SPORTS INJURY BULLETIN
PREVENTION • TREATMENT • REHABILITATION

In this issue

Issue 87 **March 2009**

From the editor

As I write, we seem to be in the midst of an emotional roller-coaster of sport, what with that Australian Open final, ongoing cricketing sensations and the Six Nations rugby. A season of high drama indeed, perhaps matched only by the drama of extreme weather across the world (I'm having a credit-crunch-free month, so that doesn't count).

Down to business, I have a fantastic bunch of stuff for readers this month, kicking off with Part 2 of Chris Mallac's gym injuries series. I've certainly learned a thing or two I never knew about the upright row from this excellent analysis, and I hope you find it similarly helpful. Do let me know whether you agree or disagree with Chris.

Another strong offering this month from David Joyce on the subject of sports concussion and how to manage it. As always with David, you know you are getting solid research-based information and sound practical advice, so if you are ever involved in first-aiding or providing assistance pitchside, this one is an absolute must-read. Team coaches take special note.

Jane Johnson makes another welcome appearance with a round-up of common forms of stretching, neatly assessed for 'compare and contrast' purposes. As she points out, there is an expanding repertoire of stretch techniques on offer these days, and trainers and therapists alike need to know at least the theory of these, if not the practice, to be able to advise their clients on the most helpful forms for their circumstances.

And finally, Nick Grantham has brought us a really special 'Research Review extra' this month. RR is looking at that ever-popular, always problematic matter of gluteus medius. And Nick has pulled together an entire repertoire of glute med exercises from one of the research papers. This is a great compilation, which should be of interest to every *SIB* reader. Enjoy!

Jane Taylor
Email: sib@sports-performance.com

Gym injuries: no 2

The upright row

Chris Mallac continues his series on the injury risks of everyday exercises

There is a wealth of shoulder exercises aimed at developing hypertrophy and strength in the deltoids and upper trapezius. Our focus this month is on one of the most common of these: the upright row.

In my view, the upright row is a somewhat superfluous exercise, as well as being one of the more dangerous exercises from a shoulder injury perspective. But if you are going to use it, here's what you should know.

Training aim

The basic goal of the upright row is to lift a weight from the hips up to the chin and lower it back down. This is achieved by holding a barbell with a pronated (palms facing lifter) grip with the hands from 7.5cm to 20cm (3 to 8 in) apart. The weight is lifted in line with the vertical axis of the body to the upper thorax/chin level and then down to the hips again. The force for the lift comes from:

- elbow flexors, such as brachialis, brachioradialis and biceps
- shoulder abductors, the deltoids
- scapular elevators such as the upper trapezius.

Main training uses

The upright row is a 'compound exercise' (it involves multiple joints), commonly used to develop shoulder strength/size. It was popularised by bodybuilder-cum-movie star-cum-politician Arnold 'I'll be back' Schwarzenegger. Arnie stated that it was a great exercise to develop upper trapezius bulk.

The exercise also requires a considerable amount of lower back extensor strength, as these muscles must work to prevent the body from flexing forwards during the lift. The major muscles trained are deltoids and upper trapezius.

Not many savvy rehab specialists use the upright row in rehab/strength training for injured athletes. For the reasons discussed below, it is a moderately risky exercise and more suitable alternatives are available. From a biomechanical point of view, the scapulae are elevated/shrugged far too much to imitate normal scapulo-humeral mechanics.

Technique: how to get it right

- Stand with the bar resting at hip height.
- Hands are 7.5cm to 20cm (3 to 8 in) apart, holding the bar in an underhand or pronated grip.
- The bar is pulled up towards chin level, leading with the elbows. At any point in the movement, the elbows should be higher than the bar.
- Wrists are allowed to flex during the movement; this is necessary for the bar to stay close to the body.
- The weight is then lowered back to the hips.
- Spine is held in neutral, with shoulders directly over the hips at all times.
- Cervical spine is held in neutral, eyes looking directly forwards.

