

When a tunnel downgrade is a surgical upgrade: Why getting an ACL register in Australia is so critical



ACL injuries are the most discussed injuries in the world of sports medicine, something that hasn't changed in the last 30 years. Aspects of ACL injuries that *have* changed in the last 15 years include increased use of MRI scans to diagnose these injuries and surgical techniques for ACL reconstruction (amongst others, see Table 1). But have these things left our patients much better off? Possibly in some ways, but for all the extra money we now spend on ACL injuries, (Table 2) I suspect our *overall* results (as a country) are perhaps still no better than they were 15 years ago. In one of the only (but still very basic) ACL registries we have in Australia (associated with the AFL injury survey) it can be seen that approximately 15% of ACL reconstructions in high level athletes need revision. This rate hasn't improved over the life of the survey¹ and is pretty high given that AFL clubs are probably choosing the most reputable surgeons in their respective cities. The revision rate for the general population (Table 2) is lower, probably because of lower patient expectation than professional athletes rather than better surgery, but is steadily increasing.

Our fee-for-service structured Medicare system funds a rapidly-increasing tab for knee MRI scans and knee reconstructions (Table 2) without questioning whether we are getting value for money. With all the hot air that Kevin Rudd and Nicola Roxon have puffed about reforming the health system, there is still no sign of an ACL reconstruction register on the horizon, even though the Scandinavian countries have successfully introduced these already². Our government seems to have no problem with the \$100 million p.a. of direct costs of ACL injuries (and perhaps 10x this in indirect costs, when you consider future decreased productivity, disability pensions, decreased rates of exercise, osteoarthritis and obesity), increasing way faster than CPI. The suggestion that we urgently need a federal government body that monitors sports injuries³, which would include a national ACL register as the first step, continues to get ignored. Can it possibly be for fear of excessive cost (of a laughably small few hundred thousand per year), when our heads are in the sand with respect to the huge annual cost increases for knee scans and knee surgery?

Table 1 – Changes in ACL management in the last fifteen years

Changes in ACL management over the past 15 years	Advantages of the change	Disadvantages of the change
More knee MRI scans performed to assess the ACL	Fewer cases where the diagnosis of ACL rupture is missed and the patient continues sport on an unstable knee	Clinical examination is downgraded in importance; far more knee reconstructions being done on patients with borderline instability and/or who would have survived well with conservative management; increased cost
Trend towards hamstring tendon graft reconstruction	Shorter hospital stays and quicker rehab, meaning some reduced cost per operation	See below (fixation devices); perhaps a trade-off against knee stability
Ever-expanding number of fixation devices & techniques	Perhaps one of them is better than the others (but without a register, how would you know?)	Less of a focus on correct graft positioning; likelihood that some fixation devices actually lead to worse outcomes, ? e.g.cross-pin
More conservative recommendations about full return to sport	Perhaps fewer graft failures from early return	A lot of patients give up sport anyway (which begs the question of whether the reconstruction was really needed)!

Table 2 – Knee reconstruction surgery and knee MRI scans under Medicare (figures from https://www.medicareaustralia.gov.au/statistics/mbs_item.shtml and therefore *exclude* publicly-performed (or Workcover, Third Party) knee reconstructions, ACL injuries treated conservatively and MRI scans paid for privately).

Australian numbers	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Growth over the decade
Privately performed knee reconstructions (Items 49536, 49539, 49542)	5,458	5,879	6,410	6,829	7,022	7,338	7,799	7,913	8,389	8,672	58.9%
Private revision knee reconstructions (Item 49551)	279	338	348	356	408	421	445	487	542	602	115.8%
Medicare-funded knee MRI scans (63328)	17,828	22,226	29,964	36,032	41,017	47,364	54,981	64,676	73,776	78,190	338.6%
Revision percentage	4.9%	5.4%	5.1%	5.0%	5.5%	5.4%	5.4%	5.8%	6.1%	6.5%	33.5%

So would an ACL register save us money? It depends on whether it actually recorded patient outcomes and whether we bothered to act on the findings. But to support my argument that an ACL register should be saving us bucketloads, I'm going to throw a cat amongst the pigeons and say that potentially a huge number of ACL reconstructions performed in Australia are a waste of money, because the operations aren't being optimally done. Just as a joint replacement register in Australia will hopefully, eventually, allow us to follow the Scandinavian countries' lead and get better outcomes from total joint replacement⁴, we surely will eventually follow their lead and get an ACL reconstruction register. Sadly it will probably be later rather than sooner because the Australian Orthopaedic Association (AOA) will probably drag the chain in pushing for an ACL register. Why would you ask for resources to be devoted to improving the quality of surgery when under the current system surgeons are guaranteed to get paid full-fare even if the quality of surgery is bad?

