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Concussion: a critical medical issue



Sports Medicine Australia has recently announced a new partnership with Sixty4, an emerging new Australian based business that develops and produces innovative sports bras for active women. For more information on Sixty4 visit www.sixty4.net

If you have a worthy cause or issue related to sports medicine or physical activity that you would like promoted in *Sport Health* via a promotional item email nello.marino@sma.org.au

SMA CEO, Nello Marino highlights the concussion themed features within this issue of *Sport Health*.

I was fortunate to attend the recent Concussion in Football Conference in Melbourne in March. This was one of those events where the competitive nature of our four major football codes gets put aside in the interest of collaboration for participant safety. Participant safety seems to have that effect.

This edition of *Sport Health* marks the first of a number of themed issues. In keeping with its ever increasing profile we have chosen to tackle the issue of concussion in sport. Dr J asserts that concussion is arguably the most critical medical issue facing collision sports over the next decade. Some with extreme views even suggest it spells the end of collision sports as we know them. This remains to be seen.

"A feature of the most recent consensus statement is the increased emphasis on special populations, particularly children."

Since the release of the 2012 concussion statement emanating from the 4th Concussion in Sport Conference in Zurich, many sporting codes have made rapid changes to rules in order to accommodate the evolving evidence of this injury. As usual Dr J provides a very open and honest account of the difficulties presented to medics involved in professional team sports and the obvious dilemmas they face making decisions in such codes.

We are also delighted to have contributions from Dr Michael Makdissi, who along with Professor Gavin Davis and Professor Paul McCrory, provides a deeper understanding of some of the factors that influence the timing of concussion recovery and offer the potential for complications following a concussion in sport. These again highlight the complexity of the injury and the variability in athlete symptom response.

"He tells of piecing his life back together after his trauma and provides a compelling understanding of the real life impact of a serious collision injury from sport."

A feature of the most recent consensus statement is the increased emphasis on special populations, particularly children. Whilst Professor Gavin Davis demonstrates that the processes adopted in the management of concussion in children are not dissimilar to concussion in adults, the obvious care and importance of ensuring children satisfy carefully graded steps in their return to play cannot be over emphasised.

Gary Johnston is someone many SMA members will have met in his role as Education and Business Development Manager at the SMA Queensland Branch. Gary's story is truly remarkable. He spent two years in a coma following a serious football accident. He tells of piecing his life back together after his trauma and provides a compelling understanding of the

real life impact of a serious collision injury from sport. Gary is a wonderful advocate for espousing the value of safe practice in sport and today uses his experience with absolute passion in the delivery of SMA sport safety training.

"Dr J asserts that concussion is arguably the most critical medical issue facing collision sports over the next decade."

Round these off with an interview with Australian Rugby Union's Chief Medical Officer, Dr Warren McDonald; a concussion overview from Dr Ryan Kohler of the Australasian College of Sports Physicians; and an overview of the assessment tools centred around the new SCAT3 written by Dr Tony Schneiders.

We look forward to providing further themed issues in the near future with upcoming editions being dedicated to drugs and supplements in sport, and the history of sports medicine in Australia forming part of the celebration of Sports Medicine Australia's 50th anniversary.

Nello Marino

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Follow SMA CEO Nello Marino on Twitter @SMACEO

Do you know your dietary health ABC? A-Z of dietary supplements and sports nutrition now online thanks to #BJSM <http://bit.ly/YEFxNU> – April 13, 2013

RT @SMAPresident announces that Prof Jiri Dvorak Medical Director of FIFA will attend SMA conference in Phuket as invited speaker Oct 22–25 – April 4, 2013

Here is content from the latest issue of the now SMA partnered *British Journal of Science and Medicine* <http://bit.ly/YEFxNU> – March 26, 2013

Interesting example of how urban planning impacts on the health of Australians <http://bit.ly/WA862H> – March 19, 2013

One key message from 1st concussion conference session, player welfare is paramount, not rushing players back to play. Test and rest! – March 20, 2013

Australian sport has a clearer picture of what it's up against. This is an opportunity to engage us all in upholding the integrity of sport – February 8, 2013

OneSMA – What it means to SMA members

Since October 2010 the SMA National Board has been consulting with SMA State Branches on OneSMA, a proposal to merge the nine separately governed organisations that make up SMA, into one organisation. This consultation has guided the final proposed structure and constitution which is now available at onesmablog.com.

What the proposed (OneSMA) merger means

The National Board has considered the benefits of OneSMA and believes that the merger will result in:

- a) Improved benefits available to all members.
- b) Increased ability to better serve members and the community, particularly those in regional areas.
- c) Improved capacity to develop alliances with sponsors and other professional bodies.
- d) Greater synergy through the elimination of duplication across the nine existing organisations.
- e) Efficiencies through improved sharing of resources such as IT and finance systems.
- f) A broader and more financially sustainable model.
- g) Better use of existing State Branch cash reserves for use in the delivery of better local services.

Overview of the OneSMA voting

Full SMA Members will be given the opportunity to vote on a motion to adopt a new constitution and a more effective and efficient new structure for SMA.

Members will have the option to vote at a general meeting on June 26, or via postal vote. All voting members will receive a postal ballot at least 21 days prior to the meeting date.

3. The change to a new constitution requires at least 75 per cent of votes submitted to be carried.
4. The ballot will be coordinated by the Australian Electoral Commission.

Board recommendation

The SMA National Board strongly recommends that members vote YES to the resolution.

Member news

Sport Health correction

Within the previous article titled 'Howzat! for medical treatment' (Volume 30, Issue 4, 2012/13), *Sport Health* would like to highlight that Dr Trefor James' position was misrepresented. Dr Trefor James' past position was a part time position and a funded position with Cricket Australia. Dr James had separate contracts as the Cricket Australia Medical Officer and as a State Medical Officer. The current Cricket Australia job description has since changed from being primarily clinical to more administrative based. *Sport Health* would like to apologise for any confusion caused about Dr James' previous role by the published interview.

Social media channels

Stay engaged with the latest happenings of Sports Medicine Australia via the following social media channels:

- **Twitter:** @SMACEO @SMAPresident
- **Facebook:** search Sports Medicine Australia
- **LinkedIn:** search Sports Medicine Australia

SMA QLD Vale Tracey O'Brien

Former SMA QLD Branch President, Tracey O'Brien passed away on March 24, aged 41, after a long and brave battle with cancer. Tracey served on the SMA QLD Board of Directors from 1999–2006 including as Branch President from 2004–2006. Tracey was a highly skilled and dedicated physiotherapist who put patient outcomes above profit in her community focused practice, while never neglecting her key priority which was her family, especially her husband John and sons Jacob and Riley.

British Journal of Sports Medicine

Highlights from the SMA focused April 2013, Volume 47, Issue 6 of BJSM include:

- Terminology and classification of muscle injuries in sport: The Munich consensus statement.
- Republished research: Treatment for acute anterior cruciate ligament tear: five year outcome of randomised trial.
- Ultrasound may promote fracture healing but this does not necessarily accelerate return of function.
- A-Z of nutritional supplements: dietary supplements, sports nutrition foods and ergogenic aids for health and performance: Part 43.

Access BJSM via the SMA Member Portal at sma.org.au

Sport Health available for iphones/ipads/android

Sport Health is now available to read on your iphone, ipad or android device through the SMA Member Portal, making reading a lot more convenient for those on the go. Visit sma.org.au and click through the SMA Member Portal to start reading.

Journal of Science and Medicine in Sport podcasts

Listen to podcasts conducted by Sports Medicine Australia on recent research featured with the *Journal of Science and Medicine in Sport*. Access at jsams.org

OneSMA – the vote

An SMA Member vote on the OneSMA proposal is scheduled via an extraordinary general meeting on June 26, 2013. Sports Medicine Australia has engaged the Australian Electoral Commission to assist with the mechanics of the vote and all members will receive a ballot in the mail prior to this date. For latest updates on the OneSMA vote visit the dedicated blog, www.onesmablog.com

Access webinars through the SMA Member Portal

Access the following webinars at sma.org.au:

- Social media for sports medicine practitioners
- Concussion

Asics Conference of Science and Medicine in Sport, October 22–25, 2013

The upcoming SMA National Conference offers a jam packed social program to maximise your networking opportunities all whilst enjoying what Thailand has to offer. Events include:

- **Welcome Reception** (one ticket is included with each full registration).
- **ASMF Fellows Dinner.**
- **Scientific Poster Session** where senior members of SMA will provide feedback to individual researchers and discuss their research (one ticket is included with each full registration).
- **Discipline Group Dinners.**
- **Conference Dinner** which is the premier social event of ACSMS 2013 which includes local entertainment, dancing and fine food (one ticket is included with each full registration).

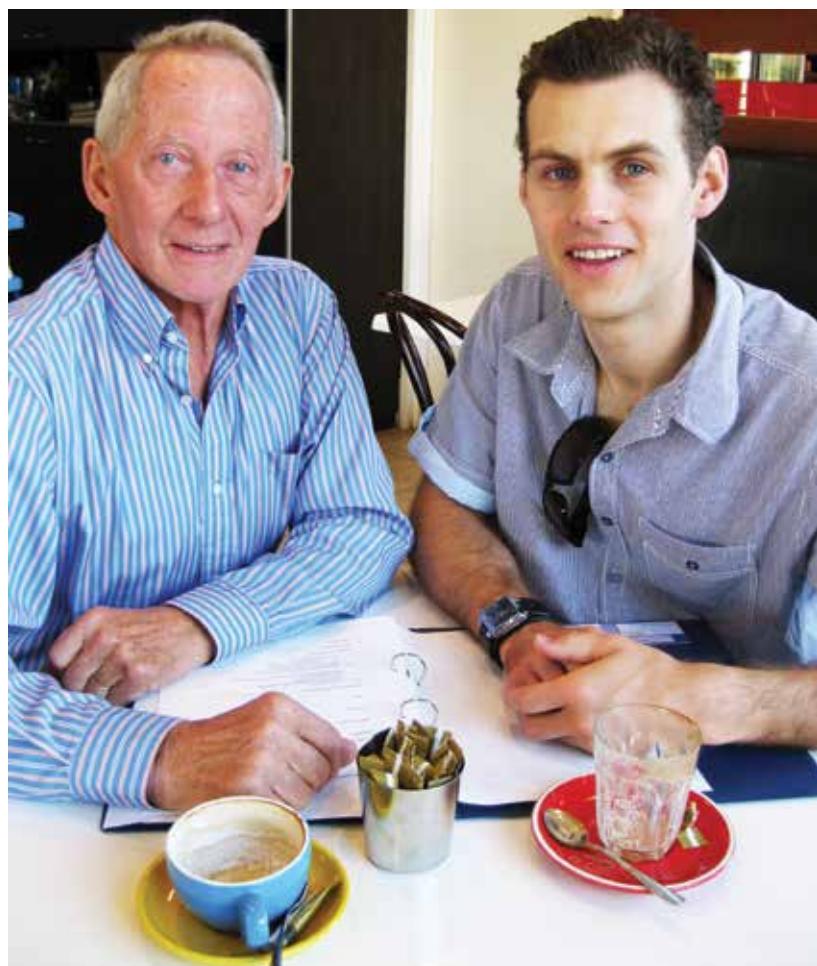
ACSMS 2013 offers you the best of both worlds – the latest in sports medicine and sports science by day; enjoyable experiences by night.

Check out what else is on offer at acsms.sma.org.au. Remember early bird conference registration closes July 31, 2013.

SMA Mentorship program

The SMA Mentorship program is travelling nicely with many in the program catching up regularly and mentees gaining benefit from the expertise provided by their mentors.

"To be matched with a member of my profession with such knowledge, clinical experience and contacts is invaluable. Peter and I meet monthly over breakfast and have discussed topics including building a client list at work, methods for networking with other physiotherapists and health professionals, opportunities to travel with sporting teams as a physio, and updating my professional image on LinkedIn. Peter has been a good sounding board for both professional and personal issues that have arisen. I have appreciated his ongoing advice and value his friendship." – Aaron Beck.



Mentor and ASMF Fellow, Peter Duras (left) with Mentee, Aaron Beck catching up over a coffee.

5 mins with... Professor Per Aagaard

Keynote Speaker, Asics Conference of Science and Medicine in Sport 2013



What is your profession?

Professor in Biomechanics at the University of Southern Denmark, Odense, Denmark.

How many years have you been in this profession?

About 25 years have been spent in the field of human biomechanics and exercise physiology, with roughly 10 years in my current position.

What does your typical day consist of?

Administrative meetings, reading and revising manuscripts, talks and meetings with colleagues and students, teaching and lecturing of students, sometimes participation in a research seminar or conference.

What is your favourite aspect of your job?

Flexibility and autonomy, teaching and student interaction, participation in research seminars and conferences, research collaboration with colleagues and friends nationally and internationally.

What has been the highlight of your career?

Every time I have a student who performs extraordinarily well. Happens often.

How did you become involved with Sports Medicine Australia?

When I was invited to speak at the Asics Conference of Science and Medicine in Sport 2013.

Can you give us an insight into your upcoming Asics Conference of Science and Medicine in Sport 2013 keynote presentation?

One of my talks will focus on how exercise and training can be used to elicit marked adaptive changes in the function of the neuro-circuitry system of the spinal cord as well as in supraspinal centers of the central nervous system. In result, mechanical muscle function (maximal strength, explosive strength [rate of force development], power) is greatly improved. This effect can be observed in athletes, healthy individuals as well as in neurological patients.

In another talk I will address the use of blood-flow restricted exercise (BFRE) in human skeletal muscle. Surprisingly, a strong stimulus for muscle growth may be achieved with BFRE. Although not much is known about the specific adaptive mechanisms involved, recent findings suggest that this training modality leads to a hyper activation of myogenic stem cells (satellite cells). The potential implications for athletes as well as patients with primary or secondary muscle loss are immense.

What are you passionate about?

Research, music and summer vacation.

What's the best piece of advice anyone has ever given you?

Don't eat the yellow snow (Frank Zappa). Particularly useful in the land of Polar bears.

Name four people, living or not, you would invite for a dinner party and why?

My wife and four kids (8, 16, 20 and 25 years). Why? When dining with this crew a long and winding journey seems to make more than full sense...



Favourites

Travel destination: Berkeley/San Francisco and Thailand (Koh Lipe and many other islands).

Sport to play/watch: Road biking, soccer.

Cuisine: Italian (only available option with an Italian father-in-law).

Movies: Juno, Pulp Fiction and Frida (amazing actor performances, fantastic music).

Songs: Alice (Tom Waits), Almost Blue (Elvis Costello/Chet Baker), Push the Sky Away (Nick Cave, entire album), Jukebox (Cat Power, entire album), Chet Baker Live in Tokyo (1987, entire album).

Book: (currently) The Secret Race by Tyler Hamilton.

Gadget: My commute bike (couldn't live without it).

ACSMS 2013 speakers

Make sure you also check out the following highlighted speakers to present at ACSMS 2013.

- Professor Jiri Dvorak, Chief Medical Officer to FIFA.
- Refshauge Lecturer Craig Purdam, Deputy Director – Athlete Services and Head of the Physical Therapies unit at the Australian Institute of Sport.
- Invited speaker Professor Kim Bennell, Professor of Physiotherapy and Director of the Centre for Health, Exercise and Sports Medicine in the Department of Physiotherapy, University of Melbourne.

Read full speaker profiles and keep up to date with further speakers as they are released at
<http://sma.org.au/conference/speakers/>



THE SMA MEMBER PORTAL

sma.org.au

WHAT YOU GET

- Access to your personal and business details to ensure they are kept up-to-date.
 - Inclusion within the SMA Member Directory.
 - Membership payment facilities.
 - Access to online scientific journals:
- the *Journal of Science and Medicine in Sport* and the *British Journal of Sports Medicine*.
- Resources including SMA member logos, recent webinars, and *Sport Health* electronic flipbooks.

The SMA Member Portal is a quick, convenient and hassle free online service.

HOW YOU ACCESS

1. Visit sma.org.au
2. Click the 'Member Portal' button on the front page of sma.org.au
3. On the member login page enter your login and password details (login is typically your email address; password is typically your member number. There is a forgot password link if this is not the case).
4. Once you have entered your login and password details you will enter the SMA Member Portal.

