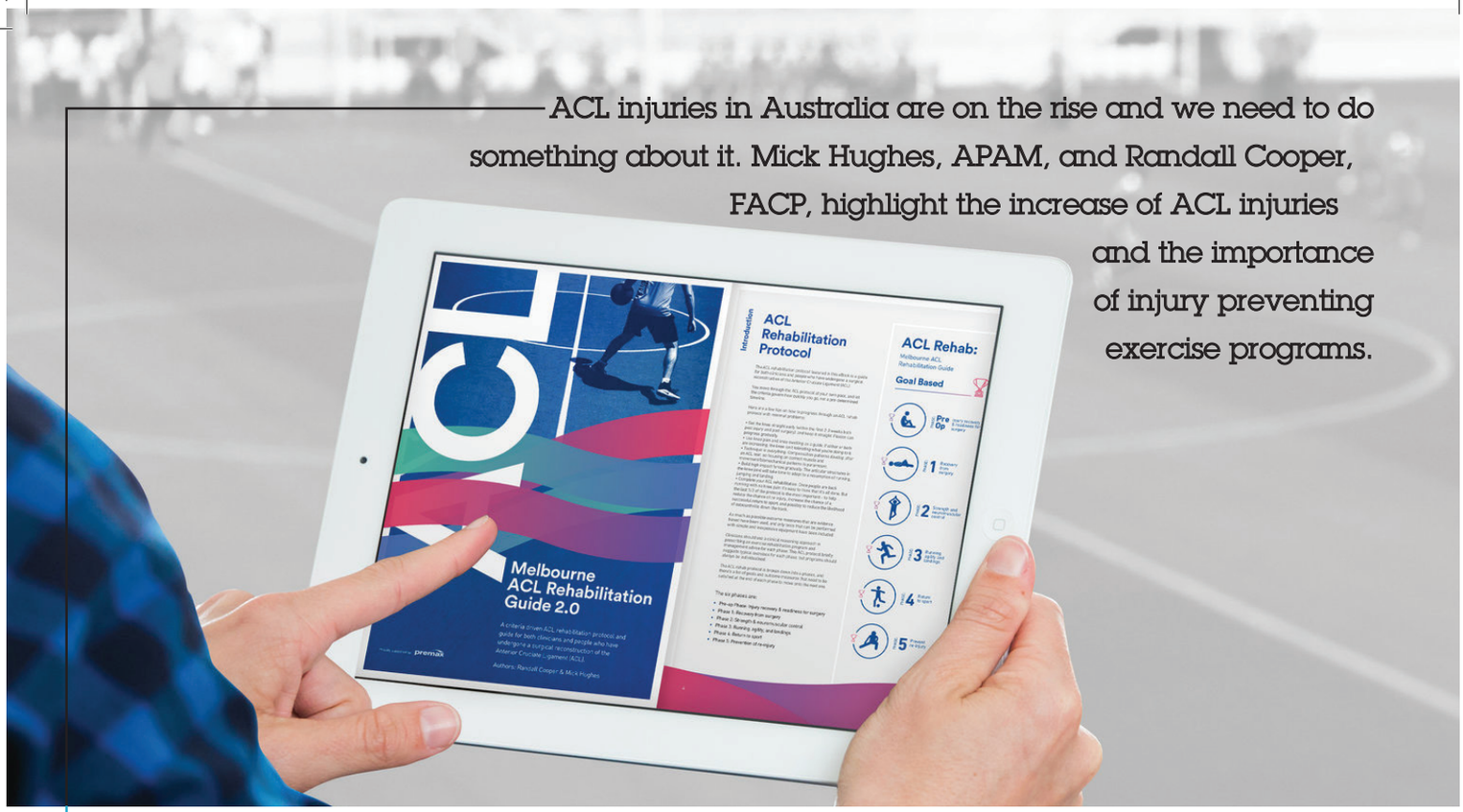

ACL injuries in Australia are on the rise and we need to do something about it. Mick Hughes, APAM, and Randall Cooper, FACP, highlight the increase of ACL injuries and the importance of injury preventing exercise programs.

Exercise-based approach to ACLR rehab

An anterior cruciate ligament (ACL) injury is a devastating short-term injury to the person, with a significant impact on their quality of life and their ability to participate in sport and physical activity. However, it is a more significant problem in the long-term with decreased function quality of life (Filbay et al 2015), with the affected knee also experiencing OA changes regardless of the person having a reconstruction or not (Chalmers et al 2014). Furthermore, the risk of having a total knee replacement later in life is significantly higher in those who sustained an ACL injury regardless of having reconstructive surgery or not, compared to those who have not injured their ACL (Suter et al 2017).

