING VERTICAL JUMPS
Starting position: Stand with your feet hip-width apart. Place your hands on your hips. Exercise: Jump as high as you can. Bend your legs slightly and your knees are flexed to approx. 90 degrees, and hold for 1 sec. Do this 10 times or until you are tired. Repeat this exercise for 30 sec. 2 sets

LEVEL 2



7 THE BENCH ALTERNATE LEGS
Starting position: Lie on your front, supporting yourself on your forearms and feet. Your elbows should be directly under your shoulders.
Exercise: Lift your right arm and pull your shoulder up to your ear, and pull your stomach in. Lift each leg in turn, holding for a count of 2 sec. Continue for 60 sec. Your body should be in a straight line. Try not to sag or arch your back. 3 sets



8 SIDWAYS BENCH RAISE & LOWER HIP
Starting position: Lie on your side with both legs straight. Lean on your forearm and the floor on your side. Rest your right arm on the floor. Exercise: Lower your leg to the ground and then pull it up again. Repeat for 20-30 sec. Take a short break, change sides and repeat. 3 sets on each side.



9 HAMSTRINGS INTERMEDIATE
Starting position: Lie on a soft surface. Ask your partner to hold your ankles down firmly. Exercise: Your body should be completely straight from the shoulder to the toes. Lift your right leg and hold it straight up as far as you can, considering the movement with your hamstring and your gluteal muscle. When you can't longer hold the position, gently pull your weight on your hands. Carry this pull-up position. Complete a minimum of 7 · 10 repetitions and/or 60 sec. 1 set



10 SINGLE-LEG STANCE THROWING BALL WITH PARTNER
Starting position: Stand 3-3 m apart from your partner, with each of you standing on one leg. Exercise: Your partner should throw the ball to you and you should throw it back to them. Repeat for 30 sec. Change legs and repeat. 2 sets



11 SQUATS WALKING LUNGES
Starting position: Stand with your feet at hip-width apart. Place your hands on your hips. Exercise: Lunges forward slowly at an angle. As you lunge, bend your leading leg until your hip and knee are flexed to 90 degrees. On the way up, raise your right foot. Then change your upper leg and hips legs. Repeat your lunge across the pitch (approx. 10 times) on each leg and then jog back. 2 sets



12 JUMPING LATERAL JUMPS
Starting position: Stand on one leg with your upper body bent slightly forward. Exercise: Jump to the right, with knees and hips slightly bent. Land gently on the ball of your foot. Bend your legs and flex slightly as you land. Do this 10 times or until you are tired. Repeat your exercise with your other leg. Repeat the exercise for 30 sec. 2 sets

LEVEL 3



7 THE BENCH ONE LEG LIFT AND HOLD
Starting position: Lie on your front, supporting yourself on your forearms and feet. Your elbows should be directly under your shoulders. Exercise: Lift your right arm and pull your shoulder up to your ear, and lift your right leg to 90 degrees. Hold for 15 sec on the ground, and hold the position for 20-30 sec. Your body should be straight. Switch leg and repeat for 60 seconds and do two sets of each your level back. Take a short break, change legs and repeat. 3 sets



8 SIDWAYS BENCH WITH LEG LIFT
Starting position: Lie on your side with both legs straight. Lean on your forearm and the floor on your side. Rest your right arm on the floor. Exercise: Lower your leg to the ground and then pull it up again. Repeat for 20-30 sec. Take a short break, change sides and repeat. 3 sets on each side.



9 HAMSTRINGS ADVANCED
Starting position: Lie on a soft surface. Ask your partner to hold your ankles down firmly. Exercise: Your body should be completely straight from the shoulder to the toes. Lift your right leg and hold it straight up as far as you can, considering the movement with your hamstring and your gluteal muscle. When you can't longer hold the position, gently pull your weight on your hands. Carry this pull-up position. Complete a minimum of 12 · 15 repetitions and/or 60 sec. 1 set



10 SINGLE-LEG STANCE TEST YOUR PARTNER
Starting position: Stand on one leg opposite your partner and at arm's length. Exercise: Hold your feet with your partner, each of you standing on one leg to push the other off balance in different directions. Try to keep your weight on the ball of the foot. Repeat for 30 sec. Change legs and repeat. 2 sets



11 SQUATS ONE-LEG SQUATS
Starting position: Stand on one leg, keeping holding onto your partner. Exercise: Lower your right knee to the ground. Then lift your right leg up and diagonally across the cross. Jump up quickly and explosively as possible. Your hands should be on the ground. Repeat the exercise for 30 sec. 2 sets