Walking the tightrope between Zurich and the stadium



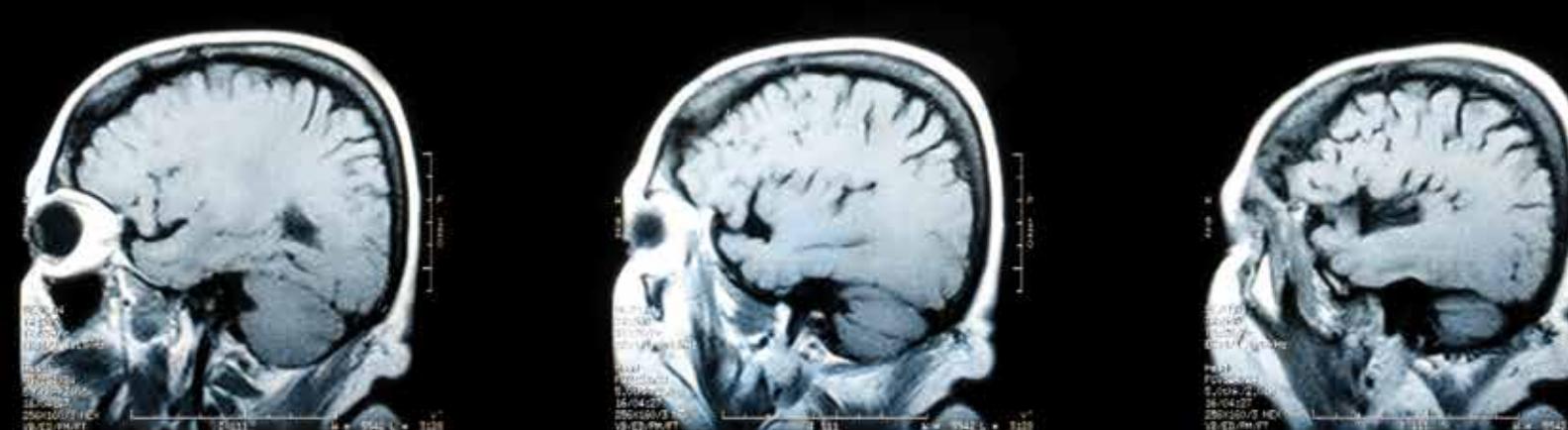
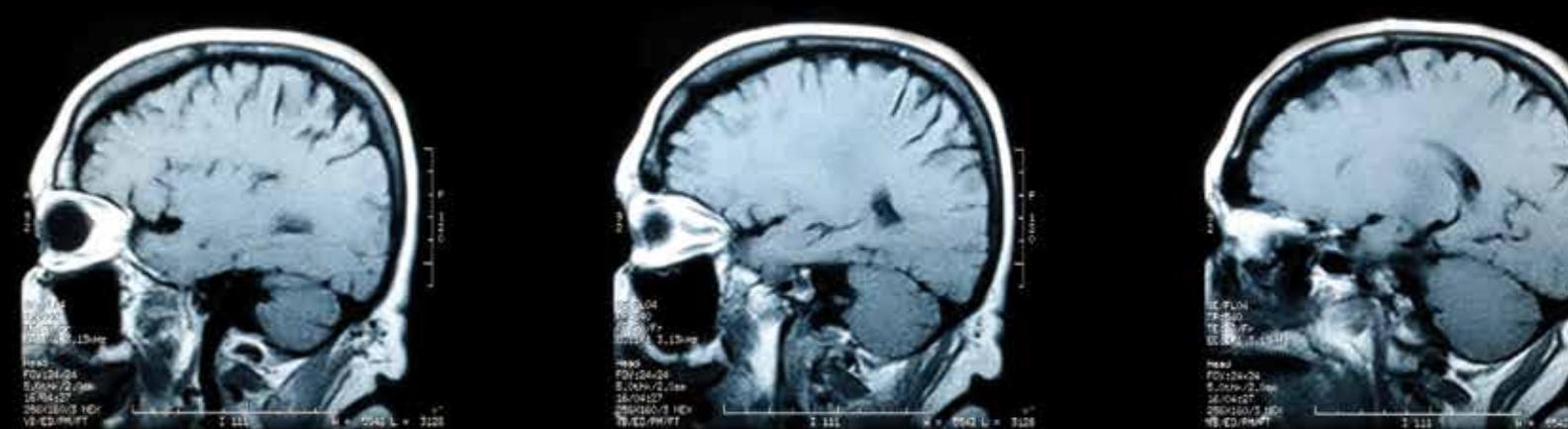
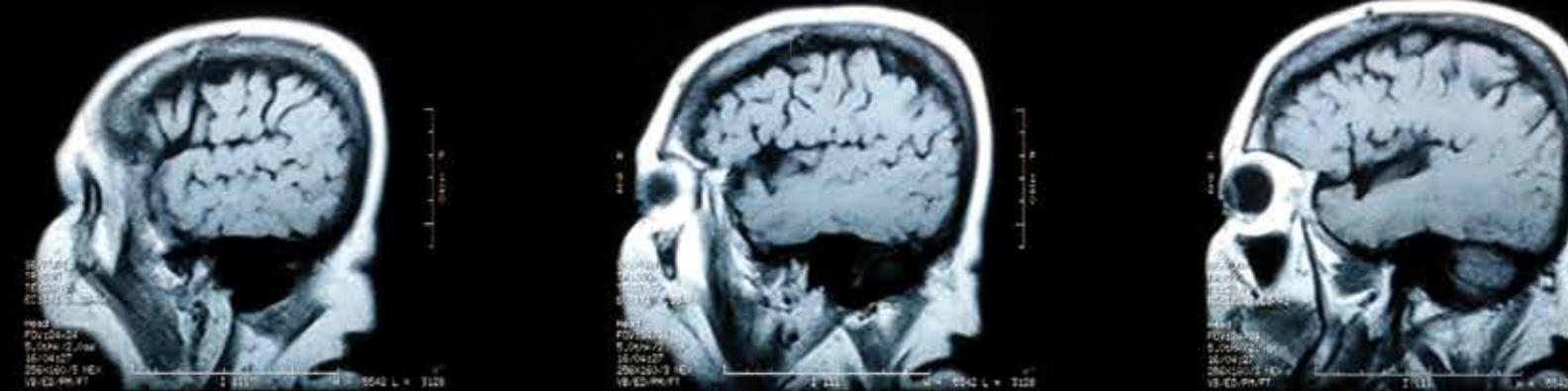
Dr J questions the concept and applicability of ‘zero tolerance’ in regards to the new concussion guidelines.

Concussion is our designated ‘hot topic’ for this issue of *Sport Health*, but we may as well designate it the ‘hot’ issue of the next decade in contact sports, as the complexity of the topic and lack of easy solutions to our dilemmas will take many years to resolve. The issue has been brewing for many years in North America (particularly with reference to the NFL and NHL). The tipping points for it to be taken as seriously here have been a combination of international consensus guidelines becoming more conservative and the uncovering of what seems like a handful of genuine cases of early degenerative brain function in retired professional Australian and NZ rugby league, union and AFL players (even without the smoking gun of an abnormal brain post-mortem from this part of the world).

“... we want the football codes to be environments where the ‘best’ doctors can flourish, not the ‘most compliant’ doctors.”

Let me declare that my two biases (‘hats I am wearing’) on this topic possibly cancel each other out and make me the mythical ‘middle ground’ expert. As an injury epidemiology and sports safety researcher, I have a strong bias towards trying to make all

sports (including the football codes) safer to play. However as a long-standing team doctor (in this debate mainly with the Sydney Roosters) I have enough experience to know how players and coaches think and act and I have as much sympathy for their views in this debate as I have for my own plight as a team doctor trying to navigate the minefield. To try to assert my middle ground credentials, I would like to denounce two opposing extreme views as being patently wrong. The first is the ‘old school’ football mentality that the ‘concussion crisis’ is a beat up and there is no risk whatsoever in playing i.e. ‘pushing through’ concussions as long as that player is fit to do their job on the football field. To hold this view would be to ignore all of the cases that have surfaced in the USA (and more recently in Australasia) suggesting strongly that chronic brain degenerative incidence is higher in retired footballers than the general population. Granted it is not very solid science at the moment (because it is so hard to do studies where conditions may have a 20+ year lag period) but the case histories, along with the pathology studies in the USA, make a compelling case that there is a real issue. What is unknown is the extent of the issue, not whether it exists. It is worth noting here that retired footballers also do better than the general population on many other non-neurological health indices, but that doesn’t absolve us (collectively) from responsibility to try to reduce neurological complications if we can.



"... the net result could be a more conservative management of the visibly obvious concussions but possibly more risky net management of the 'missed' concussions..."

However, it is equal folly to argue the opposite extreme viewpoint that 'the football codes will cease to be played in the near future' on the basis of massive numbers of ex-footballers presenting with brain damage. Just as you can't ignore the plight of specific ex-players who obviously do have a problem, you can't ignore the hundreds and thousands of ex-players (i.e. the vast majority) who don't have a problem, despite playing in an era where concussions were relatively ignored. One of the ex-players who has volunteered what looks to be a pretty scary history in his past is AFL great David Parkin, who said he was concussed or knocked out 11 times during his playing career (and played the week after every time). The difficulty of the issue is shown in the fact that he quite obviously has *not* suffered clinically significant neurodegenerative problems from this lengthy concussion history. I remember inviting him to my school to give a talk in 1983 when he was coach of Carlton and he enthralled a large audience for 40 minutes speaking eloquently without any notes. He coached into his late 50s and worked in the media as a highly astute commentator well into his 60s. He was and probably still is 'sharp as a tack', despite his history of multiple concussions. I hope to be doing as well mentally in my 60s as he seems to have done.

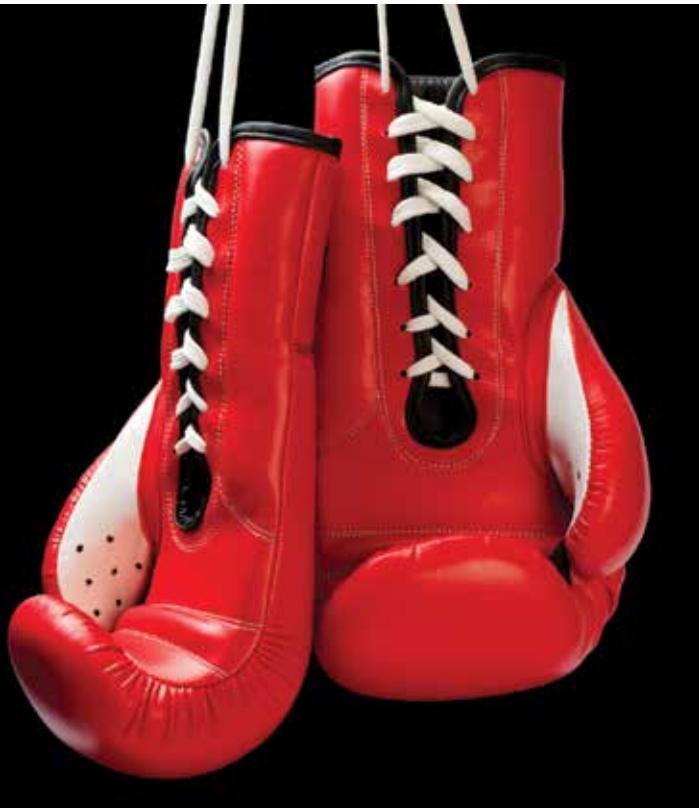
The future of concussion management may be (hopefully – but be careful what we wish for) that we develop scans or blood tests to pick which player is going to be the 1 in 50 (or in 20 or in 1,000?) to develop the premature neurodegenerative changes and distinguish from those who can 'safely' return to play once their symptoms have resolved multiple times and then also be fine post-career. This will make life easier for the guys who get 'cleared' by the scans but continue the minefield for the cases – which will no doubt arise – who get the bad news on special tests. For, say, the 21 year old superstar with an equivocal or worse scan suggesting he is going to run into trouble later on in life, is he forced into compulsory retirement, or would it be acceptable for him to play on and sign a waiver?

Back to the present, where we actually need to admit we have very little idea about individual prognosis, but we now understand that every concussed player bears some (small) future risk of premature neurodegenerative disease. I think everyone who is middle ground on the issue then appreciates that 'we need to be more conservative with respect to concussion than we have been in the past'. The 64 million dollar question is 'how much more conservative?'

Let's move onto the most recent Zurich international consensus guidelines. The experts knew they had to shift to 'more conservative' and they have delivered in this sense. But they are fairly hard-hitting, erring on the side of greater conservatism without knowing that this is definitely needed but possibly fearing that it would be a greater error to give a bit more latitude to players, teams and doctors on the day. An editorial in the recent *British Journal of Sports Medicine* edition which published the Zurich statement was entitled 'Zero tolerance: the future of head injury in sports' which gives an idea of the massive shift that the Zurich statement authors want to see. I would draw an analogy between the guidelines and recent guidelines suggesting that pregnant women should have 'zero' alcohol intake from the time of trying to conceive to finishing breastfeeding. The pregnancy guidelines eliminate the risk of anyone getting the wrong message that 'you don't have to worry about alcohol during pregnancy', but is zero tolerance so extreme to risk, so to speak, 'throwing the baby out with the bathwater'? (forgive the analogy in this case). I certainly have heard some midwives and obstetricians comment that the guidelines are over the top and describe the odd case where a woman is driven into needless high anxiety with the thought that she had been out drinking in early pregnancy before she knew of her state.

"All football codes need to move to a more conservative standpoint on the prevention and management of concussion."

So how practical is 'zero' tolerance of head injury in certain sports? Let's again start with an extreme example and work our way across to the football codes. Could the Zurich guidelines be practically applied in professional boxing, for example? Would a professional boxing bout be able to tolerate the scenario where as soon as one of the contestants takes a blow to the head that the fight is suspended, the athlete is taken to a quiet room for 20 minutes with a doctor and completes a SCAT3, and if considered fit to recommence he is then brought back into the ring for the suspended fight to continue. This is one aspect of 'zero tolerance' and I think you'll agree the spectators would not think they were getting value for their money in boxing if this was the process every time one of the contestants was hit in the head. I think even the Zurich authors would admit that their 'ideal world' guidelines don't typically translate to the sport of professional boxing, while under their breath they might condemn it as a renegade activity with no hope of a responsible concussion management policy.



"The future of concussion management may be... that we develop scans or blood tests to pick which player... can 'safely' return to play once their symptoms have resolved multiple times and then also be fine post-career."

How practical then is 'zero' tolerance in the football codes? I think in the dramatic circumstance of the player who is visibly unconscious for 10 seconds or more, we are almost at the point of zero tolerance in Australia, in that the administrators of the various football codes have threatened heavy fines for teams where these players do not leave the field and stay off. We obviously have come a fairly long way in a short period in this country in that as a viewer you expect this sort of player to come off and stay off, no matter what code you are watching. Given this advance, a lot of credit must go to the more conservative guidelines and the educational process (and threats of fines) that has accompanied them.

However, those of us with years of experience at the coalface can point out that sometimes there is a remarkably quick recovery from 10 second unconsciousness and that a player who had no noticed or reported incident can come off the ground at the end of the game in a much worse state than the one who was actually knocked out. The only way for the player with the potentially more severe 'hidden' concussion

to get a medical assessment is to volunteer to somebody on the field, say, that he doesn't know what the score is or what has been going on in the game. In the 'bad old days' he could volunteer these symptoms to a medical team member on the basis that he was going to be 'assessed' and maybe 'followed' or temporarily rested to clear his head and then resumed if he improved. In the days post Zurich 2012, if you volunteer these symptoms then you are also 'off for the entire game'. It sounds like a responsible policy, but if it leads to players being far more reluctant to volunteer symptoms to medical staff, is it a move forwards or backwards?

"Given the push-back from fans, coaches and players on safety rule-changes in all codes, will the necessary further changes come sooner rather than later?"

My fear with the Zurich guidelines is that the net result could be a more conservative management of the visibly obvious concussions but possibly more risky net management of the 'missed' concussions (i.e. player struck in the head but immediately continues, perhaps with amnesia and disorientation), not on the basis of medical staff ignoring the guidelines, but on the basis of players who want to stay on the field keeping their symptoms to themselves. This is not simply a view I have cooked up myself – both in the Sydney and Melbourne media some ex- and even current players have stated that they believe certain players will volunteer less to the medical staff now that they are 'educated' about what will happen to them if they declare concussive symptoms.

"... 'zero tolerance of head injuries' in collision sport... is, in my opinion, not an achievable aim in the very near future."

The conservative hardliners reading this who think 'players just need more education that it is in their long-term best interests to volunteer symptoms and come off' need to understand that the rules of every football code (and in fact almost all sports) mean that it can significantly hurt a team's chances of winning if a player does come off (and stay off) the field. With respect to 'non-head' injuries, it is a critical skill of players to be able to 'cope with pain' and continue despite injuries so as to not 'let the team down'. In Australia in particular, our local football codes have lots of players on the field and relatively few on the bench, so the loss of a player for the entire game can and does have an impact on the team's chances of winning. We also need to understand that coaches and players exist in an environment where their earnings and even livelihood depend on their team winning, and this is a far greater consideration to them in

the immediate term than a hard-to-assess risk of something 20 years down the track. The viewing audience rewards players who can stay on the field when hurt and coaches who put winning ahead of almost anything else. It is unrealistic to think that the expert opinion of a consensus group of risk-averse doctors in Zurich is going to always over-ride whether the player thinks he can help his team win the match currently in play.

"A dilemma for all football codes is that the Zurich guidelines make 'receiving' a concussion a 'send-off' offence for the player unlucky enough to be on the receiving end."

We also have the long-term experience of the fate of overly conservative guidelines with respect to concussion in the sport of rugby union. There was a recent era in rugby union when there was a mandatory three week stand-down period for concussion. If you went back over this period, despite concussion being pretty much as common then as it is now, virtually no one at professional level missed exactly three weeks (i.e. almost everyone was back far more quickly than this and therefore almost every concussed player's team

was in breach of the three week stand-down rule). The only difference in how teams were handling the situation was whether the team doctor thought the rule was excessively conservative and let players breach it, or whether the doctor was a stickler for the rules and players quickly learnt to never speak of any concussive symptoms to the team doctor. It certainly took a long while for the IRB to write 'exceptions' to this rule to give team doctors some discretion over the three week stand-down rule, indicating that there was a disconnect between the lawmakers and those at the coalface. Zurich is less draconian than a blanket three week stand-down, but runs the risk of similar outcomes if anyone tries to implement it to the intention of 'zero tolerance'.

"It sounds like a responsible policy, but if it leads to players being far more reluctant to volunteer symptoms to medical staff, is it a move forwards or backwards?"