There are examples which I would consider obvious of sub-optimal surgical technique that automatically get fully funded under Medicare⁵. I'm pretty suspicious there is a Sydney surgeon who uses a central portal (cutting directly through the patellar tendon) for knee arthroscopes. This is based on patients I've seen who have developed patellar tendinopathy after a knee arthroscopy and where the portal scar seems to be dead centre rather than either side of the patellar tendon. But even if it is true that this is happening, our Medicare system would completely give this the green light. A surgical rebate is fixed and sacrosanct irrespective of good, poor or uncertain surgical technique.

In contrast, pharmaceutical companies increasingly need to demonstrate quality and efficacy (on a cost-benefit basis) to justify our PBS money being spent on expensive drugs. Why does this scrutiny not apply to surgeons? Once you have jumped the single hurdle of getting a provider number (which you'll have pretty much for life), it is virtually impossible to choose a surgical technique that is so bad that Medicare will stop rebating your patients. We have many good surgeons in Australia who deservedly get very well paid for their work, but our system gives an armchair ride to those surgeons who are demonstrably bad at certain procedures but can fool some of the referring doctors enough of the time to still be seeing patients. As with the PBS, the Medicare system muse one day start taking into account relevant techniques and indications for surgery⁵.

You might think that a rogue Dr Death in Bundaberg or a single surgeon doing arthroscopies through the patellar tendon might be considered exceptions. But what if there was an example of poor surgical technique endemic in the system for a major procedure? How could we recognise it and stop it, when the potential checks in the system (like follow-up registries) basically don't exist? Unfortunately I'm coming to the conclusion that ACL reconstruction surgery may fit into this category.

Admittedly I set the bar pretty high, with the perspective of a gold-standard for ACL reconstruction set by the top surgeons of the North Sydney group⁶⁻⁸. They have what is perhaps the most-renowned sports orthopaedic practice in Australia. Some of the areas in which they were pioneers have been replicated elsewhere, such as surgical subspecialisation into various joints and a strong involvement of sports physicians, radiologists and physiotherapists in the overall sports medicine centre. But it is worth noting also that one of the planks on which they have built the success of the practice is that they do very good ACL reconstructions⁹. I've sung the praises of their senior surgeons before in this journal¹⁰ and recently I invited them to debate the merits of patellar tendon versus hamstring tendon grafts in the BJSM⁷⁻⁸. The constraints of this debate didn't allow them to venture on to the topic of correct graft placement, but I'm going to venture down this treacherous path.

The North Sydney view, which I subscribe to and which now has a lot of objective evidence to back it up, is that the correct femoral graft position for an ACL reconstruction is at the 10 o'clock (for a right knee) or 2 o'clock (for a left knee) position on the lateral wall (Figure 1), not the 11 o'clock or 1 o'clock position higher up in the notch (Figure 2 a and b)^{6, 11}. For those who are familiar with the new double-bundle techniques, this is primarily a reconstruction of the posterolateral (PL) bundle, rather than the anteromedial (AM) bundle¹²⁻¹³. Why pick the posterolateral bundle? For the simple reason that this is the part of the ACL that controls lateral knee stability from 0-30 degrees of flexion, and controls the "screw home" mechanism into full extension. The AM bundle controls lateral knee stability at 90 degrees, where you don't really need it for changing direction (Table 3). It is the same logic which allows you to arrive at the conclusion that the majority of PCL tears don't need reconstruction (unless you are an AFL ruckman or downhill skier) as most people can live with a lax knee at 90 degrees. Of course, many ACL tears involve both bundles but if you are going to tear a single bundle then in 99% of athletes you would prefer to have a stable PL bundle.

Table 3 – Differences between the two ACL bundles

	Posterolateral bundle	Anteromedial bundle
Primary clinical diagnosis	Pivot shift test and Lachman's (15–30 degrees) ^{12–13}	Anterior drawer (90 degrees)
Attachments	10 am (right) or 2pm (left) on the lateral wall of the notch and just in front of the PCL footprint on the tibia	11am (right) or 1pm (left) on the superolateral wall of the notch and on the anterior tibial spine
Functional effect of deficiency	Unable to change direction whilst running, i.e. very important	Problems with bent knee activities (e.g. ? downhill skiing)
MRI appearance	Hard to assess on coronal/sagittal MRIs because of oblique path	Particularly well seen on a sagittal MRI
Mechanism of injury	Fixed foot and internal rotation of the tibia on the femur.	Valgus mechanism
Associated injuries	Lateral femoral condyle bone bruise, lateral meniscal tear	Medial ligament tear

There is now even an RCT to show that the low tunnel reconstructions do better than high tunnel position reconstructions¹⁴ along with other cadaver and clinical studies showing that a more horizontal graft is better than a vertical one at correcting knee instability^{15–16}. Superior knee surgeons often comment that the majority of their revisions from elsewhere have failed the primary reconstruction simply because the original graft position was poor (too vertical). I suspect an ACL register could further confirm this argument if graft position photos were kept and clinical results were analysed according to position.