12 JUMPING BOX JUMPS
Starting position: Stand with your feet hip-width apart. Imagine that there is a box in front of you. Exercise: Jump up onto the box, with knees and hips slightly bent. Land gently on the ball of your foot. Bend your legs and flex slightly as you land. Do this 10 times or until you are tired. Repeat the exercise for 30 sec. 2 sets

PART 3 RUNNING EXERCISES · 2 MINUTES



13 RUNNING ACROSS THE PITCH
Run across the pitch, from one side to the other, at 75-80% maximum pace. 2 sets



14 RUNNING BOUNDING
Run with high bounding steps with high knee lift, landing gently on the ball of your foot. Use an exaggerated arm swing for each and every step. Try to get to your leading leg over the middle of your body or let your knee touch the ground. Repeat the exercise until you reach the other side of the pitch, then jog back to recover. 2 sets



15 RUNNING PLANT & CUT
Jog 4-5 steps, then plant on the outside leg and cut to change direction. Accelerate and sprint 1-2 steps and repeat 10-15 times. Maximum speed before you decelerate and to arrive again. If not, do not let your knee touch the ground. Repeat the exercise until you reach the other side, then jog back. 2 sets

FIFA 11+

- FIFA 11+ performed at least twice a week by female youth football players:
 - 37% fewer training injuries
 - 29% fewer match injuries
 - Severe injury rate almost halved
 - Higher compliance associated with a significantly lower injury risk



FIFA 11+

- FIFA 11+ performed regularly not only reduces football injuries, but has the potential to substantially reduce health-related costs:
 - NZ Accident Compensation Corporation has saved NZ\$8.20 for every NZ\$1.00 invested in SoccerSmart Programme (including FIFA 11+)



Bizzini M, Junge A, Dvorak J. Implementation of the FIFA 11+ football warm up program: How to approach and convince the Football associations to invest in prevention *Br J Sports Med* 2013 47: 803-806

FIFA 11+

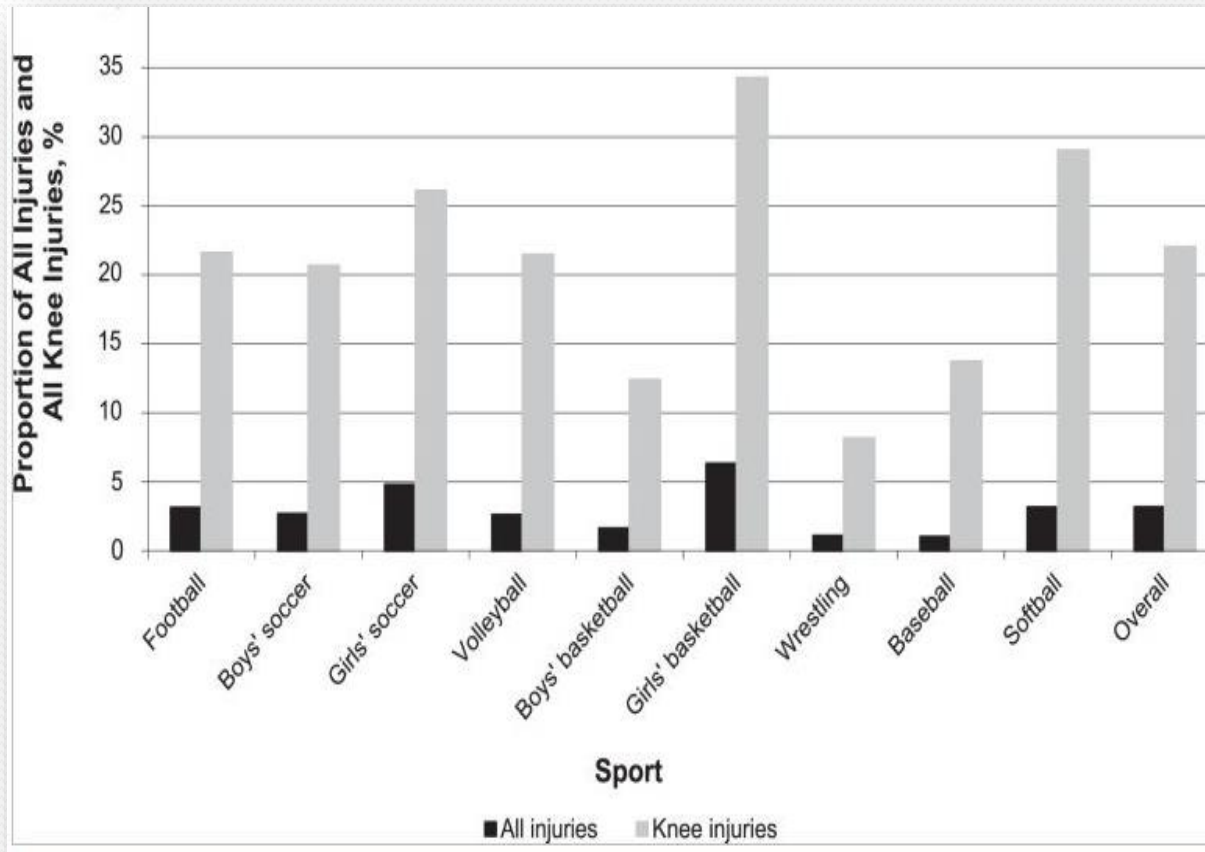
- Meta-analysis of 12 studies of FIFA 11+ implementation showed, when done ≥ 1.5 times/week:
 - Reduction in injured players: 30% - 70%
 - Players with high compliance had 35% fewer injuries than those with intermediate compliance
 - Significant improvements in components of neuromuscular & motor performance
 - Substantial cost-saving potential