The good news is that ACL injuries are largely preventable. All it takes is the simple addition of a regular injury prevention exercise program (eg, FIFA 11+, Netball Knee, AFL FootyFirst) to reduce the risk of all primary ACL injuries by 50 per cent, and all non-contact ACL injuries in females by 67 per cent (Webster & Hewett 2018). Despite these impressive numbers in risk reduction, implementation and adoption of these injury prevention programs at amateur and junior levels continues to be a challenge (Sugimoto et al 2017, Thein-Nissenbaum & Brooks 2016), regardless of it taking only 15 minutes two to three times per week, to achieve the injury prevention benefits (Sugimoto et al 2014). Furthermore, although injury prevention programs are very effective, one must understand that they do not eliminate all ACL injury risk.

ACL injury: the current landscape in Australia

Between 2000 and 2015, nearly 200,000 ACL reconstructions (ACLR) were performed here in Australia. During this time, there was a 43 per cent increase in the number of reconstructions performed, with 15–29 year old males and 15–19 year old females being the most common age groups to be reconstructed (Zbrojkiewicz et al 2018).

ACL reconstructive surgery unfortunately does not guarantee a return to pre-injury sport, nor does it guarantee graft survival. In regards to a return to pre-injury sport, only 60 per cent of non-professional patients are back playing pre-injury sport two years after their operation (Ardern et al 2015). In terms of graft survival research shows that the ACLR graft has a seven per cent failure rate over a 10 year follow-up period (Magnussen et al 2015). Interestingly, the same authors found that the contralateral limb showed an elevated risk of ACL injury of 12.5 per cent during this same period. It is important to note that younger athletes aged under 20 have significantly higher rates of second ACL injuries than their older counterparts, with second ACL injuries to either limb being as high 30 per cent within the first two years upon returning to sport (Paterno et al 2014).

Even though this article aims to discuss evidence-based ways to improve postoperative outcomes, it is very important to note that not all ACL injuries require reconstructive surgery. There is strong

evidence that reports approximately 50 per cent of ACL injured patients can cope without their ACL for at least five years following injury and have outcomes similar to those patients who elected to have ACLR (Frobell et al 2013). However, this conversation is beyond the scope of this article, as we aim to identify ways to improve outcomes in those who elect to have ACLR surgery.

To address the uncertainty of being able to return to pre-injury sport and decrease the risk of graft failure, we published the *Melbourne ACL Rehabilitation Guide* to help both the ACLR patient and the treating health professional improve the short- term and long-term outcomes of ACLR rehabilitation. For those that don't know, the *Melbourne ACL Rehabilitation Guide* is a criteria-driven, evidence-based guide that provides a clear set of goals of what the ACL patient should achieve as they work through their rehabilitation from pre-operative phase to postoperative phase, to strength and neuromuscular phase, to running/jumping and agility, to return to sport, and finally, ongoing maintenance.

The *Melbourne ACL Rehabilitation Guide* was created with the clinician and patient in mind and kept to a strong evidence-base, but required little equipment to carry out the objective testing process.

The rehabilitation guide has evolved since original publication in 2013 to coincide with the changing ACL evidence-base. We first met in 2016 when Mick was working with the Collingwood Magpies Netball team—a sporting code that has its own fair share of ACL injuries. It was not long after we decided to upgrade the publication for 2018; and as a result, we have made some important changes. These are the addition of a pre-operative phase, and the addition of new hop tests and new patient-reported outcome measures to the return-to-sport phase.

Pre-operative rehabilitation

Physiotherapists have known the long-term postoperative benefits of conducting a pre-operative physiotherapy program for many conditions, and pre-operative physiotherapy for ACLR is no different. However, the interventions of physiotherapy were largely passive with the goals of decreasing pain and swelling and increasing ROM being the priority before heading off to surgery. We now know that a very active, exercise-based approach to improve quadriceps strength and lower limb function during this pre-operative phase is more superior than waiting for the knee to settle.

An extended pre-operative physiotherapy period has shown to be beneficial in three different ways. Most importantly, it was shown that ACL patients who could attain higher knee injury and osteoarthritis outcome scores (KOOS) pre-operatively had significantly better quality of life and function six years after their reconstruction (Manssonet al 2013).

Not only is better knee function seen with a period of pre-operative strengthening, but patients are more likely to return to pre-injury sport within two years. A recent study showed that 10 extra sessions of neuromuscular training resulted in 72 per cent of the ACLR patients returning to pre-injury sport compared to 63 per cent who did not conduct 10 extra sessions of pre-operative physio (Failla et al 2016).

The third way an extended pre-operative physiotherapy period can benefit your ACL patients is that you can gather some very valuable pre-operative strength and function outcome measures that can be used during the later stages of rehabilitation when the patient is nearing a return-to-sport. Researchers found that recording the pre-operative strength and hop test results of the uninjured limb (estimated pre-injury capacity) was more sensitive than the usual limb symmetry index (LSI) strength and hop tests at predicting second ACL injuries within the first two years upon return-to-sport in ACLR patients (Wellsandt et al 2017).

