Preventing hamstring strains

By John Orchard

Unfortunately, for all of our experience with hamstring injuries (and anyone who deals with sprint athletes quickly gets plenty of experience in treating these injuries), there is almost no proven method for preventing them. This is illustrated by the annual AFL injury survey data, where hamstring strains are almost always the most common and prevalent injury, with virtually unchanged injury rates over a 10-year period (Orchard and Seward, 2002). This article will review some of the studies dealing with the issue of hamstring prevention, but also will outline some speculative methods that may help us in the future.

There are some known risk factors for hamstring strain, although the most certain risk factors – age and injury history – are not reversible (Orchard, 2001, Bennell et al, 1998). The most controversial risk factor is low strength (usually measured by reduced hamstring to quadriceps (H:Q) ratio).

Many prospective studies have found a significant correlation between poor strength and risk of hamstring injury (Burkett, 1970, Orchard et al, 1997, Yamamoto, 1993). However, none of these studies measured past injury history as a confounder, and it is possible that low H:Q ratio was highly correlated with those athletes who had a past history of hamstring strain.

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A more recent study with superior sample size to those cited previously suggested that H:Q ratio was not a risk factor for hamstring strain (Bennell et al, 1998). This paper used an eccentric protocol, which has become standard for new generation isokinetic machines. However, a possible problem with this methodology is that an eccentric protocol on an isokinetic machine can actually cause a hamstring strain itself (Orchard et al, 2001), so athletes may not give 100% effort when performing the eccentric protocol out of self-preservation.

Even if the weight of evidence is highly suggestive that low H:Q ratio may be a risk factor for hamstring strains, it is not readily apparent that attempting to reverse H:Q deficits can reduce the incidence of hamstring strain. One study from two decades ago suggested that this approach may work, but used a non-randomised methodology (Heiser et al, 1984). This has not been repeated by any follow-up studies, although recently Tyler et al reported similar results in adductors strains to the method of Heiser et al with hamstring strains (Tyler et al, 2002). The lack of follow-up studies to support the success of Heiser's method, plus the lack of acceptance by clinicians make it very unlikely that the magic bullet for hamstring prevention is simply reversing strength deficits.

Another preventive approach that is very unlikely to yield success is stretching. Almost all of the studies that correlated strength deficits with injury risk failed to find a correlation of flexibility with injury risk (Bennell et al, 1998, Burkett, 1970, Orchard et al, 1997, Yamamoto, 1993, Heiser et al, 1984). Also, recent randomised controlled trails have placed major doubt on stretching as a method for injury prevention (Herbert and Gabriel, 2002, Shrier, 1999). A major confounder for flexibility studies is that athletes with greater 'speed' show greater flexibility and almost certainly have a higher injury risk. Distance athletes have reduced hamstring flexibility and may actually may derive a performance benefit from this (Wang et al, 1993, Jones, 2002), while it is known that hamstring injury incidence declines as running speed is reduced (Bennell and Crossley, 1996).

Hamstrings... almost no proven method for preventing them

Even though the AFL competition as a whole has a remarkably consistent rate of hamstring strains, the hamstring injury rates of various teams show quite a high standard deviation. In a recent editorial, I discussed how Malcolm Blight (when coaching) focused on a heavy aerobic workload in the pre-season, which he obviously felt improved end-of-season fitness based on the results of his teams over the years (Orchard, 2002). It appeared that there was possibly a short-term cost in terms of increased rates of hamstring injury (Orchard, 2002).

Another anecdotal observation that is gaining in popularity is that afternoon running training sessions may be a risk factor for hamstring injuries. Given that footballers and sprint athletes need to do more than 7 sessions per week (when competition is included), there will be occasions in the training schedule where both a running training session and a weights session are performed on the same day. In theory, the second of the two of these sessions will be performed in a fatigued state. Since weights sessions do not have a significant risk of hamstring strain injury, it is perhaps better to perform a weights session after the running session. If players are 'sore' from a morning weights session and run in the afternoon, then perhaps the risk of muscle strain increases. Terry Wallace was quoted in the Melbourne media last season as attributing a low rate of muscle strain injury at the Western Bulldogs under his coaching to having morning skills training sessions.