Injury prevention strategies for schools

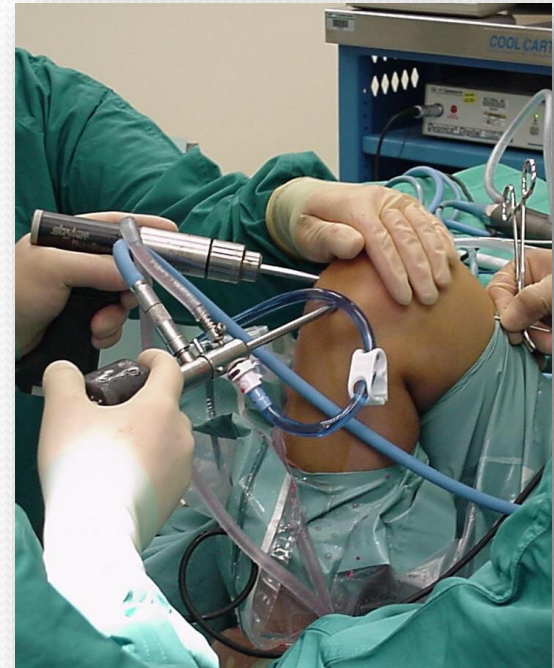
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Anterior cruciate ligament injury



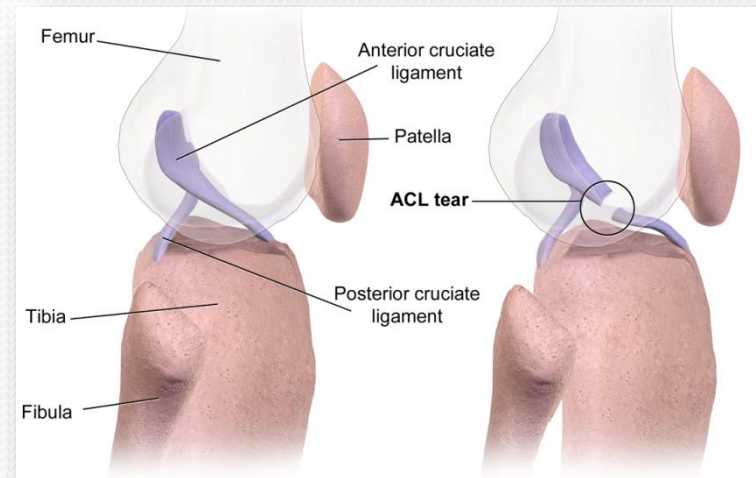
Anterior cruciate ligament injury

- Major consequences:
 - Prolonged time away from sport
 - Surgery
 - 6 – 9 months post-operative rehabilitation
 - Long term complications (ie. knee instability, meniscus tears, cartilage injuries and development of OA)



Anterior cruciate ligament injury

- 70% – 78% of ACL injuries occur in non-contact situations
- Non-contact MOI includes:
 - landing from a jump
 - rapidly stopping or cutting
 - suddenly decelerating with a change in direction