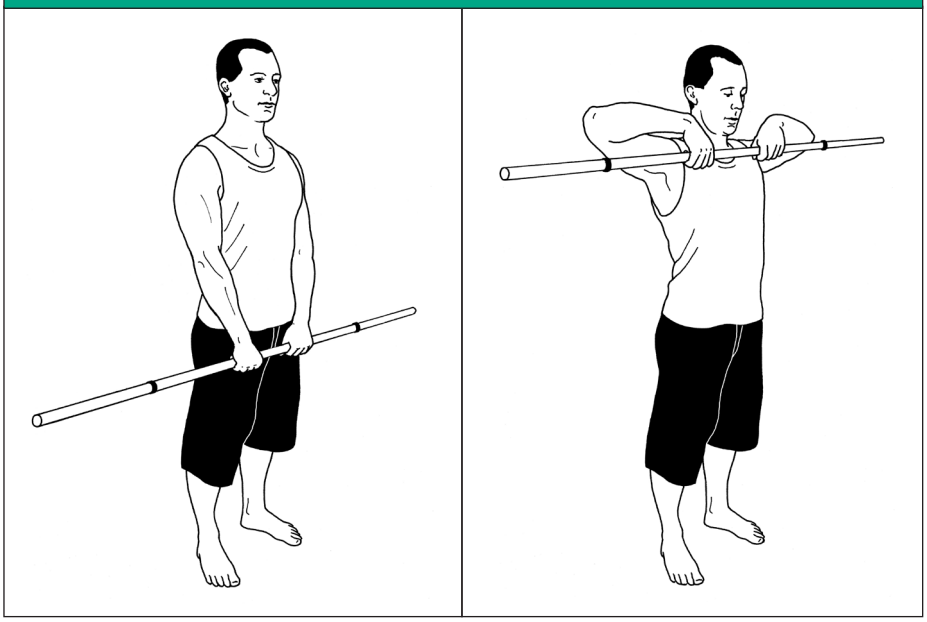
Figure 1 (overleaf) shows the correct body position at the start and the top of the lift.

Variations

Close hand grip – generally the closer the hands, the more the upper trapezius is recruited, as the hand position with a closer grip allows more scapular depression. This then requires a counterbalance force by the upper trapezius.

Wide hand grip – this is not recommended for most gym goers. The type of athlete who might use it is an Olympic powerlifter or an athlete using Olympic movements such as

Figure 1: Correct body position at start and top of lift



the 'high pull' exercise (in essence a high-speed version of the upright row).

Generally, the wider the lifter's hands are held apart, the greater the chance of shoulder impingement, as it is harder for the glenohumeral joint to externally rotate at the top of the movement. Internal rotation of the shoulder while it is abducted (elevated) is an impingement position (see below).

Height of the bar – The bar height can be limited to chest level, avoiding the impinging position of abduction with internal rotation at the top of the movement.

Lifting tips for instructor use

- Look directly forwards. Start with the chin retracted and scapulae in a neutral protraction/retraction position.
- Keeping the bar close to the body, slowly raise it to the chin.
- Lead with the elbows, not with the hands.
- Don't over-extend (lean back) at the top of the lift.

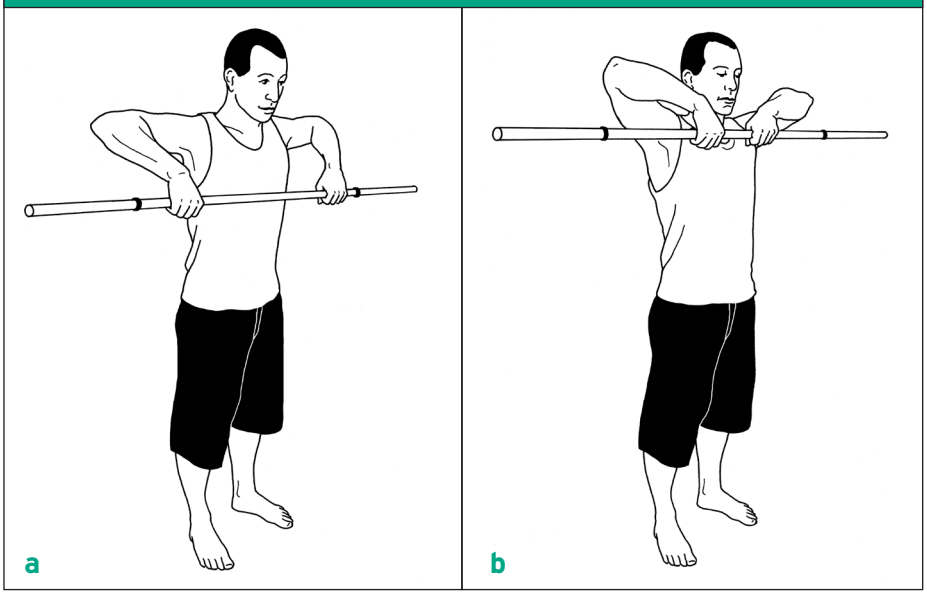
The injury risk

The primary musculoskeletal area susceptible to injury from incorrect technique is the shoulder, in particular the subacromial structures. Let us start with a quick recap of the tissues in the subacromial space and the mechanics of the glenohumeral joint with abduction.

The anatomical structures found in the subacromial space (see Figure 3 opposite) are:

- the coracoacromial arch formed by the coracoacromial ligament
- the subacromial bursa
- the supraspinatus tendon
- coracohumeral ligament
- the long head of biceps tendon.

Figure 2: (a) grip too wide (b) elbows too high



When the arm is abducted away from the body into shoulder elevation, some amount of shoulder external rotation is also needed. If the shoulder were to stay in neutral or even in internal rotation, the bony prominence on the outside of the humerus (the greater tuberosity) would abut the acromion at around 90° of shoulder abduction.