The immediate future of all the football codes is that they must all move towards stances of less toleration of head contact as part of the game and also greater tolerance (i.e. more) ability to substitute players without hurting the team's chances

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of winning. They all appear to be embarking on this shift, but it is a lot easier said than done, given what the paying audience expects in terms of entertainment. How did rugby league fans (and players and coaches) react to the banning of the shoulder charge (based on a study showing shoulder charges are 70 times more likely to lead to injury than arm tackles)? How did AFL fans (and players and coaches) react to the introduction of the substitute rule (which amongst other things minimises the damage to a team if a concussed player is ruled out for the rest of the game)? It represents progress that these changes were made, but they certainly weren't easy changes for the rule-makers to get through. Google 'NFL lead with helmet rule' and you can discover the same conflicts are occurring in this sport with respect to rule changes. Given the push-back from fans, coaches and players on safety rule-changes in all codes, will the necessary further changes come sooner rather than later?

"I think in the dramatic circumstance of the player who is visibly unconscious for 10 seconds or more, we are almost at the point of zero tolerance in Australia..."

A dilemma for all football codes is that the Zurich guidelines make 'receiving' a concussion a 'send-off' offence for the player unlucky enough to be on the receiving end. Given that a not-insignificant number of concussions result from illegal play, how can it be fair that the player who 'causes' a concussion with illegal play remains on the field when the recipient must



leave the field for good (for safety reasons)? Possibly soccer is the only code, at the moment, where a player who committed a foul causing concussion would be likely to be marched with a red card. Again, this sounds like it is the sport with the most responsible rules, but it is not a coincidence that the frequency of 'red cards' also make diving quite common to accentuate an injury. Soccer may feel less under threat with the concussion issue on the basis that upper-body tackling is not allowed, but there may be dilemmas on the horizon, even for this code. How would FIFA react if a study came out conclusively proving that players who exceeded a lifetime number of headers (in training and matches) had a greater incidence of neurodegenerative disease? I hope that they are not faced with this dilemma, but it would be no easier to resolve than the problems that the 'full contact' football codes now face.

"The viewing audience rewards players who can stay on the field when hurt and coaches who put winning ahead of almost anything else."

Now I will step back to conclude with the 'big picture' for injury researchers and team medical staff. All football codes need to move to a more conservative standpoint on the prevention and management of concussion. All football codes are moving and there has been great progress particularly in the last few years. However 'zero tolerance of head injuries' in collision sport (double emphasis on 'zero') is, in my opinion, not an achievable aim in the very near future. With my team doctor hat on, all I can hope for is that the divide between those trying to make the football codes safer and those who are playing/coaching/watching, isn't so great that it leads to an era that players who once trusted me with their symptoms (to look after their best interests) decide that it is a greater risk to let me know how they are feeling. Or to put it another way, we want the football codes to be environments where the 'best' doctors can flourish, not the 'most compliant' doctors.

Dr J

The opinions expressed in Dr J are the personal opinions of the author.

Food for thought

The Conversation recently published an article outlining that the new sport concussion guidelines were rife with conflicts of interest. Read it at <https://theconversation.com/sport-concussion-guidelines-rife-with-conflicts-of-interest-13103>

An introduction to concussion in sport



Sport and Exercise Medicine Physician, Dr Ryan Kohler provides an introduction into the main principles surrounding the management of concussion.

Concussion knowledge and application of practical guidelines in sport are based on current international concussion opinion¹⁻³. A recent exponential increase in the number of concussion publications in the literature has been summarised in these consensus documents. It should be noted that the science of concussion continues to evolve. Current paradigms should be critically evaluated and periodically reviewed.

"The advent of smart phones with onboard accelerometer and gyroscope systems will allow the development of novel methods of balance assessment on the sideline and during concussion recovery."

What is concussion?

Concussion is a disturbance in the brain's ability to acquire and process information. The reduced function of the brain represents damage to nerve cells (neurons). The neurons can be damaged by a direct blow to the head, which causes the brain to rotate and/or move forward and backward. Indirect impact to the body can transfer an impulsive force to the brain which damages neurons.

"Across football codes in Australia, the probability of concussion is approximately 1 in 7."

The effect that this has on the athlete can vary from person to person, depending on which part of the brain is affected. The impact can cause concussion signs visible to others.

"Ideally any baseline balance testing should be done under 'match' conditions. Balance testing done to assess recovery from concussion should also be done under similar clinical conditions."

Concussion should be suspected if these signs are observed:⁴

- Unresponsiveness.
- Upper limb muscle rigidity.
- Upper limb spontaneous movement.
- A fit/seizure soon after contacting the surface.
- Balance difficulty.
- Slow response.
- Vacant stare.
- Confusion.
- Disorientation.
- Holding the head.
- Facial injury.
- Speech slurring.

Minutes to hours after the impact, injury the player may complain of:

- Headache.
- Nausea/vomiting.
- Blurred vision.
- Memory loss/difficulty.
- Dizziness.
- Tiredness.
- Not feeling right.
- Sensitivity to bright light and loud noise.

Days to weeks after the impact the player could have/feel:

- Sleep difficulty.
- Persistent low grade headache.
- Poor attention and concentration.
- Sad or irritable or frustrated.
- Tired easily.
- Lethargic, low motivation.

TAKE HOME MESSAGE: A player does not have to lose consciousness to have a concussion.



How common is concussion?

1.6 to 3.8 million concussions occur in sport per year in the United States.⁵ Across football codes in Australia, the probability of concussion is approximately 1 in 7.

TAKE HOME MESSAGE: 2 to 3 players in each sporting team this season will have a concussion.

What are the potential outcomes?

It is recognised that most concussions get better in 7 to 10 days.⁶ However, ignoring concussion signs and symptoms or not recognising them, can result in potentially catastrophic consequences. Acute brain swelling, traditionally referred to as 'Second Impact Syndrome' is usually fatal. Prolonged symptoms, recurrent concussion, learning difficulties, and personality problems have also been reported.⁶

Chronic Traumatic Encephalopathy

Chronic Traumatic Encephalopathy (CTE) is a progressive degenerative disease of the brain found predominately in persons with a history of repetitive brain trauma, including symptomatic concussions as well as asymptomatic subconcussive hits to the head. The repeated trauma to the brain triggers a progressive degeneration of the brain tissue. Memory loss, confusion, impaired judgment, impulse control problems, aggression, depression, and, eventually, progressive dementia have all been shown to be possible symptoms of the disorder. The onset of disease can begin long after the last brain trauma, and has typically only been diagnosed after the death of the patient. Recently, a study in the USA has utilised brain scan technology to develop a potential test for CTE.

TAKE HOME MESSAGE: At present, no definitive cause and effect can be identified between repetitive head trauma and long term brain damage in athletes.



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What should parents, coaches and other support staff do before the season?

Parents, coaches and support staff can prepare for the sports season by studying up on concussion. They need to have resources that allow easy recognition of possible concussion; have easy access to a checklist of the warning signs of structural brain injury; know where the closest medical help is in relation to the current location; and know where to find the closest emergency department or medical practice.

“... ignoring concussion signs and symptoms or not recognising them, can result in potentially catastrophic consequences.”

Complications can occur if the player is returned to play before they have recovered from their concussion. Consider baseline computerised brain function testing (Axon, ImPACT) because this testing:

- Detects when impaired brain function lasts longer than the athlete has symptoms.
- Precisely measures reaction time so allows for repeated testing over time.
- Provides extra information in players with previous concussions.
- Helps to find those players with delayed brain function recovery who need more detailed testing with a neuropsychologist.
- Is a useful add-on to clinical assessment and judgement.
- Provides added assurance for aggressive return to play decisions in professional sport.
- Is easy to administer and takes a short time.
- Helps when an athlete under reports their symptoms in order to keep playing.
- Younger players may not recognise the symptoms of concussion.
- Athletes may be overly anxious.
- Can be of medicolegal benefit to show that all available resources were used in a concussion case.

“... the science of concussion continues to evolve. Current paradigms should be critically evaluated and periodically reviewed.”

What should parents, coaches and other support staff do at the sideline?

Parents, coaches and support staff can identify suspected concussion. Any player with suspected concussion must be withdrawn from playing or training immediately. Furthermore, no player with concussion should be returned to play or practice later that day. All players with concussion, or suspected of concussion need an urgent medical assessment. In the days or weeks following concussion, a player should not be allowed to return to play or train until they have had a formal medical clearance.

TAKE HOME MESSAGE: Any player with suspected concussion should be removed from play and not returned to sport or training that day.

How do you manage the unconscious player?

Basic first aid principles apply. The player's neck needs to be protected and an open airway secured. Urgent hospital referral is necessary for any player who has lost consciousness as a result of a blow to the head or body. Indications for urgent referral to hospital include:

- Fractured skull.
- Penetrating skull trauma.
- Loss of consciousness.
- Deterioration in conscious state following injury.
- Increasing confusion.
- Worsening headache post injury.
- Persistent vomiting.
- Any convulsive movements.
- Focal neurological signs.
- More than one episode of concussive injury in a match or training session.
- All children with head injuries.
- High-risk patients (e.g. hemophilia, anticoagulant use).
- High-risk injury mechanism (e.g. high velocity impact, missile injury).
- Inadequate post injury supervision.



When should a medical doctor be seen?

A concussed player should be followed up by a medical doctor with experience in managing concussion. The medical doctor should see the player on a number of occasions, performing serial assessments.³ At the first visit, the doctor will do a full neurological examination and document current symptoms. It is recommended that balance testing and computerised neuropsychological testing document the recovery process. Recovery from concussion may take longer in younger players (under 18) therefore a conservative approach to playing sport again should be followed.

Balance testing – one part of diagnosis and recovery

Balance testing has traditionally used the Balance Error Scoring System (BESS) as one sideline check to diagnose concussion. The BESS described by Guskiewicz, uses three static stances (a narrow double-leg stance, single-leg stance and tandem stance) on two footing surfaces (firm floor and medium density foam).⁷ Each stance is held for 20 seconds

and up to 10 points assigned in each test for standard errors detected by the tester. McCrea et al reported high specificity values across days 1–7 post concussion.⁸

“A concussed player should be followed up by a medical doctor with experience in managing concussion.”

The Sport Concussion Assessment Tool (SCAT3) utilises a modified BESS. This test assesses balance performance on a firm surface only, counting errors for three stances (a narrow double-leg stance, single-leg stance and tandem stance) held for 20 seconds each. To adequately assess postural stability, challenging the vestibular system on foam or a mobile tilting surface is required. A simple Romberg test is inadequate, and a recent study performed on healthy subjects has shown the reliability of static single leg stance balance testing to be poor. In a recent study by Iverson, normative data for the modified BESS for adults are published.¹¹

“The onset of disease can begin long after the last brain trauma, and has typically only been diagnosed after the death of the patient.”

There are practical issues to consider with both forms of the BESS as a sideline test. All baseline testing is typically done in the clinic on firm surfaces either in runners or barefoot. No ankle tape or ankle braces are used. Sideline testing is typically done on grass in cleats with ankles taped or braced. Ideally any baseline balance testing should be done under ‘match’ conditions. Balance testing done to assess recovery from concussion should also be done under similar clinical conditions.

Timed dynamic balance tasks may be used for the sideline diagnosis of concussion and the assessment of recovery from concussion. Schneiders et al reported that dynamic balance tasks in healthy subjects have been reported as practical and reliable measures of motor performance. No data exist on the reliability of timed dynamic balance tasks in concussed athletes. Timed dynamic balance tasks should be done under ‘match conditions’ if they are to be used field-side or if they are used to assess postural stability in concussion recovery. Newer balance testing regimens may incorporate cognitive tasks during balance testing. The tandem gait has also recently been added to the SCAT3 assessment.^{9,10}

The advent of smart phones with onboard accelerometer and gyroscope systems will allow the development of novel methods of balance assessment on the sideline and during



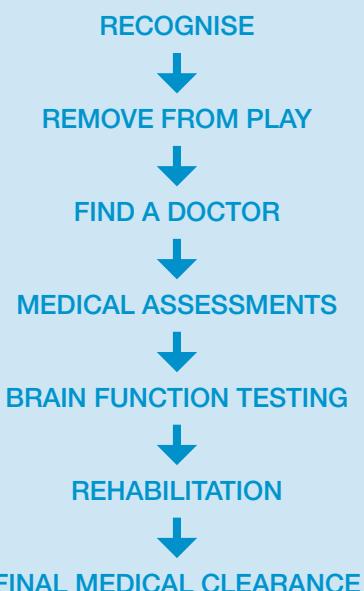
concussion recovery. Smart phone systems have the capacity to evaluate balance function during dynamic activity with higher sampling frequencies and greater accuracy than human observation alone. Novel algorithms using three dimensional accelerations can compare relative symmetry difference values in standing postures and dynamic gait function. Significant variation in dynamic gait function from baseline could aid in the diagnosis of concussion, or be a useful measure of concussion recovery.

"Urgent hospital referral is necessary for any player who has lost consciousness as a result of a blow to the head or body."

How does the athlete get back to playing sport?

Players should return to activity only after symptoms have gone away. Initial balance and visual training can start within days of concussion. Once the player feels well, exercise can begin and be made more challenging every 24 hours. If a player starts to feel unwell during or after exercise, they should rest for 24 hours and then attempt the same exercise challenge. Only when a player hands a written medical clearance from a doctor to their coach, can that player start contact training or practice once again.

Concussion Action Plan



Dr Ryan Kohler

References, as indicated within the article, are available at sma.org.au/publications/sport-health

The concussion modifiers

Clinical features may be associated with a higher risk of adverse outcome following concussion in sport



One of the difficulties when managing concussion in sport is there are few factors that help the clinician predict outcome following injury. Dr Michael Makdissi, Professor Gavin Davis and Professor Paul McCrory present an abridged version of a paper prepared for the 4th International Conference on Concussion in Sport¹, providing an overview of the clinical factors that may influence timing of recovery or potential risk of complications following concussion in sport.

Concussion in sport reflects a functional injury rather than structural damage to the brain. The clinical features of the condition typically come on rapidly and resolve over a sequential course.²⁻⁵ Whilst the time course of recovery is variable, the evidence suggests that the majority of concussed athletes recover clinically within 10 days of injury.²⁻⁵ Concussion however is not a benign injury. A small percentage of athletes suffer complications such as persistent symptoms and in rare instances of concussion in children and adolescents, malignant cerebral oedema may result.²⁻⁵ Furthermore, there is growing concern regarding an association between repeated head trauma and long-term risk of depression and/or dementia.⁶⁻⁹

“In adults, the majority of concussions resolve clinically within 10 days of injury.”

One of the key difficulties for clinicians is there are few factors to reliably predict which athletes will recover uneventfully, and which athletes will run into trouble following their concussion.²⁻⁵ At the 3rd International Conference on Concussion in Sport, a number of clinical features or ‘modifiers’ were identified as being associated with an increased risk of prolonged recovery or complications following concussion (Table 1 opposite).^{4,10} A number of other factors, such as female gender and genetics were considered at the time; however, it was decided that there was insufficient evidence for their inclusion as modifiers.⁴

The concussion modifiers were reviewed at the 4th International Conference on Concussion in Sport.^{1,5} This article provides an overview of the findings of this review.

“The main problem with relying on symptoms is that they are subjective and often not well recognised or incompletely reported by athletes.”

Table 1 – Concussion modifiers^{4,5}

Factor	Modifier
Symptoms	Number
	Duration (>10 days)
	Severity
Signs	Prolonged loss of consciousness (>1min) Amnesia
Sequelae	Concussive convulsions
Temporal	Frequency – repeated concussions over time
	Timing – injuries close together in time
	‘Recency’ – recent concussion or traumatic brain injury
Threshold	Repeated concussions occurring with progressively less impact or slower recovery after each successive concussion
Age	Child and adolescent (<18 years old)
Co- and pre-morbidities	Migraine, depression or other mental health disorders, attention deficit hyperactivity disorder, learning disabilities, sleep disorders
Medication	Psychoactive drugs, anti-coagulants
Behaviour	Dangerous style of play
Sport	High risk activity, contact and collision sport, high sporting level

Symptoms

There is good evidence of a relationship between the number and severity of symptoms and the overall severity of the concussion. The consistent finding is that the higher the number and severity of symptoms reported at the time of injury, the higher the severity of concussion.¹¹⁻¹⁴ In addition, athletes reporting four or more symptoms are more likely to take longer to recover following concussion.

Other clinical features that have been associated with prolonged recovery include amnesia,¹⁵⁻¹⁸ prolonged headache,^{12,16,18} fatigue or fogginess,^{12,17-19} self-reported cognitive or memory problems,^{13,17,20} and dizziness at the time of injury.²¹

The main problem with relying on symptoms is that they are subjective and often not well recognised or incompletely reported by athletes.²²

“One of the key difficulties for clinicians is there are few factors to reliably predict which athletes will recover uneventfully, and which athletes will run into trouble following their concussion.”





Signs

Loss of consciousness (LOC) and impact seizures

Traditionally, LOC has been a clinical marker for higher injury severity in traumatic brain injury (TBI).²³ Studies on concussion in sport however have demonstrated that brief LOC does not appear to reflect injury severity or predict time to clinical recovery.^{12,15,21,24} One study however demonstrated that concussed players with prolonged LOC (>1 minute) were more likely to miss seven or more days of sport.¹⁷ No other studies have been published on prolonged LOC.

“... the presence of any modifier following a concussion should raise awareness of a more complicated injury with a higher risk of poor outcome.”

In a large-scale retrospective series in Australian football, impact seizures were demonstrated to be benign with no adverse clinical, cognitive or neuroimaging outcomes observed either at the time of injury or long-term follow up.²⁵ No new studies have been published on outcome following impact seizures since this time.

“... previous concussion is a risk factor for future concussion.”