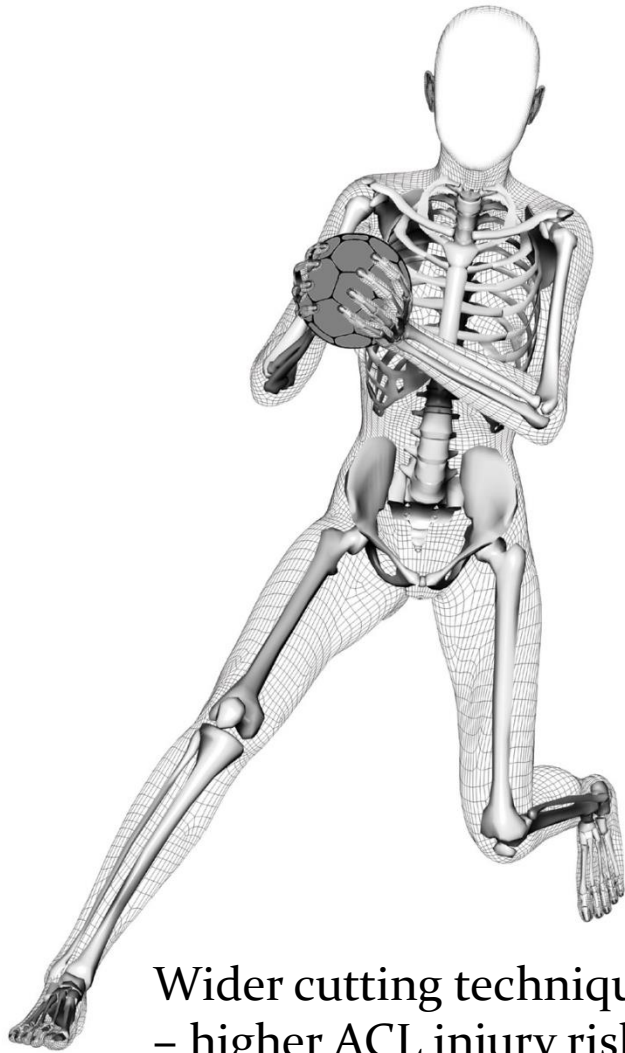


ACL injury in females

- Non-contact ACL injuries 2 – 9 (ave = 3.5) X more in females
- Female risk factors:
 - Neuromuscular recruitment patterns:
 - Slower hamstrings activation; greater quadriceps activation
 - ‘Landing’ characteristics:
 - Minimal knee flexion; hip internally rotated & adducted; tibia externally rotated; valgus stress across knee; trunk tilted laterally
 - Also:
 - Anatomical differences
 - Smaller femoral notch, smaller ACL , more knee laxity, larger Q angle
 - Hormones and menstrual cycle
 - Greater flexibility

Ireland ML. The female ACL: why is it more prone to injury? *Orthoped Clin N Am.* 2002;33:637–51

Voskanian N. ACL Injury prevention in female athletes: review of the literature and practical considerations in implementing an ACL prevention program. *Curr Rev Musculoskelet Med* (2013) 6:158–163



Wider cutting technique
– higher ACL injury risk



Narrower, safer
cutting technique

From: Myklebust, G. ACL prevention in female handball. Aspetar Sports Medicine Journal

ACL injury (Norwegian handball)



PEP program for ACL injuries

- 20 minute program done 2–3 times a week during a 12 week soccer season
- Program:
 - Educational video on safe and unsafe landing patterns
 - Team workouts :
 - stretching, strengthening & plyometrics
 - soccer-specific agility drills
- Results (intervention vs. control):
 - 1st year (52 vs. 95 teams): 88% reduction in ACL injuries
 - 2nd year (97 vs. 112 teams): 74% reduction in ACL injuries

Mandelbaum BR, Silvers HJ, Watanabe DS, et al. Effectiveness of a neuromuscular and proprioceptive training program in preventing anterior cruciate ligament injuries in female athletes: 2-year follow-up. *Am J Sports Med.* 2005;33:1003–10