I used to think that “other” surgeons were probably competent at doing most ACL reconstructions but maybe missed the optimal graft position a bit more frequently and hence may have had higher failure rates. I’m starting to worry that there might be “other” surgeons out there who *routinely* use an incorrect graft position. Recently I did a Google Image search on ACL grafts and was shocked by what I saw – a lot of the grafts were in the wrong overly-vertical position (Figure 2). Even worse was that these images weren’t from one-off “stuff-ups”, but from the surgeons’ own websites indicating what their “optimal” ACL grafts looked like. The images from Figure 2 seem to originate from overseas, but I warn you that I went very close to including some graft pictures published on the web from reputable Australian surgeons that I thought were closer to Figure 2 than Figure 1.

Over the last few years I have become more nosy in asking other sports physicians how other surgeons operate. To my dismay, I’ve heard that a significant number of surgeons in Australia use a transtibial technique (Figure 3) for the femoral tunnel (drill the tibial tunnel and use the same tunnel to keep going up to drill the femoral tunnel). When companies who manufacture devices (Figure 3) promote this technique, it may be forgivable for surgeons to follow their instructions (although there should always be some scepticism about companies trying to flog their own fixation devices). From my knowledge of knee anatomy, this almost guarantees that the position of the femoral tunnel will be more vertical than horizontal. I’ve convinced the best way to get a correct (low) femoral tunnel position is to come in through an anteromedial arthroscopy portal with the knee in full flexion^{6, 17–18} (Figure 4).

I also have grave concerns about the use of any form of cross-pin fixation on the femoral end, with a high likelihood again that the tunnel will be too vertical (unless the cross-pin is pointing more towards the patient’s opposite shoulder than their opposite knee). I would hypothesise that an ACL register would almost certainly show worse results for this type of fixation in a genuine athlete. There may be some good results in patients who have incorrect tunnel placement for their ACL reconstructions, but I would argue that the number one reason for a good result would be that the patient elects to not attempt rapid change of direction on the knee after the reconstruction – meaning of course that he or she didn’t need the reconstruction in the first place!

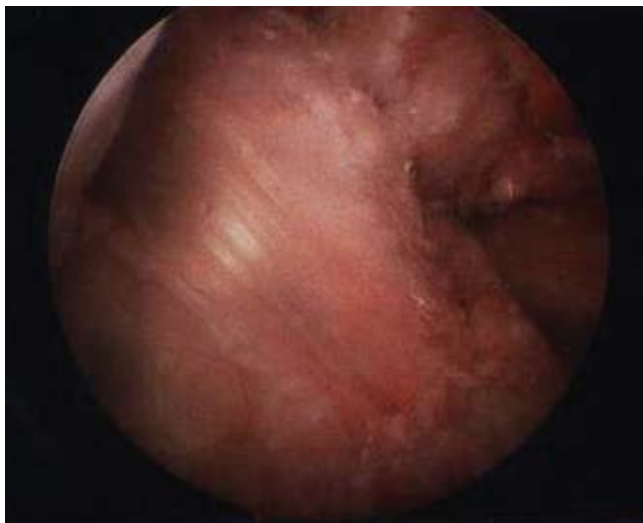
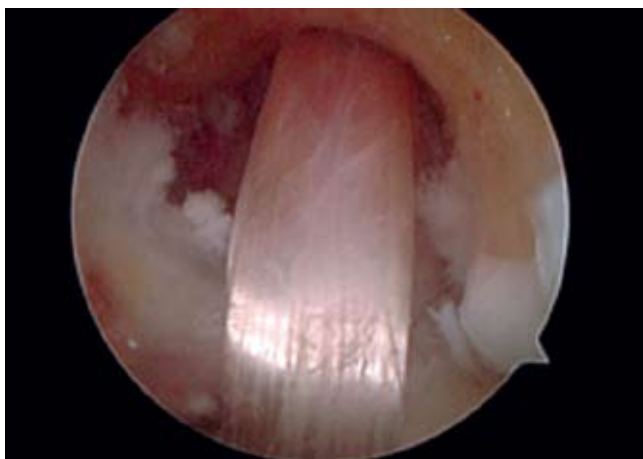
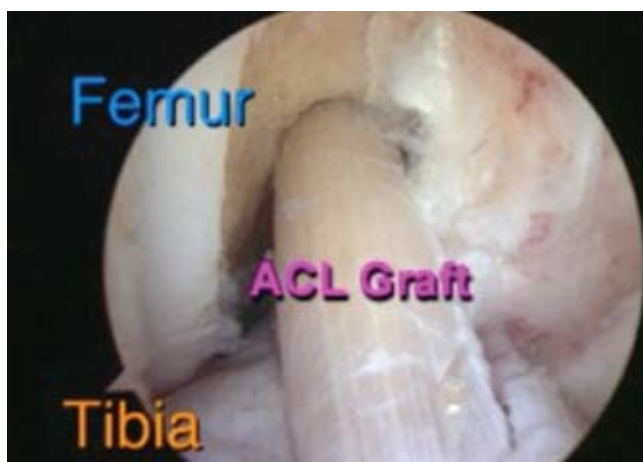