Overall, brief LOC and/or impact seizures do not reliably predict outcome following concussion. In athletes with prolonged LOC or impact seizures (i.e. >1 minute) however, a cautious approach to management should be followed and structural head injury or underlying seizure disorders should be considered.

Concussion history

1. Concussion history and malignant cerebral oedema

Malignant cerebral oedema following head injury is a rare but well-recognised condition.²⁶ It is more common in children than in adults and typically has a poor outcome.²⁶ Although the condition (previously called ‘second impact syndrome’) has been linked to recurrent head trauma, the scientific evidence to support this theory is limited.²⁷

“... the higher the number and severity of symptoms reported at the time of injury, the higher the severity of concussion... athletes reporting four or more symptoms are more likely to take longer to recover following concussion.”

2. Concussion history and risk of acute concussion

A number of studies have consistently demonstrated that previous concussion is a risk factor for future concussion.²⁸⁻³²

It has been proposed that head trauma may reduce the threshold for future concussions. In one prospective study in collegiate athletes, the majority of repeat concussions were observed within 10 days of an initial injury, suggesting a possible 'window of vulnerability' for further concussion.³⁰ This finding however has not been replicated in other prospective cohort studies, with no obvious pattern demonstrated in the incidence or timing of repeat concussions.^{12,33} Style of play may be an important confounding variable, whereby tackling technique and illegal tackles may be important risk factors for head injury.³¹

3. Concussion history and timing of recovery following concussion

In general, athletes with a previous history of concussion are more likely to present with a longer duration of symptoms and are withdrawn from competition for longer following their injury. There is limited evidence to suggest that the timing or 'recency' of injury makes some difference to timeframe of recovery following concussion.³⁴ There is also limited evidence to suggest longer timeframes of recovery for each subsequent concussion.¹⁸

"Consideration should be given to a multidisciplinary team approach, which should include referral to a doctor with expertise in managing concussion in sport."

4. Concussion history and long-term deficits

Many of the early studies on long-term deficits following concussion were cross-sectional in design and used performance on cognitive testing to estimate impairment. Major limitations included a reliance on retrospective recall of concussion history, which is known to be inaccurate and unreliable,^{35,36} and failure to account for important variables that can impact on cognitive performance, such as age, education, alcohol use and other socio-economic factors.³⁷

Not surprisingly, the results of these studies were conflicting regarding the effect of repetitive head injury on brain function, with some studies demonstrating impaired cognitive performance in athletes reporting a history of two or more concussive injuries,³⁸ and others failing to demonstrate any significant effects of self-reported concussion history on cognitive performance.³⁹

Higher quality studies using prospective designs and/or medically verified concussions have been published in recent years. Furthermore, more sophisticated investigation



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techniques looking at brain function and connections are now available. The use of advanced imaging and investigation techniques has demonstrated persistent changes in some individuals after concussion, especially those with prolonged symptoms.⁴⁰⁻⁴³ At present, the clinical significance of these changes remains unclear. Nevertheless, in the clinical setting it is prudent to adopt a conservative approach in the management of athletes involved in sports with a high risk of recurrent head trauma or those who present with recurrent concussions.

Age

It has been suggested that the impact force required to produce concussion is greater in children than adults. The poorly developed cervical musculature, in combination with the increased head to neck ratio in children, results in greater injury to the child's brain for the same impact force.^{44,45} Recovery from concussion in children generally takes longer than in adults. This is evident in time taken for symptom resolution, as well as neurocognitive recovery.⁴⁶⁻⁴⁹ Consequently, it is recommended that children should be managed more conservatively than adults.

“... brief LOC and/or impact seizures do not reliably predict outcome following concussion.”

Other factors

Other factors are included as concussion modifiers because they can impact on the ability to assess a patient following concussion (e.g. co-morbidities, medications) or affect the future risk of concussion (e.g. contact versus other sports).

Summary

In adults, the majority of concussions resolve clinically within 10 days of injury. The current study reviewed the literature regarding clinical factors associated with prolonged recovery or poor outcome.

The current literature supports the role of a number of clinical factors as concussion modifiers. It is important to note however that whilst an association has been demonstrated between the modifiers and risk of poor outcome following concussion, in many cases (e.g. recurrent head trauma) a causal link has not been clearly established. Nevertheless, the presence of any modifier following a concussion should raise awareness of a more complicated injury with a higher risk of poor outcome. Consequently, a more conservative



approach is recommended, including more detailed assessment and slower time to return to sport. Consideration should also be given to a multidisciplinary team approach, which should include referral to a doctor with expertise in managing concussion in sport.

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References, as indicated within the article, are available at sma.org.au/publications/sport-health

Management issues in paediatric sports concussion



Neurosurgeon, Professor Gavin Davis highlights how concussion in children should be managed, the symptoms and signs to look for and the guidelines to follow.

Sports concussion is more common in the paediatric age group than any other group of athletes, with the reported incidence up to 1 per 1,000 athlete exposures^{1,2}. It is generally accepted that fewer than 20 per cent of concussed children are diagnosed with concussion, with fewer again seeking medical attention. It is therefore imperative that those managing children in sport are aware of the (i) possible symptoms and signs of concussion, (ii) have an essential game-day management plan, (iii) institute the appropriate medical referral following concussion, (iv) develop an individualised recovery program, (v) implement an appropriate return to school program, and (vi) provide age appropriate return to sport advice.

Children are not merely 'little adults' but have significant physical, physiological and developmental differences that place them at risk of long term sequelae if sports concussion is not managed appropriately. A child's brain cells become myelinated (develop neural insulation which increases the speed of processing brain signals) in a progressive, stereotypical fashion with age³. In addition to the rate of myelination changing over time, different brain regions develop myelination at different ages – thus concussion effects will differ according to the child's level of myelination. It is well appreciated that concussion may take longer to recover in younger children than in adolescents and adults, and therefore, a more conservative approach to management is required in this age group.⁴⁻⁶

“... referral to a medical practitioner for formal assessment is required in all cases... to exclude underlying structural injury.”

It should also be appreciated that children with concussion are at potential risk of malignant cerebral oedema.⁷ Whilst this condition is extremely rare, its consequences are often catastrophic. Therefore, management of concussion in children requires a different paradigm, reinforcing the requirement for a conservative approach.

Symptoms and signs of concussion

It is critical to appreciate that loss of consciousness (LOC) does not occur in many cases of concussion². Whilst LOC is usually a straightforward sign to recognise, the other possible symptoms and signs of concussion must be appreciated in order to avoid missing the diagnosis. Concussion should be suspected in the presence of any one or more of the following:

- Symptoms (e.g. headache).
- Physical signs (e.g. unsteadiness).
- Impaired brain function (e.g. confusion).
- Abnormal behaviour (e.g. change in personality).

“Whilst concussion in children is common, if appropriately managed, the child will usually progress to rapid recovery with return to school and subsequent return to play.”

At the recent 4th International Conference on Concussion in Sport held in Zurich, in November 2012, a specific set of tools was developed to assist in the diagnosis of children aged 5 to 12 years (ChildSCAT3), whilst the 'adult' tool (SCAT3) was deemed appropriate for use in children aged 13 to 17 years.⁸ (Free download of the ChildSCAT3 and SCAT3 is available at <http://bjsm.bmjjournals.com/content/47/5.toc>). The ChildSCAT3 and SCAT3 were developed to be used by medical professionals; while a more general tool for use by lay persons was also developed (Pocket Concussion Recognition Tool [CRT]). The CRT includes a list of visible clues of suspected concussion, in addition to symptoms and signs that may suggest a concussion (see Figure 1 [CRT]). Whilst the CRT list of symptoms and signs is for use in athletes of all ages, the ChildSCAT3 includes a specific list of symptoms that has been validated in children.⁹ This symptom list includes a child-report list and a separate parent-report list of symptoms. The child-reported symptoms may be used on the day of injury, whilst both the child and parent lists may be used on all subsequent days, to assess and monitor recovery.

Figure 1: Pocket Concussion Recognition Tool.

Pocket CONCUSSION RECOGNITION TOOL™

To help identify concussion in children, youth and adults

RECOGNIZE & REMOVE

Concussion should be suspected **if one or more** of the following visible clues, signs, symptoms or errors in memory questions are present.

1. Visible clues of suspected concussion

Any one or more of the following visual clues can indicate a possible concussion:

- Loss of consciousness or responsiveness
- Lying motionless on ground/Slow to get up
- Unsteady on feet / Balance problems or falling over/Incoordination
- Grabbing/Clutching of head
- Dazed, blank or vacant look
- Confused/Not aware of plays or events

2. Signs and symptoms of suspected concussion

Presence of any one or more of the following signs & symptoms may suggest a concussion:

<ul style="list-style-type: none"> - Loss of consciousness - Seizure or convulsion - Balance problems - Nausea or vomiting - Drowsiness - More emotional - Irritability - Sadness - Fatigue or low energy - Nervous or anxious - "Don't feel right" - Difficulty remembering 	<ul style="list-style-type: none"> - Headache - Dizziness - Confusion - Feeling slowed down - "Pressure in head" - Blurred vision - Sensitivity to light - Amnesia - Feeling like "in a fog" - Neck Pain - Sensitivity to noise - Difficulty concentrating
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3. Memory function

Failure to answer any of these questions correctly may suggest a concussion.

"What venue are we at today?"
"Which half is it now?"
"Who scored last in this game?"
"What team did you play last week/game?"
"Did your team win the last game?"

Any athlete with a suspected concussion should be IMMEDIATELY REMOVED FROM PLAY, and should not be returned to activity until they are assessed medically. Athletes with a suspected concussion should not be left alone and should not drive a motor vehicle.

It is recommended that, in all cases of suspected concussion, the player is referred to a medical professional for diagnosis and guidance as well as return to play decisions, even if the symptoms resolve.

RED FLAGS

If ANY of the following are reported then the player should be safely and immediately removed from the field. If no qualified medical professional is available, consider transporting by ambulance for urgent medical assessment:

- Athlete complains of neck pain
- Deteriorating conscious state
- Increasing confusion or irritability
- Severe or increasing headache
- Repeated vomiting
- Unusual behaviour change
- Seizure or convulsion
- Double vision
- Weakness or tingling/burning in arms or legs

Remember:

- In all cases, the basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the player (other than required for airway support) unless trained to do so
- Do not remove helmet (if present) unless trained to do so.

from McCrory et. al, Consensus Statement on Concussion in Sport. Br J Sports Med 47 (5), 2013

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Game-day management

On the day of injury, if there is any suspicion of a concussion, the child must be removed from the field of play, be medically assessed, and is not to return to play that day. In the acute assessment period, the standard first aid rules must be applied, including appropriate management of the airway, breathing and circulation, with due care of the cervical spine. To assist in developing a game-day management plan, the Australian Football League (AFL) has produced guidelines for the community management of concussion, including the management of children with suspected concussion (see appendix). The AFL guidelines describe the three important steps in the game-day management of concussion in children as:

1. Recognising the injury.
2. Removing the player from the game.
3. Referring the player to a medical doctor for assessment.

“When returning children to play, they should be medically cleared and then follow a stepwise supervised program...”

Any person responsible for the management of children in sport must have read and understood these guidelines, and developed a management plan that may be rapidly implemented in the case of suspected concussion. Given that children sustain concussion not only on the sports field, but also in the schoolyard, playground and local park, the responsible adult caring for the child may be the team coach, a trainer, a teacher, a parent, or even an older sibling. Whoever is responsible should follow these guidelines.

“Medical clearance is required before the child may return to school.”

Referral for medical assessment

As part of the management guidelines, referral to a medical practitioner for formal assessment is required in all cases. This is particularly important to exclude underlying structural injury. The medical practitioner may be present at the game. If not, referral to the local general practice or hospital emergency department is required. The appropriate emergency telephone numbers should be provided to trainers and other staff involved in match day care before the commencement of play. It is appropriate to include this list of telephone numbers with the CRT provided to every trainer at the start of each sporting season.

“... the primary goal in the management of children following concussion is return to school/learn, rather than return to sport. This is a critical difference between the management of adults and children with concussion.”

Develop a recovery program

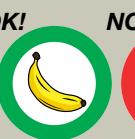
As described, children may often take longer to recover than adults following concussion. As such, an appropriate recovery program should be developed. The first step involves explanation to the child and the parents. The explanation should include the likely symptoms, the expected duration of symptoms, and the impact this will have on home activity, school activity and sport. They should also be provided with a list of symptoms and signs to watch for that may indicate development of a more significant intracranial injury.

In the first few days following concussion, the child should have physical and cognitive rest. The child must not return to school or sport during this period. It is expected that most children will be able to return to school after one to two days, but extended absence may be required in some circumstances.

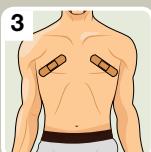
Rest should include refraining from sport, school, reading, computer, internet activity, and electronic games. The child may gradually introduce cognitive activities, if they do not result in a worsening of symptoms. Following symptom resolution, the child may proceed to the return to school program, as described overleaf. Medical clearance is required before return to school. It should be stressed that the primary goal in the management of children following concussion is return to school/learn, rather than return to sport. This is a critical difference between the management of adults and children with concussion. The child is not to return to play until successful return to school is achieved.



IF



PREPARE FOR THE RUN

IF YOU FEEL LIGHT-HEADED,
YOUR DOG WILL PROVIDE OXYGEN

FOLLOW THESE ESCAPE METHODS TO FLOAT

ALWAYS REMEMBER
THE NEAREST
EXIT FROM YOUR
DAILY ROUTINETRANCE 12
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Return to school

As described previously, cognitive development in the child may be affected by concussion, and as such, it is critical to manage the return to school process carefully, to ensure the child is provided with the maximal opportunity to learn. Medical clearance is required before the child may return to school. It is reasonable for a child to miss a day or two of school after concussion, but extended absence is uncommon. When the child is asymptomatic, or mild symptoms are not worsened by mental activity, the child may commence the return to school process. In most cases, return to fulltime class activity will occur one to two days following the concussion. However, for the child with persistent symptoms, a more individualised program is required, which will require a team approach with the child, parents, doctor, teachers and other health professionals.

Developing a program for children with persistent or delayed symptoms requires consideration of:

- Extra time to complete assignments/tests.
- A quiet room to complete assignments/tests.
- Avoidance of noisy areas such as cafeterias, assembly halls, sporting events, music class.
- Frequent breaks during class, homework, tests.
- No more than one exam/day.
- Shorter assignments.
- Repetition/memory cues.
- Use of peer helper/tutor.
- Reassurance from teachers that the student will be supported through recovery via accommodations, workload reduction, alternate forms of testing.
- Later start times, half days, only certain classes.

“On the day of injury, if there is any suspicion of a concussion, the child must be removed from the field of play, be medically assessed, and is not to return to play that day.”

When the child has successfully returned to school, is asymptomatic, and has undergone medical clearance, a return to sport program may be developed.

Return to sport

There should be no return to play until the child has successfully returned to school/learning, without a worsening of symptoms. Children must not be returned to play the same day of injury. When returning children to play, they should

be medically cleared and then follow a stepwise supervised program, with the following stages of progression:

Rehabilitation stage	Functional exercise at each stage of rehabilitation	Objective of each stage
No activity	Physical and cognitive rest	Recovery
Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity, 70 % maximum predicted heart rate. No resistance training	Increase heart rate
Sport-specific exercise	Skating drills in ice hockey, running drills in soccer. No head impact activities	Add movement
Non-contact training drills	Progression to more complex training drills, eg passing drills in football and ice hockey. May start progressive resistance training	Exercise, coordination, and cognitive load
Full contact practice	Following medical clearance participate in normal training activities	Restore confidence and assess functional skills by coaching staff
Return to play	Normal game play	

There should be approximately 24 hours (or longer) for each stage and the child should drop back to the previous asymptomatic level if any post-concussive symptoms recur.

“Sports concussion is more common in the paediatric age group than any other group of athletes...”

If the child is symptomatic for more than 10 days, then review by a health practitioner, an expert in the management of concussion, is recommended. Medical clearance should be given before return to play.

Conclusion

Whilst concussion in children is common, if appropriately managed, the child will usually progress to rapid recovery with return to school and subsequent return to play. It is crucial that those caring for children in sport are familiar with the symptoms and signs of concussion, and have developed appropriate guidelines to manage concussion in children. It is critical for the child's cognitive development that return to activity is introduced in a stepwise fashion, and that management of concussion in the child is more conservative than in adults. The child's ability to return to learn depends on it.

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References, as indicated within the article, are available at sma.org.au/publications/sport-health

Appendix: AFL Guidelines – The management of concussion in Australian football with specific provision for children 5–17 years can be accessed at <http://www.aflcommunityclub.com.au/index.php?id=66>

Life and education after brain injury



Sport Health interviews Gary Johnston, an SMA staff member who suffered a severe brain injury which left him paralysed and brain damaged early on in his sporting career.

Tell us a little bit about yourself.

I have been involved in sport all of my life, as an athlete, coach, sports trainer, manager and spectator, in various sports. I live in the outer suburbs of Brisbane with my beautiful wife and two wonderful children.

What is your position with Sports Medicine Australia?

Education and Business Development Manager for Sports Medicine Australia Queensland Branch.

What does this involve?

Sports Medicine Australia Queensland Branch is the peak body providing sports medicine membership and educational services to the Queensland sporting community and to sports medicine professionals.

As the Education and Business Development Manager my key roles are to raise awareness of the importance of appropriate injury prevention and management training in sport, maintain

our high standard of course delivery in the SMA Safer Sport Program courses and as a result hopefully increase the number of people who undertake this important training.

“... I collapsed and was taken to hospital in a coma. I woke up two years later completely paralysed and brain damaged.”