In summary, it is clear that simply waiting for the knee to settle after injury is not best practice, and the new pre-operative phase of the *Melbourne ACL Rehabilitation Guide* reflects this. The ACLR patient can and should be quite active during the pre-operative phase to build strength, function and, importantly, to gain some pre-operative strength and hop test data that can be used as baseline measurements during the return-to-sport testing phase.

ACLR rehabilitation

There is not much that has changed from the 2013 version of the *Melbourne ACL Rehabilitation Guide*. We still have a strong active, exercise-based approach with little recommendation for passive therapies. We also continue to encourage sound clinical reasoning for exercise selection during rehabilitation, rather than a recipe of exercises started at arbitrary time points. Every ACLR patient is different, and as a result, their rehabilitation needs to be different.

Return-to-sport following ACLR

As mentioned before, only 60 per cent of non-professional ACLR patients will return to pre-injury sport within two years following ACLR. Back in 2013, returning to sport following ACL injury was a time-based decision, with any time between six to 12 months postoperative being the accepted best-practice. This was supported by a systematic review by Barber-Westin and Noyes in 2011, who summed up the literature at the time:

- 40 per cent of studies used no criteria to determine readiness to return-to-sport
- 32 per cent of studies used time postoperative only
- 15 per cent of studies used time postoperative and subjective criteria

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- Only 13 per cent used some form of objective criteria (isokinetic dynamometry, thigh circumference, general knee examination, hop tests and validated questionnaires).

We can't help but feel that these arbitrary time points since surgery, and lack of objective strength and function measures may be contributing to the lower numbers of ACLR patients returning to pre-injury sport—or any form of physical activity due to fear of re-injury and lack of confidence. Simply waiting 12 months and returning to sport/physical activity without adequate rehabilitation to match the demands of that activity is no longer acceptable practice. That is why we have set high-standard discharge goals (>95 per cent limb symmetry index) to be completed at the return-to-sport phase.

To help address these fears and concerns of re-injury and open up the conversation with the ACLR patient, we've added two new patient-reported outcome measures along with the pre-existing International Knee Documentation Committee (IKDC), the ACL-return to sport after Injury (ACL-RSI) and the Tampa scale of kinesiophobia (TSK-11).

The ACL-RSI was chosen because it is a valid and reliable outcome measure to assess the psychological impact of returning to sport after ACLR surgery (Webster et al 2008). The TSK-11 was added as it was found to identify those at risk of sustaining a second ACL injury (Paterno at al 2018). In this study, the authors found that when the ACLR patient scored 19 or more on the TSK-11, they were 13 times more likely to sustain a second ACL injury within two years of returning to sport compared to those that scored 18 or less.

In regards to functional return-to-sport testing, in 2016, two game-changing papers were published that clearly showed that the decision to return athletes back to sport following ACLR should be criteria-driven, rather than based on a static orthopaedic clinical examination and time since surgery. On top of a clinical examination, discharge criteria in both papers consisted of quadriceps and hamstrings isokinetic strength testing, a hop test battery of at least three different hop tests and patient reported outcome measures. Full discharge was classified as passing 90 per cent on all of the discharge criteria.

The first paper on professional athletes found that when athletes chose to return-to-sport without passing all of the discharge criteria, 33 per cent re-injured their ACL graft, compared to just 10 per cent of the athletes who waited to return-to-sport until they passed all discharge criteria (Kyritsis et al 2016).

The second paper looked at all types of knee injuries, not just ACL injury, and found that when discharge criteria was not met, 38 per cent had a knee re-injury, whereas only five per cent of those that passed all discharged criteria sustained a knee re-injury (Grindem et al 2016).

Overall, the decision to return-to-sport following ACLR is complex for all of those involved. For some patients, they may not want to return to their pre-injury sport for many reasons (eg, fear of re-injury, work commitments, family commitments), but it is our job as physiotherapists to encourage them to remain active and be engaged in their rehabilitation for as long as possible. We can help them improve their quality of life for many years down the track.

For those with the goal of returning to pre-injury sport, particularly those sports that involve high-risk pivoting, twisting and landing actions, we need to make sure that the person is thoroughly tested and passed the criteria for discharge—in both a fresh and fatigued state. It is our job to make sure we are sending them back to sport with significantly less of a chance of re-injury.

Conclusion

An active, high-quality, exercise-based approach to ACLR rehabilitation yields the best short-term and long-term outcomes by far, and it is not only reserved for day one post-surgery to the first day the person returns to sport; it is important that the patient commences exercise and strengthening as soon as possible after the ACL injury and then maintains it long-term. It is our job, as health professionals, to encourage lifelong commitment to their knee health and their general health.

We are proud of the *Melbourne ACL Rehabilitation Guide* and what we have put together to help guide clinicians and patients to achieve better short-term and long-term outcomes for those rehabilitating an ACLR.. We hope you like what we have done too. Copies can be purchased at premax.co/au/all/acl-rehab-protocol.

Email ngeditor@physiotherapy.asn.au for references.