ACL injury prevention program

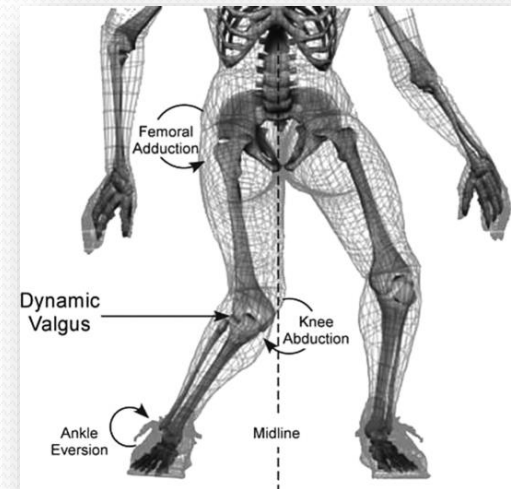
- RCT of highly compliant (87%) male & female youth handball players
- Structured warm-up programme:
 - Running exercises with and without ball
 - Technique training, specifically focussed on:
 - Safe cutting movements
 - Two-feet landings after jump shots
 - Balance training
 - Strength and power exercises
- Results: 50% reduction in acute ACL injuries

Key components of ACL programs

- Warm-up program:
 - Combination of balance/co-ordination, technique, lower limb and core strength, plyometric and agility exercises
- Focus on technique:
 - A narrower cutting technique
 - Landing on two-feet landing + toe-landing
 - Proper balance on landing, with hip, knee and toes all in line
- Vary exercises and increase difficulty (for motivation)
- Exercise in pairs (fun and maximise movement quality)
- Include ball exercises when basic exercises are well established

Identify athletes at risk

- Screening tests can be used to identify athletes who are at greater risk for ACL injury
 - Drop vertical jump test
 - Single leg hop
 - Single leg squat
- ‘At risk’ posture of lower limb
- Specific programs for athletes at risk



Barber-Westin SD, Smith ST, Campbell T, Noyes FR. The drop jump video screening test: retention of improvement in neuromuscular control in female volleyball players. *J Strength Conditioning Res.* 2010;24:3055–62

Hewett TE, Ford KR, Hoogenbottom BJ, *et al.* Understanding and preventing ACL injuries: current biomechanical and epidemiologic considerations – update 2010. *N Am J Sports Phys Ther.* 2010 Dec; 5(4): 234–251.

Injury prevention strategies for schools

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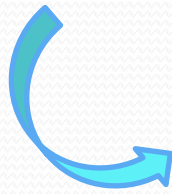
Ideal Coach : job description

- Have knowledge of:
 - Sports injuries:
 - Micro- and macro-traumas
 - Sport specific patterns of injuries
 - Injury prevention programs
- Deliver prevention programs effectively
- Communication skills (incl. player education, player motivation, etc.)
- Up-to-date with sport rule changes
- Work with healthcare professionals



Training considerations

- Time management
- Periodization of training schedule (to avoid overload)
- Strength & flexibility training
- 'Grooving' of movement patterns
- Age-appropriate training
- Early specialization



- Increased risk of injury in young athletes

Early identification of injury

- Elite young athletes not infrequently downplay their symptoms in order to continue playing
- Coaches should be aware of the more common symptoms of injury:
 - Pain with activity
 - Changes in form or technique
 - Decreased interest in practice
 - Pain at night



Rugby injury patterns

- Systematic review of injuries in adolescent rugby:
 - Injury necessitating medical attention = 27.5 to 129.8 injuries per 1000 match hours
 - Injuries more common:
 - During the first 4 weeks of the season
 - In higher age groups & in A-team players
 - 8thmen (then flanks and back-line players)
 - In the tackle (55% of all injuries)
 - In the lower limb (37%), head and neck (29%) and upper limb (20%)

Training vs. Competition

- In some studies, the majority of injuries occur during training not competitive events
- Reasons include:
 - Rules of sport aren't applied as strictly in training
 - Protective gear may be neglected during training
- Players and coaches must be mindful of injury prevention at all times

‘Healthy’ attitude to injuries

- Accept that an injured player simply can't perform optimally
- Insist on quality first aid
- Encourage qualified sports medicine management early
- Accept the opinion of qualified medical practitioners wrt injury management, RTP decisions, etc.