Why did you get involved in promoting safety in sport?

Sport is an avenue that brings communities together, gives people a sense of belonging and also gives those who cannot be involved an opportunity to stay involved at a support staff/administration level. Sports safety is paramount within the sporting community, as when we feel we are in danger we tend to back away from the suspected risk – sports safety ensures that the game continues.

Tell us a little bit about your sporting career when you were younger.

I was fortunate to play all different types of sport when I was younger. These ranged from rugby league, to cricket, to hockey, to swimming. It really didn't matter what it was as long as I was running or kicking a ball, I felt like I could conquer the world.

“The severity of a concussion in the long run will be determined by how well it is managed when it occurs.”

I come from a sporting family who reached high levels within competitive sport in their chosen fields, so naturally I set high goals for myself and remained focused on achieving those goals which was to play rugby league in the Winfield Cup (now known as the NRL Telstra Premiership).

I understand you endured a serious brain injury during your football career. Can you describe this?

I used to play centre in rugby league and in a particular game when one of our forwards went off the field due to injury I was moved to that position. I suppose I suffered quite a few head knocks that game, including a head clash, a high tackle and a collapsed scrum – I don't really remember much at all, everything has been explained to me over the years.

I was left on the ground and the sports trainer who attended to me didn't recognise the signs and symptoms of my head injury, i.e. slurred speech, uncoordinated movement.* I was allowed to continue playing, and ended up setting up another

try and converted the goal to win us the game. To all of the spectators I appeared to be ok, however the players around me noticed that I was not my normal self.

We celebrated the win after the game in the dressing sheds. Upon leaving the sheds, I collapsed and was taken to hospital in a coma. I woke up two years later completely paralysed and brain damaged.

How did your club handle this situation?

I really don't know but their support was ongoing throughout my time in hospital and recovery, hence the reason why I am still here today. They were instrumental in supporting my parents through my ordeal; as the last rights were read over me a few times, when my parents were pressured to turn off the life support machine and the ongoing monetary pressure they faced.

What was your recovery like?

My recovery was a long and painful process of doctors and physios. It took me a couple of years to regain function within my legs to walk unassisted and eventually run. I still have a limp on my left side which becomes more evident with fatigue. While most people wouldn't notice, I still have residual effects from my brain damage and have precautionary scans on an ongoing basis. I suffer from headaches, occasional memory loss and slurred speech sometimes. I have no memory before my accident.

"I can now say that I have fulfilled my dream in representing Australia in rugby league on home soil and overseas."

Many times I wanted to give up, my focus was sport and I knew that now I could never be a monumental part of the game I loved. I felt sorry for myself and had to battle the psychological demons as well as the physical barriers that were stopping me from reaching my dream of representing Australia in rugby league. I had to face the fact that this was now never going to be a reality which tore me up inside.

Then a real tragedy happened in my life that involved two of my best friends, and I really hit rock bottom. I felt sorry for myself and thought to hell with everything.

At that point in time I met my two idols – Mal Meninga and Arthur Beetson who both advised that I could be anything I wanted to be.

I thought about how I could stay involved in sport (as sport was when I was the happiest in my life). I couldn't play anymore however I made a decision to stay involved as a sports trainer and ensure that no one would be mismanaged in regards to injury management whilst I was around. I started to learn more about the body and how it works, then began to volunteer my time around sporting communities and schools as the sports trainer for their events and carnivals. I enjoyed being involved in sport again and set my new sites on becoming a sports trainer. I can now say that I have fulfilled my dream of representing Australia in rugby league on home soil and overseas. I have also represented many international sides and Queensland teams in various sports. As a sports trainer.

"They were instrumental... as the last rights were read over me a few times, when my parents were pressured to turn off the life support machine and the ongoing monetary pressure they faced."

What are your thoughts on how sporting clubs handle concussion currently?

I personally feel that not enough is being done in some codes of sport however we are always trying to continually improve awareness on the subject.

There is now evidence that in contact sports there is a link to long lasting effects on the brain after a concussive injury. I hear many people dwell on the problem but only a handful are working on a solution. I am not saying that injuries will be prevented in sport but there must be a better way of managing our athletes and we can only achieve this through research and education.

What does Sports Medicine Australia teach sporting clubs/personnel in regards to managing concussion?

Some of the things we teach in our courses are that if someone has sustained a concussion that it is best to take a conservative approach before they return to sport, especially as it's now thought that full recovery of brain function may take longer than previously thought. We also teach lay people and sports trainers what the signs and symptoms of concussion are and we reinforce the importance of anyone with symptoms of concussion obtaining medical clearance before they return to play.

"Our goal in Queensland is to have at least one properly trained person in a dedicated sports safety role at every sports event."

The severity of a concussion in the long run will be determined by how well it is managed when it occurs. This is why education of trained sporting personnel is so important. The need for better education at all levels and across all sporting codes in regards to concussion is certainly evident.

Why are Sports Medicine Australia Safer Sport Program courses so important?

They increase the number of people who can be present at sports events who have a basic idea of what to do, and also what not to do, if someone is hurt or has a medical problem. Our goal in Queensland is to have at least one properly trained person in a dedicated sports safety role at every sports event. There aren't enough health professionals to cover all of the events so SMA Safer Sport Program accredited sports trainers and sport first aiders are necessary to cover the gap.

What are the main tools sporting clubs need to handle concussion appropriately?

Sports need to have clear sports safety guidelines in place for their particular sport and to make sure that everyone involved knows what those guidelines are. Everyone involved in sport, players, coaches, and parents need to be educated on the correct return to play practices, in order to correctly manage concussions, if and when they occur.

"... not enough is being done in some codes of sport however we are always trying to continually improve awareness on the subject."

Sports Medicine Australia provides education at all levels in regards to concussion. Our sports trainers are trained in the recognition of concussion and are across how it should be managed and the appropriate return to play management.

Please contact Gary Johnston on 07 3367 2700 or email gjohnston@sportmedicine.com.au for any information concerning Sports Medicine Australia Queensland Branch Safer Sport Courses.

* When a player is on the field complaining of neurological symptoms, without further assessment (i.e. including taking him off the field) severe brain injury can't be ruled out and this is one of the major arguments for removing players from the field.



Image supplied by Elsevier from Sports Medicine for Sports Trainers, 10th Edition, 2013. Image by Chris Canham Photography.

Concussion in rugby union



Sport Health interviews Warren McDonald, Chief Medical Officer of the Australian Rugby Union on the subject of concussion in his sport.

What is the prevalence of concussion in rugby union?

It is difficult to be precise but we know that it is a significant number. There are a few reasons as to why it is difficult to be accurate;

1. There has been a lack of reporting in contact sports in general.
2. The diagnosis of concussion is a clinical diagnosis, and there is no test that is the 'gold standard' for diagnosis.
3. A perception that concussion isn't a real or significant injury and, particularly in contact sports, that you have to toughen up and get on with playing.

As a result I think it is safe to say that there has been a general under-reporting of concussion in sport in general, particularly in contact sports, and that there have been a large number of unreported concussions.

"The headgear that is worn by rugby union players protects the face, scalp and ears from superficial injuries but we don't believe it will protect a player from concussion."

In the Australian context, Australian Rules football is recognised as the code with the highest incidence, followed by the rugby codes. At least part of the reason for this is that Australian Rules football is a 360 degree game; players can be contacted from any direction and are often unprepared for this contact. In rugby union and rugby league, one usually can see the contact coming and can brace/prepare themselves for this.

"Whilst five minutes is a relatively short time to assess a player... the trial is showing a very high correlation between the results... and the subsequent diagnosis of concussion."

Does the management of concussion in rugby union differ from that of other major football codes in Australia?

All the football codes in Australia have a similar approach to the management of concussion which is based on the Zurich Consensus Conference guidelines.

The guidelines for rugby are produced by the International Rugby Board (IRB) who were one of the sponsors of the Zurich conferences. That means within rugby the same principles should be adhered to in all competitions worldwide.

Can you explain some of the changes to concussion that have taken place recently?

There have been significant changes to the guidelines for concussion management over the last few years, specifically after the Zurich conference of 2008 and modified after the 2012 conference.

Historically, rugby has long had a concussion regulation that stated that any player diagnosed with concussion was to stand down from playing and training for three weeks before returning. There were ways of circumventing this requirement and returning sooner if the player was assessed by a neurological specialist. However, it was recognised that a lot of people either did not know of or ignored this regulation.

"We are still some way off perfecting the science around the topic, but we have made huge strides in the last few years."

Rugby (specifically the IRB) changed its guidelines in 2011. The principles of these guidelines are;

1. Concussion must be taken seriously to protect both the short term and long term welfare of the athlete.
2. Any player with suspected concussion **must** be removed from the field of play or training and not returned to the field of play or training on the same day.
3. Must be medically assessed to confirm whether they have concussion or not.
4. If diagnosed with concussion must go through a graded return to play protocol.
5. Players who have suffered a concussion must receive a medical clearance before returning to play.

We believe these guidelines approach concussion management appropriately. The introduction of these new guidelines has been a significant step forward and concussion management is now a more clearly defined process.

"I think the changes that have been made in the management of concussion over the last couple of years are very positive."

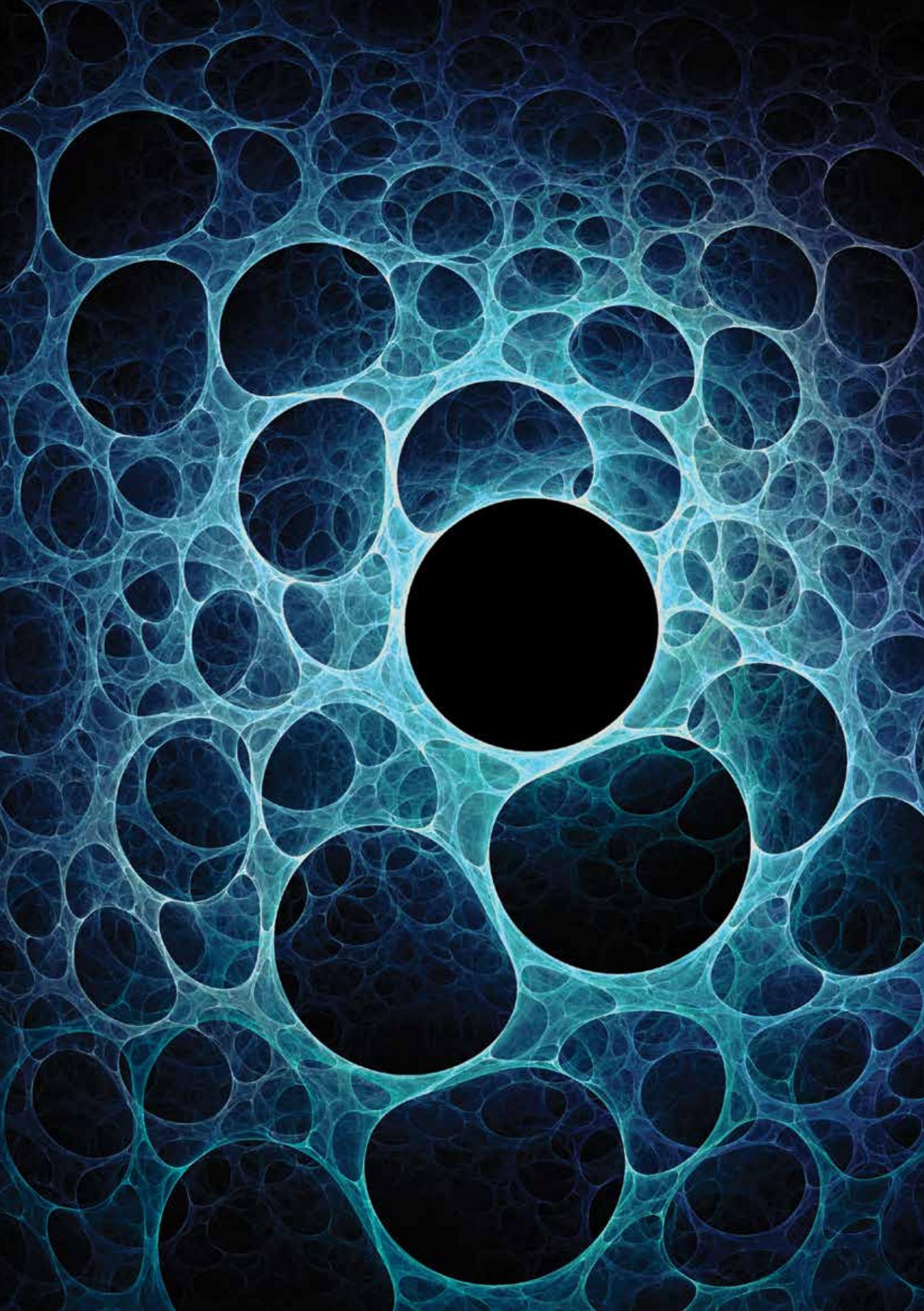
The other change in concussion management has occurred at the elite end of the game where there has been the introduction of a Pitchside Suspected Concussion Assessment (PSCA) process. This is being trialled at present and is only for the very top levels of the game where there are enough appropriately trained people to administer the process. The trial began



in mid-2012 and so far it appears to be providing accurate assessments of whether a player should be removed from the field of play after receiving a potential concussive injury.

Essentially any player suspected of having a concussion can be removed from the field of play for five minutes to be assessed. The assessment is standardised and designed to exclude concussion, not diagnose it. If a patient passes the testing process they are allowed to return to play; if they fail one component of the test they are not allowed to return. If they are able to return to the field of play, they are still monitored regularly throughout the remainder of the game. All players who go through this process (whether they return to the field or not) are then tested after the game and the following days to assess whether they develop any symptoms or signs of concussion.

"... I think the message has to be that concussion is a real injury with the potential to cause both short and long term consequences."



At present, there is variation in the time available to establish whether concussion has occurred.

Why is this? How long is appropriate?

I believe this question is referring to the AFL who have introduced a concussion bin this year which allows a player up to 20 minutes to be assessed and return to the game if they are deemed fit to do so. As much as anything, the different timeframes reflect the differing nature of the replacement rules in the sports. AFL has continuous and rolling substitutions throughout a game. Rugby has a limited number of replacements and once a player is replaced he cannot return to the game except in the case of a blood injury or if there is a safety issue, such as a front row injury. In rugby the five minute PSCA is an opportunity to assess a player so it therefore protects player welfare, it does not change the fabric of the game and is not a long enough time to allow tactical manipulation of the bin by coaches.

“The introduction of these new guidelines has been a significant step forward and concussion management is now a more clearly defined process.”

We recognise that concussion can be an evolving injury and any player who is assessed using the PSCA requires ongoing assessment throughout and after the game, whether they return to the game or not. Whilst five minutes is a relatively short time to assess a player, it is significantly more than was previously available to assess a player and so far the trial is showing a very high correlation between the results of the PSCA and the subsequent diagnosis of concussion. That is those players who return to the field of play following a PSCA are generally not subsequently being diagnosed with concussion, whilst those that are not allowed to return to play are very likely to be diagnosed with concussion. The trial is still in progress so the final outcome is still some way away but so far so good.

“The trial began in mid-2012 and so far it appears to be providing accurate assessments of whether a player should be removed from the field of play after receiving a potential concussive injury.”

What are some of the challenges for rugby union in implementing some of the recommendations made within this statement?

I think the biggest challenge is education of players, coaches, officials, medical staff and the public that concussion must be treated seriously. It is a real injury to the brain and the brain

needs to recover from injury like any other body part. As yet we do not know what the long term effects of concussion are, especially repeated concussions. However, I think the message has to be that concussion is a real injury with the potential to cause both short and long term consequences. It therefore needs to be treated appropriately. This is even more pertinent for young people.

“... there has been a general under-reporting of concussion in sport in general, particularly in contact sports, and there have been a large number of unreported concussions.”

As a Chief Medical Officer, what changes would you ideally like to see made?

I think the changes that have been made in the management of concussion over the last couple of years are very positive. I am very pleased that concussion is very topical at present. I think the publicity it has received has allowed us to get the message out to the public that concussion must be taken seriously and treated appropriately. We are still some way off perfecting the science around the topic, but we have made huge strides in the last few years. We need to change the culture that once said ‘you were tough and macho’ if you played on despite concussion; instead the message should be ‘you are injured, treat the injury’. You are not letting the team down by going off the field with a concussion – rather you are letting the team (and yourself) down by not going off when you are injured.

“I think the biggest challenge is education of players, coaches, officials, medical staff and the public that concussion must be treated seriously.”

There seems to be more rugby union players wearing helmets when compared to other football codes.

Does rugby union have any helmet policies in place? If not, why do you think rugby union players prefer to wear helmets?

Rugby does not have a specific headgear policy. The headgear that is worn by rugby union players protects the face, scalp and ears from superficial injuries but we don't believe it will protect a player from concussion. Concussion involves movement of the brain within the skull, and helmets/headgear do not prevent this. Despite this, I personally like the idea of players wearing headgear to protect injury to the face, scalp and ears. What I hope is that they do not provide players with a false sense of security that encourages reckless play.

The keys to business success

To help make the most of your business, *Sport Health* brings you the following business insights.

Essential elements of good web design

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Your website is often the first time a prospect connects with your business. That's why it needs to make the right impression and keep their attention.

Here are eight tips to a great website user experience:

- **Ditch the splash page:** it's become a thing of the past. Don't annoy your user with this useless page, you have 10 seconds to grab their attention and if they have to wait to get to the core info they won't stick around.
- **Easy navigation:** that invites your visitor to explore the pages of your site is essential. Make sure the navigation buttons are clear and legible. Use underlines, breadcrumb navigation or different colour buttons to indicate which page the user is viewing.
- **Clear contact details:** are essential. Don't make your user search your site for contact information. Ideally your phone number should be displayed on the top right hand corner of every page. A specific contact page with enquiry form is best, and reduces the risk of receiving spam. Adding an extra form to the home page for quick enquiries or quotes may assist traffic to your site.