Figure 1 – correct positioning of a right ACL graft (at 10 o'clock, filling up the lateral wall of the notch)



Figures 2 (a) and (b) – Incorrect positions of ACL grafts (too vertical, almost at 12 o'clock), published on the web on overseas websites as allegedly "good" grafts

The modern obsession with MRI scans perhaps means that there may be a greater tolerance for poor graft position than in the pre-MRI days. A dysfunctional graft will give a positive pivot shift test, which (apart from the patient's tolerance of change-of-direction) is the best way to assess knee stability. An incorrect graft position will actually show up the intact graft more clearly on an MRI than a correct one, as the pictures are generally done in coronal and sagittal planes, which is better for showing vertical grafts. The MRI seems to be used more and more as a replacement for good clinical examination.

There is an important debate amongst knee surgeons about the merits of various ACL grafts⁷⁻⁸ – do you go for a bone-patellar-bone graft for stability or a 4-strand hamstring graft for lower graft morbidity? For this debate to be relevant, you need to have the graft in the correct position in the first place. If you have a vertical graft, then the knee won't be stable in the functional positions of multi-directional sports. For a badly positioned graft, you might as well go all the way to an artificial ligament (or not do an operation at all), since you'll want every ounce of quads and hamstring proprioception to hold the knee together at 30 degrees when the ACL graft won't.

Proponents of the double-bundle reconstructions will argue that it is more anatomically correct to reconstruct both of the bundles. In one sense this is faithful to the anatomy, but in a virgin knee there isn't a bony wall between the two bundles of the ACL. I would certainly think a double-bundle reconstruction is better than a vertical single-bundle one. However, if the PL bundle is the critical one for functional knee stability, which I believe is the case, then I believe that bone-PT-bone or 4-strand hamstring is going to be stronger in this position than 2-strand hamstring, as per the double-bundle technique. I think it is another question with room for reasonable debate, but yet again one that we should be trying to answer with a national ACL register. If there was political will it would be so easy to create and fund an ACL register – just devote 5% of the Medicare funding for each ACL reconstruction to maintaining a register, or 100% of the rebate of any recalcitrant surgeon who doesn't want to participate. We should immediately move to the position that if you want public funding to operate for high volume surgeries you should be part of a register which tries to improve the quality of surgical outcomes. If there are any surgeons who are scared of being part of an ACL register, you'd have to ask questions why they wouldn't want to have their results scrutinised.

So if you are not a surgeon and are shocked at the graft position next time you see a post-operative photo, what can you do about it? If the surgeon doesn't have

a good explanation, then someone as frank as me would suggest trying to steer patients who need ACL reconstructions to surgeons who are aiming to get a low/better tunnel position (by drilling the femoral tunnel through the medial portal rather than with a transtibial technique). But rather than upset the apple cart, maybe it is more politically correct to just join the campaign for us to follow the Scandinavian lead and get an ACL register in Australia.

Dr J

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Figure 3 – Taken from a device manufacturer's website showing the technique for drilling of the femoral tunnel through the tibia. Perhaps it should be titled "How to get a poor (too vertical) graft position"!



Figure 4 – Fully flexed knee – the best position for drilling the femoral tunnel through the medial arthroscopy portal to get a 10 o'clock or 2 o'clock tunnel position. This position will lead to a more horizontal femoral tunnel than the technique seen in Figure 3