The greatest challenge in hamstring prevention is in helping the athlete who has had multiple muscle strains. An analysis of the AFL injury data showed a very high risk of hamstring and calf strain for those older players who had suffered multiple muscle strains in the past (Orchard, 2001). It is fascinating that there is no correlation between quadriceps strain and age, when the correlation is very strong for hamstring and calf strains.

Without giving away any secrets, there are good examples in most of the popular sports of players who seem to be constantly tearing hamstrings (and/or calf

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muscles). In the AFL, Robert Harvey, James Hird and Paul Kelly are some of the highest profile examples in recent years, although the list is extremely long. In the NRL, you can almost time the onset of the State of Origin series with the news that David Peachey is out with a hamstring strain. In cricket, Steve Waugh has been forced to give up bowling because of his propensity towards muscle strains, and it has only been his super-elite ability with the bat that has allowed him to continue playing at a high standard for many years. Some football players unfortunately notice that at the same time in their career that they start to tear hamstring and calf muscles regularly, they lose 'half a yard' of pace.

In discussing the Steve Waugh case with Patrick Farhart, who was co-authoring the case history of one of Steve's injuries (a left calf strain) (Orchard et al, 2002), Patrick drew my attention to a paper published by Chris Briggs

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in the mid 1990s (Briggs and Chandraraj, 1995). This was a discussion of the lumbosacral ligament in pelvis, and showed a correlation between L5/S1 degenerative changes and compression of the L5 nerve root by the lumbosacral ligament. The lumbosacral ligament and its propensity for extraforminal entrapment of the L5 nerve root was first described by Nathan et al. and by other anatomists since (Olsewski et al, 1991, Transfeldt et al, 1993, Nathan et al, 1982).

This anatomical configuration is quite possibly present in many of these players who find that they have recurrent hamstring and calf tears despite regular maintenance. If a nerve entrapment such as this were present, it could also explain the correlation between hamstring injury risk and low strength, but the difficulty in reducing the increased risk by strengthening. This anatomical configuration also is compatible with an athlete that has no restriction of lumbar and hip flexion, as it is most possible that any entrapment by the lumbosacral ligament would be worse in extension. It is worth mentioning that for many years 'piriformis' syndrome has been described as a cause of recurrent posterior thigh pain, with inconsistent (although some excellent) results from division of the piriformis muscle to release the sciatic nerve (McCrory and Bell, 1999).

Unfortunately, the lumbosacral ligament is not easily accessible. The best method for reaching it would probably be through an anterior approach, possibly with an abdominal laparoscope.

This type of surgery has recently been described (Matsumoto et al, 2002). It remains to be seen whether it would be technically easy to divide the ligament to free an entrapped L5 nerve root, and whether this procedure would reduce the risk of hamstring injury without causing side effects. It also remains to be seen whether such an entrapment could be confirmed with no invasive methods (such as MRI) prior to surgery. If this theory is accepted as justifying experimental exploration by a spinal surgeon, there will probably be no shortage of elite athletes lining up to be 'guinea pigs' for a lumbosacral ligament release.

Hamstring injuries cause 15% of missed playing time in the AFL and have an average recurrence rate of 30% for the remainder of the season (Orchard and Seward, 2002). The changes that occur subsequent to a muscle strain almost certainly take months rather than weeks to reverse, so that it is likely that even those players who successfully return to full competition soon after a hamstring strain are doing so with subtle gait alterations that may affect performance or predispose to other injuries (Orchard and Best, 2002).

The most unlikely scenario is that no progress will be made in the prevention of hamstring injuries. Medical science gives us great confidence, and too many examples of success where a condition seemed untreatable or unpreventable, for a problem that is as common as hamstring strains to continue to confound us forever. This is not to say that they will ever be eliminated, only that it would be more surprising that in a further 20 years time that scientifically proven methods for preventing hamstring strain had been established.

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