- **Subscription forms:** helps to build your database but you need to spell out to the user what they are signing up for. If it's a newsletter, tell them how often they can expect to hear from you. Showing a newsletter sample or e-book sample on your website will assist the user in deciding if they want to subscribe.
- **Pop up windows:** will scream at your user and chase them away. Make sure your website is a calm and pleasant place to visit and respect your audience without the hard sell. Avoid blinking or flashing graphics, studies show that people find them extremely distracting.
- **Photographs:** can add a lot of personality to your website and help your target audience to connect with you. Stock photography is useful if chosen with care, however the best option is to organise an onsite photo shoot at your place of business. A professional photo of yourself and team on the appropriate page will allow your visitor to connect with you and personalise their website experience.
- **Text:** needs to be large enough to read and well contrasted. Black text on white is best for accessibility. White text on black or other colours can be difficult to read. Also consider that some people are colour blind, so keep colours simple and well contrasted to ensure your visitor is comfortable on your site. Large scrolling blocks of text will bore your visitor. Keep text to a minimum – succinct and informative is ideal.
- **Make it mobile:** as your site must be accessible on all devices such as tablets, iPads and mobile phones. It has to look good and function well so that your user can access all pages and contact you from the mobile website. (Tip: Flash sites do not work on Apple mobile devices).

The digital age is here to stay and websites are the porthole to your business. By keeping it simple, informative and easy to use your website will attract the right clients to your business.

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Women wanted – please apply now!

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Federal Sports Minister, Kate Lundy is currently leading the push to increase the number of women on the boards of sporting organisations, arguing that Australian sports codes would be better run and achieve better results with more women at the helm. Figures compiled by the Australian Sports Commission (February 2013) show that of the 58 sports funded by the commission, six have no female board members and 26 have just one.

This campaign for gender equity gained further momentum this April when the Australian Olympic Committee announced three women Olympians were to join its board, reaching the 40 per cent target Kate Lundy has set.

Disappointingly though, we are yet to see this trend continue in senior management and executive positions in sporting organisations. We do not attribute this to a lack of willingness of sporting organisations to employ women, but rather a low number of women applying for these senior management roles in the first place.

2012 was a record year for Sportspeople Recruitment, managing our highest ever number of global executive search assignments, including Chief Executives and High Performance Directors for clients in Melbourne, Canberra, Sydney, Auckland and Wellington. While the number of applications received for all these jobs has increased, it is disappointing to see the relatively low number of females applying for some of these senior roles. The same trend is not evident for entry level to middle management roles, where men and women are equally represented in the candidate pool.

We know the number of females on our database and generally within our entire network are at an all-time high; while our targeted approach for all recruitment assignments includes contacting female candidates within this network and of course, others identified as strong prospects for the role. Naturally our merit approach to all our recruitment work ensures we have the same practices for both male and female candidates.



Over the past decade for roles where Sportspeople Recruitment was responsible for the search, development and referral of a shortlist, 57.6 per cent of final appointments have been male and 42.4 per cent female. This includes roles across the full spectrum of responsibility, from entry-level to Chief Executive and virtually everything in between.

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And remember that old saying... if you're not in it, you can't win it! Don't hesitate applying if the only concern you have is that you may be unsuccessful.

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Make insurance pay off at tax time

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At this time of year many clients are considering various ways to reduce their tax liability, yet many are unaware of the tax benefits that come from having life insurance. Therefore, we look at Term Life Insurance (death cover) and Income Protection Insurance and their tax treatment.

One of the biggest advantages of having life insurance inside super is that you can use a tax deductible contribution (e.g. superannuation guarantee, salary sacrifice, or personal super contribution for self-employed individuals) to pay for the premiums. Please remember that the concessional contribution limits currently sit at only \$25,000; this contribution limit includes all contributions made to all superannuation funds in a financial year for both insurance and investment purposes.

There are four possible options when considering the funding of life insurance via superannuation:

- Salary sacrifice in super with reduction in superannuation guarantee payments.
- Salary sacrifice without reduction in superannuation guarantee payments.
- Normal superannuation guarantee.
- For the self-employed a life cover under a superannuation structure.

Clients will need to check with their employment agreements to ensure which option has been implemented by their employer.

When considering income protection insurance outside of super, the premiums are normally fully tax deductible if the life insured and the policy owner are the same. This applies to the self-employed and employees. Term life insurance and total and permanent disablement insurance (TPD) outside of superannuation will not receive a tax deduction for premiums that are paid. New rules also now apply for Life/TPD inside super where only a partial deduction can be claimed for the TPD cover. Newly designed policies are available through most life companies to maximise deductions for the TPD cover inside super. Your adviser will be able to give you the best advice on these new covers. Income protection is generally best structured outside superannuation, as is Trauma cover; the latter will be unavailable from July 1, 2013 inside super.

You should also consider the tax implication of benefit payments. When a lump sum death benefit is paid from a super fund to the member, if the benefit is paid to a taxation dependant, then the entire amount is tax free. There may be tax liability in other situations. The amount of tax depends upon the age of the member, and who the beneficiary is. It should be noted that taxation dependants are different to superannuation dependants. Under tax law, children over 18 are non-dependants unless financially dependent or can demonstrate an interdependency relationship.

In summary, seek advice from a professional adviser to ensure you get the best outcome.

For further information contact Graeme Crofts, Director on 03 5244 6876.

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Social media: Word-of-mouth marketing on a giant scale

Brought to you by ZOO Advertising



Following the success and popularity of SMA's recent webinar on marketing your sports medicine business via social media, we bring you a snapshot of some tips and tricks when approaching your social media presence.

It's no secret that social media has become a crucial digital tool in your brand's marketing strategy. But getting it right is the key.

Social media is like word-of-mouth marketing on a giant scale. The conversations you generate on social media travel to hundreds, even thousands of people. Social media will help you find new customers and clients, increase loyalty with existing customers and clients, extend your brand personality and increase your profile as an authority on a topic or subject area. In Australia, Facebook is by far the most significant social media presence with over 11 million Australians using a Facebook profile.

To make sure your business is making the most of this unique opportunity to directly engage and share information through a network of friends, family, business contacts and like-minded strangers, we've pulled together a few useful tips to help you get the results you're after:

- **Think about your brand:** Remember it is the essence of who you are, what you stand for and how you communicate with others. It includes your visual identity, logo, photos, images and your tone of voice.
- **Create a profile:** You will need three pieces of artwork – a profile picture, cover artwork (Facebook) and background artwork (Twitter). It's important to invest in your profile as an unprofessional social media profile will create negative associations amongst your existing and potential customers.
- **Develop a strategy:** Ask yourself what you want from social media. Understand what you want to achieve, be it more clients, customers, credibility or loyalty. Know how much time you are willing to invest – once a day, once a week or on an ad-hoc basis?

FACEBOOK USERS BY SPORTS MEDICINE INTEREST



Source: Facebook

- **What to say:** Have a conversation with your customers and clients. Offer creative but focused content that defines your brand identity and has worth for your target market. Encourage interaction through 'likes' and 'shares' by running competitions, special offers and promotions. Ensure that you post regularly and remember that people who either 'like' or 'share' will be promoting your brand to their online friends.
- **Complaints:** Complaints are inevitable when using social media but don't be tempted to delete negative feedback. Instead turn a negative into a positive by excellent customer service.

Remember don't underestimate the power of social media. Embrace it and you'll open your doors to the biggest audience in the world.

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Physical sideline tests for the assessment of sports concussion

A clinician's guide to the SCAT3



Dr Tony Schneiders, Senior Lecturer from the University of Otago looks at the neurological screening component of sideline concussion testing featured in the new SCAT3, which is aimed at assisting clinicians with diagnosis, injury severity determination and assessment of clinical recovery.

Sport-related concussion is a transient functional injury to the brain and considered a sub-category of mild traumatic brain injury (mTBI)¹. There is currently no single 'gold standard' for diagnosing concussion² and multiple assessment domains are utilised by health professionals in order to make a diagnosis which is fundamentally clinical in nature. These domains include neuro-cognition, post-concussion symptom evaluation, and physical assessment. Recently there has been a suggestion that physical performance-based measures may be superior to symptom reporting due to an athlete's tendency to not fully recognise their symptoms or even under report them³. Physical tests commonly utilised in concussion assessment include tests for balance, coordination, and gait, as these have been shown to be manifest in most persons who sustain a concussion but usually resolve within three to seven days of the initial injury.

“... while the CISG have made significant headway over the last decade regarding the standardisation and validity of sideline concussion testing as evidenced by the SCAT3, there is still quite some way to go.”

Rudimentary physical tests for concussion assessment were introduced in the 2005 Concussion in Sport Group's (CISG) Summary and Agreement Statement and were included in the Sport Concussion Assessment Tool (SCAT)⁴. These tests took the form of a basic gait assessment, the pronator drift test, and pupil motion observation which where all scored dichotomously as either pass or fail. These physical tests were therefore primarily subjective and subsequently replaced in the second edition of the SCAT (SCAT2)⁵ with a test for static balance using the modified Balance Error Scoring System (M-BESS)⁶ and the evaluation of hand-eye-coordination utilising the timed Finger-to-Nose test (FTN)⁷. Both these tests have been retained in the latest version of the CISG's screening tool; the SCAT3.



“... signs of a concussion could be masked by the previous activity/exercise if this test is conducted too soon after a concussion... a 15 minute pause before conducting these tests is therefore justified from a scientific perspective; however, it may not be pragmatic for many sports which do not have this window available for sideline testing of concussion.”

Finger-to-Nose Test

The FTN is a derivative of the classic neurological assessment for tremor, dysmetria, and dyskinesia and is a timed version that measures the speed and, to a lesser extent and indirectly, the accuracy of performing five repetitions of the test from a fully extended arm to a touch of the nose with the index finger. The test does have face validity, being specifically developed for use in sports concussion assessment but has yet to be fully evaluated in a specific concussion cohort. Normative values have been generated for the completion of this test and are in

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the vicinity of three seconds with small but significant gender, BMI, hand dominance and, trial effects⁸. The SCAT sets the screening threshold for this test at <four seconds which is two standard deviations (SD) above the mean. As part of the validation process for inclusion in the SCAT, Sullivan et al.⁹ studied the FTN's diagnostic ability in a cohort of patients with one or more structural lesions on neuroimaging and compared them with control subjects with normal imaging. This study reported high specificity but low sensitivity suggesting the FTN may not be able to rule out people who test negative for a structural brain injury. There is, however, some suggestion from this group's currently unpublished work that higher sensitivity is likely for this test in concussed patients who often have clear signs of decreased coordination immediately after injury without the comorbidity associated with patients with structural lesions (e.g. Multiple Sclerosis).

"The most recent Consensus Statement on Concussion in Sport... suggests a minimum rest period of 15 minutes before conducting the tests."

Balance Error Scoring System (BESS)

The BESS as used in the SCAT, was not originally designed to measure postural instability in concussed individuals but much research has been produced on it since it started being used for this purpose. The M-BESS consists of three static stances; double leg, single leg, and tandem; each held for 20 seconds and performed on a firm surface (e.g. floor). During this time an assessor counts and records the number of errors that occur from lifting hands off the hips, opening eyes, stepping, stumbling, or falling, moving the hip >30 degrees into abduction, or remaining out of the test position for >5 seconds. The BESS has previously shown mixed reliability in concussed populations dependent on the study cohort under investigation¹⁰. In particular, the single leg stance component has emerged as a test that has a high rate of performance variability resulting in poor intra-rater reliability⁸ as well as significant improvement (learning effect) under serial administration¹¹. Finnoff et al.¹² recently criticised the BESS as not having adequate reliability to be used as a measure of postural stability. In addition, their calculations returned minimally detectable change (MDC) scores for intra-rater and inter-rater that demonstrated that almost a 50 per cent increase in score from baseline to retest would be needed for a clinician to determine that the increase in errors was due to increased postural instability as a result of a concussion. Additionally, the length of time taken to complete testing (10 minutes),



the complexity of the M-BESS scoring system, as well as the lack of weighting of errors (where falling is equal to lifting hands from hips), would seem to make the M-BESS a challenging tool to administer and score as a sideline measure of concussion. Of note, the M-BESS has also yet to be validated in a concussed population and the environment in which the test is administered also needs to be considered given that M-BESS scores have been shown to change between testing on the sideline when compared to a locker room¹³.

Tandem Gait

A recent addition to the SCAT3 is the inclusion of the timed Tandem Gait Test (TGT) which was developed specifically as a test for concussion screening and is similar to sobriety tests used by law enforcement officers in some countries. The TGT has been shown to have high intra-rater reliability⁸. This modified gait test evaluates locomotion, dynamic balance and lower limb coordination and requires the athlete suspected of having sustained a concussion to walk three metres on a line (e.g. sideline) using a heel-toe gait, turn and return to the starting position as quickly as possible. As with the FTN, a stopwatch is used to time the test and published normative data suggests that the average time if not concussed is approximately 11 seconds⁸. The SCAT3 has a cut-off set at 14 seconds which again is two SD above the mean. As with all screening tests, using a baseline measure for each athlete is considered a much stronger comparison than normative or reference values and should be utilised where possible. While the SCAT3 suggests four repetitions of the TGT with the best score recorded, Schneiders et al.⁸ found that the difference between the first trial and the mean of three trials was only 0.1 seconds which is suggested to be close to

the error rate when using a handheld stopwatch. A pragmatic decision in a busy sporting environment might therefore be to perform only one repetition of the TGT; particularly if there is a clear timing or movement quality deficit in the athlete. Additionally the environment in which the test is performed is likely to change the outcome of the test. In a follow-up study, Schneiders et al.¹⁴ studied athletes performing the TGT on four surfaces (grass, hardwood flooring, artificial turf, concrete) while either barefoot or wearing their normal sporting footwear (football boots, turf shoes, court shoes) in order to ascertain the effect of the test in different environments where concussion screening is likely to be undertaken. This study demonstrated that footwear offered a protective role for the feet resulting in a quicker heel-toe gait, therefore footwear needs to be standardised if serial testing is employed, or athletes are being compared from pre-season or baseline scores. However, wearing no shoes/boots is suggested by the authors as the 'default' footwear condition if the surface being tested on is likely to change as TGT times barefoot were constant across all surfaces.

"There is currently no single 'gold standard' for diagnosing concussion..."

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Effects of sports activity/exercise

The most recent Consensus Statement on Concussion in Sport¹⁵ also discusses the issue of the timing of balance assessments after exposure to sport (exercise) due to the negative effect of exertion on test performance and suggests a minimum rest period of 15 minutes before conducting the tests. Wilkins et al.¹⁶ demonstrated that BESS scores increased immediately after a fatiguing exercise protocol, demonstrating that balance ability diminished. This was also shown to occur with the TGT¹⁷, but only under a high intensity exercise protocol (>85% APMHR) and this had significantly reduced when tested again 15 minutes post exercise. Moderate intensity exercise (75–85% APMHR), in this study, had no effect on TGT scores but deficits in static balance (single leg stance) were still evident. Test-retest reliability was considerably higher for the dynamic task (TGT) compared with the static task suggesting that TGT is a more robust measure under most exercise conditions. Interestingly, two earlier studies demonstrated that exercise had a facilitatory effect on performance of FTN^{18,19}, meaning that signs of a concussion could be masked by the previous activity/exercise if this test is conducted too soon after a concussion. The CISG's recommendation of a 15 minute pause before conducting these tests is therefore justified from a scientific perspective; however, it may not be pragmatic for many sports which do not have this window available for sideline testing of concussion.