Injury prevention exercise programs

- Review of 21 trials (> 27,000 athletes; age range = 10.7-17.8):
 - Overall RR = 0.54
 - Girls profited more from injury prevention than boys
 - Significant injury reduction with:
 - Programs focussed on specific injuries (RR 0.48)
 - Programs aimed at all injuries (RR 0.62)
 - Pre-season & in-season programs similarly beneficial
 - Programs that include jumping/plyometric exercises showed significantly better injury prevention (RR 0.45) than programs without such exercises (RR 0.74)

Implementation of programs

- Assessment of injury prevention programs at a professional youth soccer academy (compared to FIFA 11+):
 - Implemented primarily by coaches (assisted by physios)
 - Multiple delivery formats + extensive use of equipment
 - Results:
 - Average 1 'FIFA 11+' exercise in its original form
 - Another 4 'FIFA 11+' exercises in a modified form
 - Implementation challenges included poor staff communication, competing training priorities & heavy game schedules

Implementation of programs

- Implementation of FIFA 11+ in 65 (of 125) female Norwegian football teams aged 13–17 years in one season
- Results:
 - 77% of teams completed program (mean 1.3 sessions/wk)
 - 35% lower risk of all injuries in high compliance group vs. intermediate compliance
 - Coaches who had previously utilised injury prevention training, coached teams with a 46% lower risk of injury
- Positive attitudes towards injury prevention correlated with high compliance and lower injury risk

Implementation of programs

- ACL injury surveillance (female handball):
 - 1998-99: 0.5 ACL injuries/team/season
 - 2010-11: 0.25 ACL injuries/team/season (ie. 50% reduction when compliance was good)
- “The coach is the key partner. The coach is the one who can include balance and strength exercises with knee control as a natural part of every warm-up. Our results indicate that coaches have taken our messages seriously ...” (Grethe Myklebust)

Player education

- Attitudes of Australian Football players (aged 17-38 years) regarding lower limb injury and prevention:
 - 74.4% : doing specific exercises in training would reduce injury risk
 - 64.1%: training should focus more on improving game performance rather than injury prevention
 - $< \frac{3}{4}$ of all players believed that balance (69.2%), landing (71.3%) or cutting/stepping (72.8%) training could prevent injury

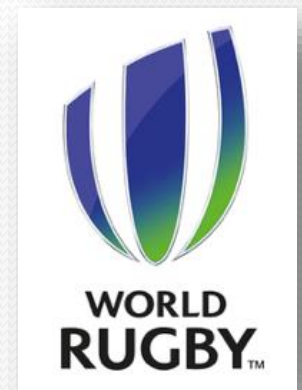
Promote fair play

- Risk of injury is lowered by:
 - Respecting the rules
 - Respecting the referee
 - Respecting the opposition
- In addition:
 - Enhances enjoyment
 - Valuable life lesson



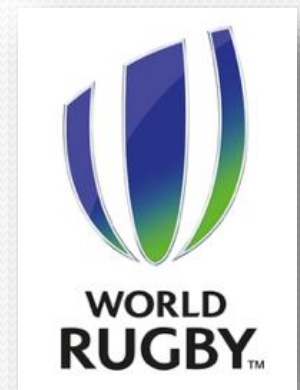
Rule changes

- Head injury risk in rugby:
 - 1.94 HIAs/1000 tackles (tackler = 1.4; ball carrier = 0.54)
 - Tackle characteristics most associated with HIAs:
 - Active shoulder (vs. passive shoulder and smother tackle)
 - Front on (vs. side, back or angle approach)
 - Tackler at high speed or accelerating into tackle
 - Ball carrier static or unbalanced and ‘unbraced’
 - Body position:
 - Tackler: upright
 - Ball carrier: falling or diving
 - High contact (head-head or head-shoulder contact 4.25 X greater risk than contact below the sternum)



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Applying rule changes

- Accept that the changes are based on quality research
- Train correct tackling techniques:
 - Tackler: bent at the waist
contact below the sternum
 - Ball carrier: bent at the waist
braced
- Potential to significantly reduce HI risk to the tackler and the ball carrier



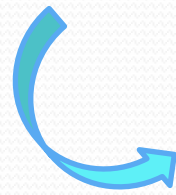
Work with healthcare professionals



... not!

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- ‘Grooving’ of movement patterns
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- Early specialization

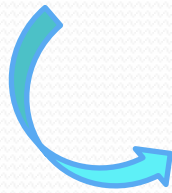


- Increased risk of injury in young athletes

Training considerations

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Specific area of expertise of the biokineticist



- Increased risk of injury in young athletes

Communication

- “South African sports medicine is 10 years behind that in Australia ...

Dr Peter Harcourt circa 1997



Dr Peter Harcourt
Melbourne Sports Medicine Physician

Communication

- “South African sports medicine is 10 years behind that in Australia ...
- ... in the way you communicate with the coach and the athlete”

Dr Peter Harcourt circa 1997



Dr Peter Harcourt
Melbourne Sports Medicine Physician

Thank you for your attention

Dr Mike Marshall
24 August 2017