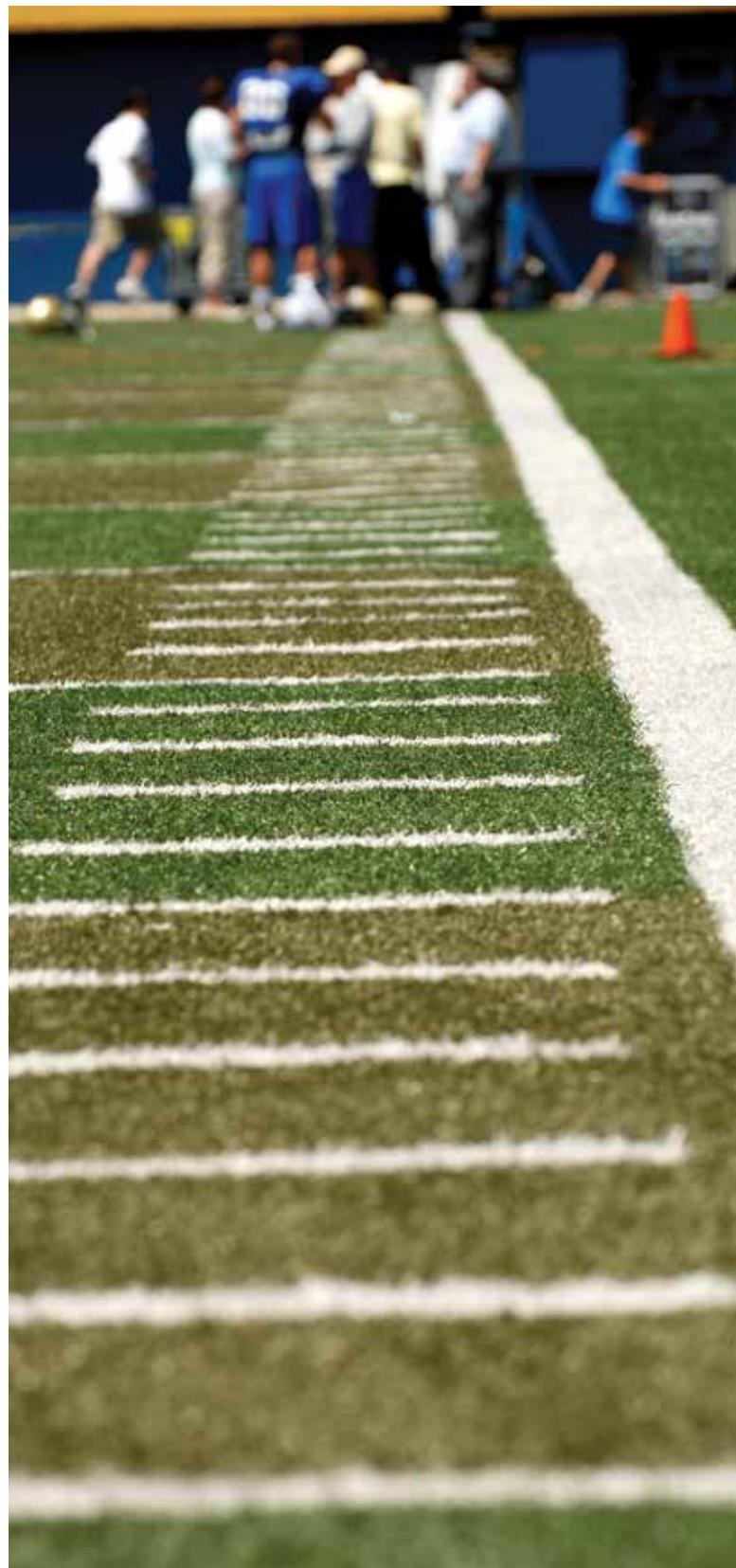
“... physical performance-based measures may be superior to symptom reporting...”

In summary, while the CISG have made significant headway over the last decade regarding the standardisation and validity of sideline concussion testing as evidenced by the SCAT3, there is still quite some way to go. It is also important to remember that these tests are not yet fully evaluated for all environments they are conducted in, or more importantly, the condition they are trying to identify, and therefore research is ongoing. In isolation, these tests do not specifically diagnose whether a concussion has occurred but their appeal lies in their ability to provide information that clinicians can use to guide diagnosis, determine injury severity and, assess clinical recovery including an athlete's return to sport and activity.

Dr Tony Schneiders

Senior Lecturer, University of Otago

References, as indicated within the article, are available at sma.org.au/publications/sport-health



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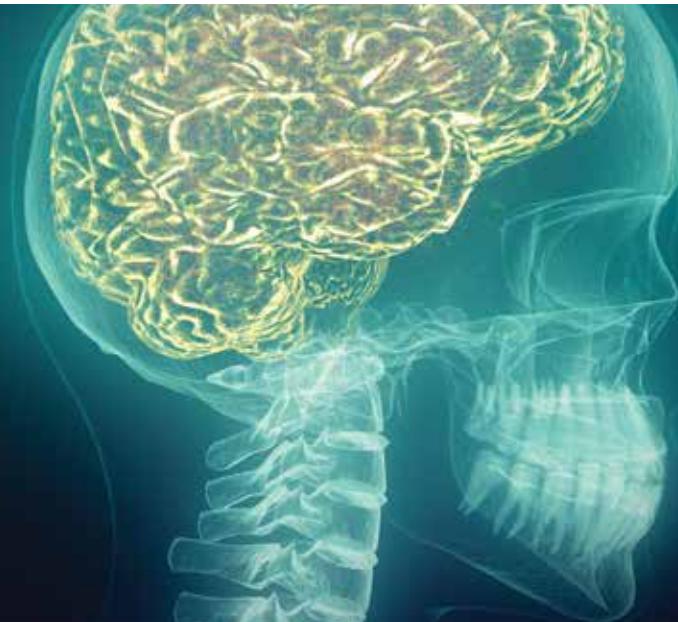


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SMA partnership to raise concussion awareness



Nick Rushworth, Executive Officer of Brain Injury Australia highlights a new partnership between his organisation and Sports Medicine Australia to provide a 'grassroots' concussion awareness and education campaign, starting in the second half of 2013.

Brain Injury Australia (BIA) is the national peak advocacy organisation representing, with its State and Territory Member organisations, the needs of the over 600,000 Australians living with an acquired brain injury (ABI), their families and carers. ABI refers to the multiple disabilities arising from any damage to the brain that occurs after birth. Common causes of ABI include head trauma, stroke, infection, alcohol and other drug abuse, and progressive neurological diseases such as Parkinson's disease. Significantly, the Consensus Statement from the 4th International Consensus Conference on Concussion in Sport held in Zurich last November acknowledged, for the first time, that concussion is a 'subset of TBI [traumatic brain injury]'.

Brain Injury Australia has recently completed a policy paper on concussion in sport for the Australian Government, available at www.braininjuryaustralia.org.au. The paper focuses on Australia's three major 'collision' sports – Australian Rules football, rugby league and rugby union and identified a broad lack of recognition of the injury and its potential seriousness. Its key recommendation was for a national cross-sport education campaign in awareness and best practice assessment and management of concussion, suitable for sports administrators, coaches, trainers, players and the broader community.

BIA and SMA have already collaborated during 2012's national Brain Injury Awareness Week, which is built around BIA's idea of the 'Five Rs' of concussion for the purposes of community education: 'Recognise the injury; Removal from play; Referral to a doctor; Rest and then Return to play'.

"... concussion is a 'subset of TBI [traumatic brain injury]'."

SMA and BIA are aware of larger sporting codes such as the AFL, ARU and NRL taking action to optimise their concussion management, according to evidence-based 'best practice'. But there still remains a great deal of work to be undertaken in transferring that knowledge to other sports and down to amateur 'community' play. SMA and BIA plan to bridge that gap by delivering: face-to-face concussion education presentations delivered by sport and exercise doctors; online presentations outlining effective concussion assessment and management strategies; media and communications centred around concussion; and other resources, such as blogs, on effective concussion management, all built around the '5Rs'.

More details will be available soon via www.sma.org.au and www.braininjuryaustralia.org.au



Early-onset knee osteoarthritis after anterior cruciate ligament reconstruction: don't forget the PFJ



Adam Culvenor, Australian Physiotherapy Australia Member (APAM) and 2011 ASMF Research Foundation Grant winner, and Kay Crossley, APAM, from The University of Queensland discuss the patellofemoral joint and the long-term outcomes following anterior cruciate ligament reconstruction.

Anterior cruciate ligament (ACL) rupture is a relatively common but devastating consequence of participation in cutting, jumping and pivoting sports. ACL reconstruction (ACLR) aims to restore knee stability and joint function and is frequently performed to enable the individual to return to competitive sporting pursuits. Rehabilitation after ACLR is intense and protracted, with successful return to sport and physical activity without complications the ultimate goal. Return to competitive sport may be permitted as early as six months post-operatively; however, the time to resumption of sport varies. While timeframes of 12 months post-surgery are typically expected, recent research indicates that fewer than 50 per cent of individuals will have returned to competitive sport by 12 months.¹ However, most people (82 per cent) return to sport at some level, with many (63 per cent) returning to their pre-injury level of participation.²

While many individuals achieve a return to sport and physical activity, the consequences of ACL injury extend for many years. ACL injury is a well-established risk factor for the development of tibiofemoral osteoarthritis (OA). Degenerative radiographic changes in the tibiofemoral joint are evident in 50–70 per cent of subjects, 5–20 years after ACL injury.³ Furthermore, current research does not provide evidence that ACLR reduces the rate of OA development or improves long-term symptomatic outcomes. Since most people sustain an ACL injury in early adulthood (late teens to early 30s), the resultant OA occurs in young adults, approximately 15 years earlier than expected in the general population. This early-onset OA is frequently associated with knee pain and decreased physical function, which may result in limitation or premature cessation of physical activity with subsequent impact on healthcare resources. Therefore, our research and clinical focus should shift from its primary emphasis on 'return to sport' to include elements of maintaining long-term joint health. However first, we need to understand more about early-onset OA in all knee joint compartments after ACLR.

Is patellofemoral joint osteoarthritis an under-recognised consequence of ACLR?

The tibiofemoral joint is intimately related to the ACL, with joint damage, such as meniscal and articular cartilage lesions, frequently reported at the time of injury. However, there is increasing awareness that the patellofemoral joint may also be at risk of OA after ACLR. Radiographic patellofemoral OA after ACLR is studied much less frequently, with the few studies that have evaluated this reporting a prevalence ranging from 11 to 90 per cent, 2 to 15 years after surgery.⁴ Importantly, the prevalence of patellofemoral OA appears to be at least as high as tibiofemoral OA. Most studies that have evaluated patellofemoral OA after ACLR include participants who had received a bone-patellar tendon-bone (BPTB) autograft. However, the hamstring tendon autograft is increasing in popularity and although harvesting the hamstring tendon has minimal direct effect on patellofemoral structures, patellofemoral OA rates do not appear to be different between the graft types.⁴ Thus, the current literature indicates that patellofemoral OA may develop after ACLR, regardless of graft type.

“Knee pain after ACLR is common, but we need to be cognisant of the importance of the patellofemoral joint to the long-term outcomes after ACLR.”

Patellofemoral symptoms are also common following ACLR, particularly after a BPTB autograft. Indeed, patellofemoral pain is said to be one of the most serious and troublesome complications that compromise final outcome after ACLR. This anterior knee pain, crepitus and stiffness may be attributed to graft site morbidity, from removal of the middle third of the patellar tendon and associated bone. However, it is possible that patellofemoral symptoms may result from the development of early-onset OA in these patients.

Why is the patellofemoral joint at risk of OA after ACLR?

A number of potential factors may contribute to the development of patellofemoral OA after ACLR. These factors include biomechanical consequences of injury and/or surgery and concomitant joint damage at the time of injury or due to the resultant instability.

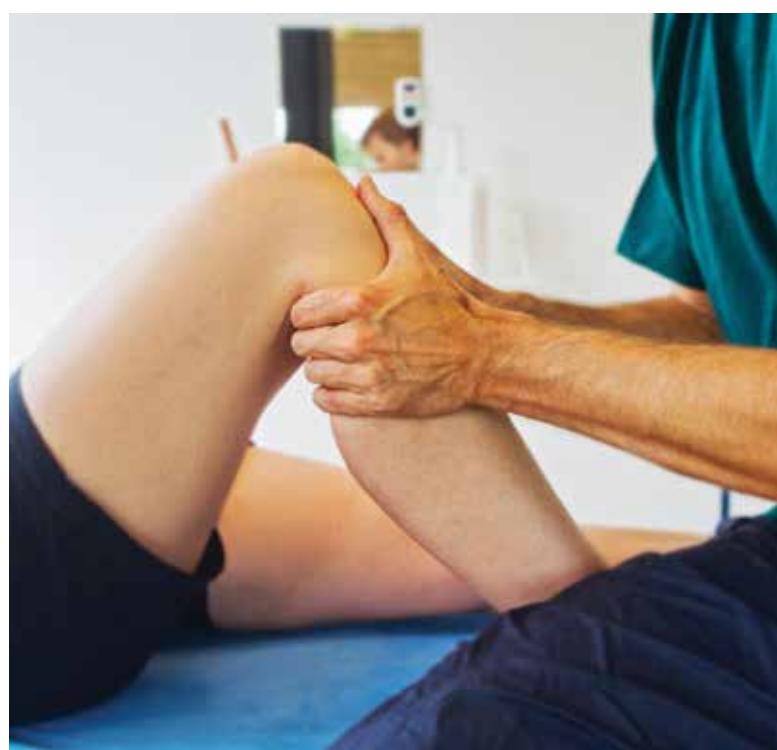
“While contemporary rehabilitation is focused on return to sport, current research indicates that this focus should shift, to incorporate tibiofemoral and patellofemoral joint protection strategies.”

Biomechanical alterations following ACLR change patellofemoral load

Altered tibiofemoral joint biomechanics, including joint motions and loads, are hallmark features following ACL injury. Although the anterior-posterior instability associated with an ACL rupture is frequently corrected, motions and loads in other planes may not be fully restored with ACLR.⁴ The persistence of such changes is thought to contribute to tibiofemoral OA development by redistribution of joint load. Due to the intimate relationship between the patellofemoral and tibiofemoral joints, altered tibiofemoral joint biomechanics may also influence patellofemoral joint mechanics, stress and OA development.

Transverse plane

Abnormal tibiofemoral transverse plane rotations persist after ACLR, with a greater tibial rotation range, or ‘external rotation offset’ (decreased internal rotation/increased external rotation) observed in the ACLR knee compared to the uninjured knee and healthy controls.⁴ This external tibial rotation may have consequences at the patellofemoral joint, with experimental studies noting that tibial external rotation results in increased lateral patellar tilt and rotation and patellofemoral load.⁴ As yet it is not known whether newer ACLR techniques, for example, double-bundle and oblique-tunnel orientation techniques, can restore transverse plane kinematics more effectively.





Frontal plane

Altered frontal plane mechanics, including increased external knee adduction moments, have been observed after ACLR. Increased knee adduction moment may be related to medial tibiofemoral OA development, but this finding is not consistently observed. If present, altered frontal plane tibiofemoral static or dynamic alignment (varus/valgus) can affect medial and lateral patellofemoral loading patterns with potential consequences for patellofemoral OA.

Sagittal plane

Persistent sagittal plane alterations after ACLR, such as loss of full knee extension, may increase knee flexion angles during ambulation. Since increasing tibiofemoral flexion angles are linked to higher patellofemoral contact pressures, such consequences may be detrimental to the patellofemoral joint. Indeed, inability to achieve full knee extension has been linked with the presence of both patellofemoral and tibiofemoral OA.⁴

Quadriceps strength deficits contribute to altered patellofemoral load

Quadriceps weakness can persist for many years after ACLR. Since quadriceps weakness is associated with patellofemoral OA development and progression in other populations,⁴ reduced quadriceps strength after ACLR may pose a risk for patellofemoral OA. Furthermore, it is possible that altered coordination of the medial and lateral vasti components may be evident after ACLR. Abnormal vasti activation patterns have been observed in people with knee pain and effusion which are common after ACLR. Since patellofemoral biomechanics can be affected by imbalance in vasti activation, such changes could contribute to patellofemoral symptoms and OA.

Concomitant injury to the patellofemoral joint can occur with/after ACL injury and reconstruction

The substantial force required for ACL rupture, or the instability associated with ACL deficiency, may damage articular cartilage and subchondral bone, both in the patellofemoral and tibiofemoral joints. Articular cartilage lesions affecting the patellofemoral joint have been documented at surgery in 2–29 per cent of individuals.⁴ Importantly, this articular cartilage damage predicts the development of long-term radiographic patellofemoral OA.⁵ Furthermore, meniscal and ACL injuries also frequently co-exist and meniscectomy has been shown to predict patellofemoral OA development in those with ACL injury.⁶ While the mechanism underpinning this relationship is unclear, loss of meniscal tissue could alter tibiofemoral frontal plane alignment or transverse plane rotation, with consequences for patellofemoral contact pressure.

“While timeframes of 12 months post-surgery are typically expected, recent research indicates that fewer than 50 per cent of individuals will have returned to competitive sport by 12 months.”

What can be done to help alleviate the problem of patellofemoral OA after ACLR?

Awareness of the vulnerability of the patellofemoral joint to injury and degeneration after ACL rupture and reconstruction is an important first step before addressing any of the issues related to the patellofemoral joint. Including the patellofemoral joint in standard imaging protocols will reduce the chance of patellofemoral damage being overlooked, and the emergence of stronger magnet MRIs and other more sensitive methods for evaluating articular cartilage such as T2 mapping will also assist in diagnosis and structural qualitative evaluation.

“... our research and clinical focus should shift from its primary emphasis on ‘return to sport’ to include elements of maintaining long-term joint health.”

Although the causal relationship between the factors presented above and the development or progression of patellofemoral symptoms and OA have yet to be established, it appears as though interventions designed to address the neuro-mechanical consequences of ACL injury and repair could be important for a person with, or at risk of, patellofemoral OA. Such interventions could focus on ensuring full range of movement is achieved in the early post-operative phase, restoring coordination of medial and lateral vasti using a motor relearning approach, and addressing altered tibiofemoral frontal and transverse plane biomechanics via hip (e.g. strengthening) or foot (e.g. in-soles) interventions. Importantly, while the optimal patellofemoral load magnitude and direction is not known, it may be beneficial to minimise the compressive force and stress on the patellofemoral joint during the early phases of rehabilitation. Large or unaccustomed patellofemoral compressive forces can elevate patellofemoral subchondral bone stress and cause patellofemoral cartilage degeneration. However, prior to resumption of high-impact activities it is also important to ensure the patellofemoral joint is accustomed and ready to manage the higher load that invariably occurs with high-impact activities. This should be achieved through carefully monitored exercises that gradually progress patellofemoral load without causing aggravation of symptom.

“Awareness of the vulnerability of the patellofemoral joint to injury and degeneration after ACL rupture and reconstruction is an important first step before addressing any of the issues related to the patellofemoral joint.”

Where do we go from here?

Knee pain after ACLR is common, but we need to be cognisant of the importance of the patellofemoral joint to the long-term outcomes after ACLR. While we have proposed a number of potential reasons for the development of patellofemoral OA after ACLR, further research is required to confirm these factors. This knowledge could assist with the development of new surgical or rehabilitation techniques, designed to reduce patellofemoral load. While contemporary rehabilitation is focused on return to sport, current research indicates that this focus should shift, to incorporate tibiofemoral and patellofemoral joint protection strategies.



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Adam is a physiotherapist and PhD candidate, investigating patellofemoral osteoarthritis after anterior cruciate ligament reconstruction.

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Kay is an Associate Professor and Reader in Physiotherapy at the University of Queensland. She has an interest in the development of early-onset osteoarthritis after sporting injuries to the knee and hip.

This article is based on the following peer-review published manuscript: Culvenor AG, Cook JL, Collins NJ, Crossley KM. Is patellofemoral joint osteoarthritis an under-recognised outcome of anterior cruciate ligament reconstruction? A narrative literature review. *British Journal of Sports Medicine*, 2013, 47:66-73.

References, as indicated within the article, are available at sma.org.au/publications/sport-health

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The emerging prominence of nutrition in injury management



Johan Leech, Provisional Sports Dietitian, says it is well known that nutrition intervention is essential during rehabilitation, but is the role of nutrition being overlooked in the acute phase of injury?

Serious injuries are an unavoidable part of elite level sports. If they are not managed well, they can lead to poor recovery, including impaired muscle size and strength, and ultimately fewer competitive successes for the athlete and team.

Similar to other aspects of elite level sports, optimising nutrition will greatly enhance recovery of the injured athlete. This is better understood with regards to the rehabilitation phase of injury management, such as maintaining a strong immune system and enhancing exercise-induced muscle hypertrophy (muscle gain).

“Whether omega-3 FA’s, extra leucine, or creatine supplementation play a part in nullifying anabolic resistance is not yet set in stone, but it looks promising and is worth consideration.

However, one aspect of injury management often overlooked is the role nutrition can play in the acute phase of serious injury. In fact, it is fair to say the beneficial effects nutrition intervention can have on muscle atrophy (muscle loss) is quite undervalued. And of course, this should be the first point of call as muscle unloading leads to rapid losses in size, architecture and function within the first two weeks¹.

This article focuses on the role of nutrition in acute injury management, highlighting interventions that have the potential to significantly reduce injury-induced muscle loss.



Energy intake – should we restrict?

There's no doubt that dietary patterns need to change once an athlete has been injured. Their energy requirements alter with inactivity, and this is variable depending on severity of injury and locale of immobilisation. But energy-restriction can easily become, well, too restrictive. It's important to be mindful that resting energy expenditure can be initially increased by up to 20 per cent if the injury is severe.

Whilst the athlete certainly won't need to continue following Michael Phelps' infamous 12,000 calorie/day diet, the changes in total energy intake might not need to be as great as first thought.

"The question remains whether extra leucine must be ingested with or without extra protein, and if it will have an impact on muscle protein synthesis of an injured, immobilised muscle."

The first priority is to not over-restrict calories or protein. The risk here being that the athlete suffers from energy or protein malnutrition, which exacerbates inflammation and prolongs the healing process. Further, insufficient caloric intake decreases rates of muscle protein synthesis, which is the major contributor to muscle loss². Thus a negative energy balance accelerates the catabolism of lean body mass.

Energy intake changes require maintenance of a delicate balance that should be quickly identified and agreed upon by the dietitian, athlete and coach. Excessive caloric intake post-injury can lead to small body fat gains, but in most instances this is preferable to decreased muscle protein synthesis.

Muscle atrophy and dietary protein

Skeletal muscle atrophy is common in many disease states and conditions such as sarcopenia, burns, and cancer cachexia. It's also common in the injured athlete, as prolonged disuse/inactivity of the injured part of the body results in decreased muscle mass.

The mechanism for change in muscle mass, known as muscle protein balance, is the balance between muscle protein breakdown and rate of muscle protein synthesis³. Ideally of course, we want to ensure the highest rate of protein synthesis compared to protein breakdown. This is called positive muscle protein balance.

"Oh and I still don't encourage chicken nuggets as a regular source of protein, despite all of Usain Bolts' success – he is just the exception."

Unfortunately during injury, particularly injury requiring immobilisation of a limb, athletes end up with negative muscle protein balance. This is due to lengthy disuse of the injured area, and a decrease in the rate of protein synthesis, particularly myofibrillar protein synthesis². Management should aim to keep muscle protein synthesis as efficient as possible, to offset the rate of muscle atrophy from muscle unloading.

Thus, the primary role for nutrition intervention is to maintain an adequate protein intake in order to ameliorate the muscle breakdown. This involves not only ingesting 20–25g of high biological value protein at each sitting⁴, but also distributing protein intake frequently throughout the day. Following this protocol helps to minimise the extent of negative muscle protein balance, and in turn alleviate the severity of muscle atrophy.

Oh and I still don't encourage chicken nuggets as a regular source of protein, despite all of Usain Bolts' success – he is just the exception.

"... the beneficial effects nutrition intervention can have on muscle atrophy (muscle loss) is quite undervalued."

Immobilisation and anabolic resistance

Serious injuries such as dislocations, fractures, and blown ACLs tend to result in immobilisation of an area for an extended period of time. Unfortunately, immobilisation significantly reduces the ability of myofibrillar proteins to respond to amino acids². This effect is known as anabolic resistance.

In 2008 a well-known Canadian study found that a higher level of blood amino acids partially alleviated decreased protein synthesis in subjects with immobilised limbs. However it was never abolished, even at the highest levels of blood amino acids². Thus it seems an increase in dietary protein can help minimise muscle loss, but it may not have the same effect on protein synthesis as it would on a healthy, uninjured athlete. In any case, adequate amounts and appropriate distribution of dietary protein are essential to recovery.



Can we ameliorate anabolic resistance?

Omega-3 FA

Overcoming anabolic resistance is a relatively new area of research, but there are some early indications that omega-3 fatty acids (FA) may help minimise muscle loss associated with immobilisation.

Previously the only evidence that omega-3 FA's could help reduce muscle loss were rodent studies⁵ and a UK study on an elderly group⁶. However, later that year (in 2011) the same team from the UK concluded that long chain omega-3 FA supplementation has anabolic properties in healthy young and middle-aged adults⁷. That is, supplementation (doses of 1.86g EPA and 1.50g DHA per day) causes an increase in muscle protein anabolic response⁷, which potentially helps ameliorate anabolic resistance associated with immobilisation.

The exact mechanisms responsible for their findings remain unknown but it seems likely they are related to the anti-inflammatory properties of omega-3 FA's.

It's worth noting that as inflammation is crucial for healing, excessive anti-inflammatory measures such as omega-3 FA supplementation may not be ideal immediately following a severe injury.

“In 2008 a well-known Canadian study found that a higher level of blood amino acids partially alleviated decreased protein synthesis in subjects with immobilised limbs.”

Leucine

Ingesting additional leucine is another nutritional intervention that could potentially reduce anabolic resistance in the injured athlete. Leucine intake was found to help reduce loss of muscle in rats during immobilisation⁸. And on elderly humans, two studies found that anabolic resistance may be overcome by increasing leucine content of dietary protein^{9,10}. The question remains whether extra leucine must be ingested with or without extra protein, and if it will have an impact on muscle protein synthesis of an injured, immobilised muscle. Watch this space.

Creatine

Creatine supplementation is also now being investigated for possible effects on minimising anabolic resistance and muscle loss. As it is well-known to enhance exercise-induced muscle

hypertrophy, the theory is it could play a role in alleviating muscle atrophy as well. There is currently conflicting evidence, and more research needs to be undertaken.

"Whilst the athlete certainly won't need to continue following Michael Phelps' infamous 12,000 calorie/day diet, the changes in total energy intake might not need to be as great as first thought."

The prominence of nutrition intervention in injury management is now gaining traction in the fast-paced world of sports medicine. Especially now that we better understand the key role nutrition can play in ameliorating muscle atrophy of injured athletes yet to begin rehabilitation. It's clear that energy and protein requirements tend to decrease at the onset of injury, yet an overly restrictive diet may in fact be detrimental to the recovery process. Whether omega-3 FA's, extra leucine, or creatine supplementation play a part in nullifying anabolic resistance is not yet set in stone, but it looks promising and is worth consideration.

Following the acute phase of injury, our focus should turn to the role of nutrition in rehabilitation... perhaps a topic to discuss next time.

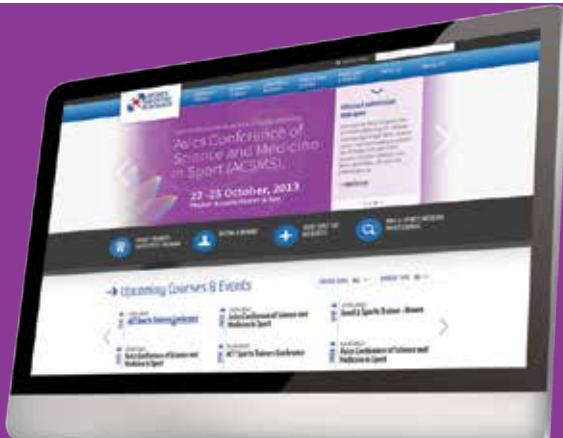
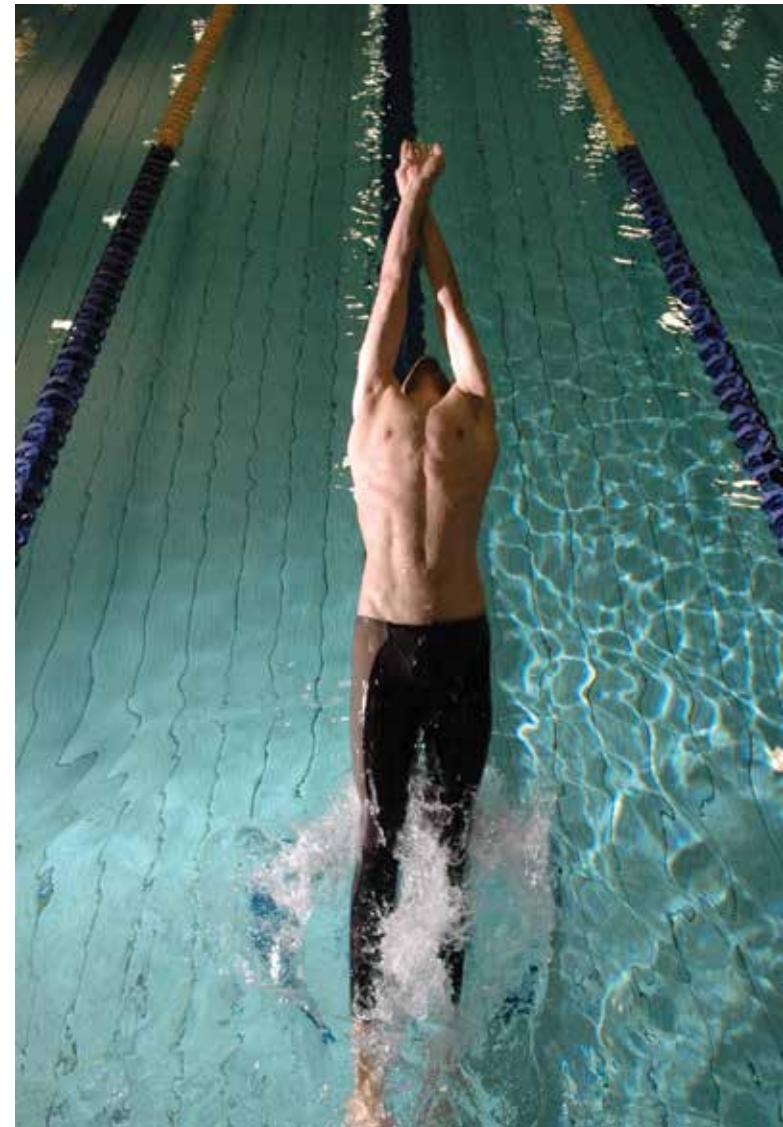
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References, as indicated within the article, are available at sma.org.au/publications/sport-health



SMA NEW LOOK WEBSITE: LAUNCHING SOON

Sports Medicine Australia will soon be launching a brand new website. The new look and reorganisation of the navigation will provide members with a simpler way of accessing the wealth of information, tools and resources available.

In addition to a more user friendly design, there will be new features including the ability to book and pay for training courses and events online, a jobs board for members to post and apply for jobs and a newly revamped e-newsletter.

www.sma.org.au

Discipline group news and events

Australian Psychological Society College of Sport and Exercise Psychologists (CoSEP)

News:

- 2013 began as a controversial year for the profession of sport and exercise psychology with the Australian Institute of Sport's adoption of the Winning Edge as the new high performance strategy, and Swimming Australia's independent review.
- CoSEP provided a response to the Senate in their enquiry into the Australian Sports Anti-Doping Authority Amendment Bill, which was to strengthen their investigative functions.
- CoSEP also provided a submission into another of the Senate's investigations into the advertising and promotion of gambling in sport.
- An ongoing issue is the investigation of the misuse of the title 'sport and exercise psychologist'. This title can only be used by psychologists with the official endorsement by the Australian Health Practitioner Regulation Authority and the Australian Psychological Society that highlights relevant and specific qualifications and experience in the field (there are only 47 psychologists endorsed in sport and exercise psychology in Australia).

For more information visit

www.groups.psychology.org.au/csep/

Exercise & Sports Science Australia (ESSA)

News:

- Important changes to accreditation guidelines will occur from 2014. ESSA will only be accepting Exercise Physiologist accreditation applications from graduates of NUCAP (National University Course Accreditation Program) approved courses (i.e. programs) as of January 1, 2014. That is, graduates of non-NUCAP approved courses will not be eligible to apply for exercise physiology accreditation (AEP) from this date. If you are a graduate from a non-NUCAP approved course or have graduated/are graduating from a non-NUCAP approved course in 2012 or 2013 and wish to apply to become an accredited exercise physiologist, it is essential that your application is received by ESSA by December 31, 2013.

For more information visit

www.essa.org.au/exercise-physiology/

Upcoming events:

- ESSA has a range of professional development options available to you: national conferences, face to face workshops and courses, webinars, online courses, podcasts and DVDs. To access course dates and information visit www.essa.org.au/professional-development

For more information visit www.essa.org.au



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Sports Dietitians Australia (SDA)

Upcoming events:

June 2013

- 15 Nutrition for Exercise & Sport Course – QLD (Gold Coast)
- 15 Nutrition for Exercise & Sport Course – ACT (Canberra)
- 22 Nutrition for Exercise & Sport Course – VIC (Melbourne)

August 2013

- 10 Nutrition for Exercise & Sport Course – TAS (Launceston)
- 17 Nutrition for Exercise & Sport Course – NSW (Port Macquarie)
- 31 Nutrition for Exercise & Sport Course – VIC (Melbourne)

For more information visit www.sportsdietitians.com.au

Sports Doctors Australia (SDrA)

News:

- SDrA is delighted to have Associate Professor Gavan White, SDrA Vice-President, as the guest editorialist for the July edition of the *British Journal of Sports Medicine*.
- A working party on ‘supplements in sport’ is being formed through SMA involving representation from SDrA, ACSP, ESSA and SDA. Dr Neville Blomeley will be representing SDrA on this working party.

Upcoming events:

- SDrA is keen to continue a ‘clinical’ contribution to the annual SMA conference in Phuket, October 22–25, 2013. An abstract has been submitted for a possible ‘symposium on concussion in sport’, a very hot topic in sports medicine following changes in how concussion is handled, especially in AFL football. An abstract has also been submitted for a workshop on ‘lower limb injuries in sport’.

For more information visit www.sportsdoctors.com.au

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The following highlights the most popular article downloads at jsams.org from the quarter ending in 2012.

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2. **The effect of ankle taping or bracing on proprioception in functional ankle instability: A systematic review and meta-analysis**
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Raymond, J.; Nicholson, L.L.; Hiller, C.E.; Refshauge, K.M.
3. **Promoting lower extremity strength in elite volleyball players: Effects of two combined training methods**
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Voelzke, M.; Stutzig, N.; Thorhauer, H.A.; Granacher, U.
4. **Exercise prescription for patients with type 2 diabetes and pre-diabetes: A position statement from Exercise and Sports Science Australia**
Vol. 15, Iss. 1, January 2012
Hordern, M.D.; Dunstan, D.W.; Prins, J.B.; Baker, M.K.; Singh, M.A.F.; Coombes, J.S.
5. **A review of the clinical evidence for exercise in osteoarthritis of the hip and knee**
Vol. 14, Iss. 1, January 2011
Bennell, K.L.; Hinman, R.S.
6. **Predictability of physiological testing and the role of maturation in talent identification for adolescent team sports**
Vol. 9, Iss. 4, August 2006
Pearson, D.T.; Naughton, G.A.; Torode, M.
7. **Physiological limits to exercise performance in the heat**
Vol. 11, Iss. 1, January 2008
Hargreaves, M.
8. **Effects of synchronous music on treadmill running among elite triathletes**
Vol. 15, Iss. 1, January 2012
Terry, P.C.; Karageorghis, C.I.; Saha, A.M.; D'Auria, S.
9. **Effect of water immersion methods on post-exercise recovery from simulated team sport exercise**
Vol. 12, Issue 3, May 2009
Ingram, J.; Dawson, B.; Goodman, C.; Wallman, K.; Beilby, J.
10. **Vertical jump in female and male basketball players? A review of observational and experimental studies**
Vol. 13, Iss. 3, May 2010
Ziv, G.; Lidor, R.

Podcasts

Listen to interviews with authors discussing their work and the latest from JSAMS, via podcast at jsams.org or through iTunes by searching *Journal of Science and Medicine in Sport*.