The soft tissues between the greater tuberosity and the acromion would then become impinged, namely: the subacromial bursa, the supraspinatus tendon, the coracohumeral ligament, and the biceps tendon.

The biomechanical nature of the upright row (pulling a straight bar in the frontal plane) makes it difficult to allow external rotation to occur, thereby making the exercise risky for the shoulders.

Technique fault 1: hands held too far apart on the bar

The biggest issue with having the hands held too far apart (more than 20 cm or 8 in) is that the shoulder finds it very difficult to externally rotate in this position (see Fig 2a). Crucially with a narrow grip, the hands can go higher than the elbows at the top of the lift, which enables shoulder external rotation to occur. It's impossible to get the hands above the elbows when the grip is too wide, so the shoulder stays in some degree of internal rotation.

Technique fault 2: elbows remain high throughout

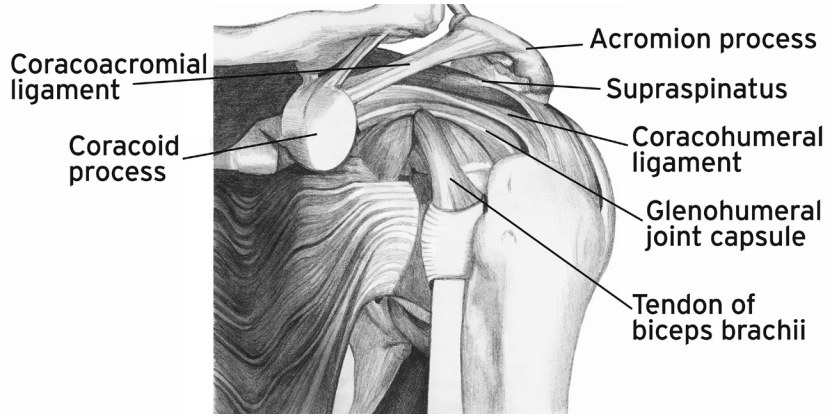
It is quite common for strength coaches to be taught to keep the elbows higher than the wrists throughout the movement. If this position is maintained at the top of the lift, the hands/wrists reach just below chin level and the elbows will be up at about ear level. Try this and see how much internal shoulder rotation (read: impingement) is required to hold this position (see Fig 2b). If, however, the elbows stop at shoulder level but the hands continue to chin level, then the last phase of the movement deploys external shoulder rotation (read: safe).

Technique fault 3: excessive weight on the bar

This is possibly the most dangerous technique fault. If the initial inertia (weight) of the bar is too great, the lifter will initiate the movement by flexing at the hips/trunk and using some back extensor force. The spine is forced into a degree of extension during the upward phase of the lift, potentially compressing the lumbar spine joints.

Furthermore, at the start the lifter's cervical spine is usually forced into some extension (the chin pokes out). This alone

Figure 3: Anatomical structures in the subacromial space



will compress the cervical spine joints, but the significant contraction of the upper trapezius at the start of the lift, in order to aid shoulder elevation, results in a greatly magnified compressive load on the cervical spine.

The upper trapezius fibres originate on the base of the occipital bone of the skull, so as the upper trapezius rapidly and forcefully contracts, the upper cervical spine is forced into further extension, with the downward force of the upper trapezius compressing these joints further.

Technique fault 4: bar too far away

If the bar is allowed to travel in an arc too far away from the body, the distance increases from the bar to the axis of rotation for flexion/extension of the trunk. The leverage on the back extensors becomes magnified, increasing the spinal compression force on the lumbar spine during the lift.

The dumbell upright row introduces similar problems. In addition, the bulk of the dumbell moving up the trunk on the lift will usually increase the distance from the vertical weight force to the shoulder axis of rotation (as the hands are generally farther from the body than with a barbell). This results in a large internal rotation moment that needs to be counteracted by the external rotators, as well as increased load on erector spinae. In short, dumbell rows may be even more risky than the barbell.

Alternative exercises

There are several exercises that recruit the deltoids and upper trapezius while avoiding the shoulder-impinging internal rotation position of the upright row and the cervical spine compression caused by the upper trapezius.

Seated dumbell shoulder press

The old-school seated dumbell shoulder press is a great alternative for deltoid strength / hypertrophy development, as the shoulder is allowed to externally rotate fully during the lifting phase. Starting at shoulder level, the weight can be either pressed above the head with both arms simultaneously or alternating. This exercise is made even safer if the supporting bench can be inclined to around 80° (the lifter sits leaning back a bit). This allows the glenohumeral joint to elevate fully without any subacromial compression.

Dumbell lateral raises

Hold either one or two dumbells and lift the weights out to the sides of the body, to about 90° abduction. This is an almost exclusively deltoid exercise, as the leverage of a straight arm lifting sideways away from the body imparts a large mechanical lever on to the deltoid.

To perform this exercise in the safest way possible, allow the hands to travel slightly forward in the frontal plane, about 10-15° (ie, hands end up forwards of shoulders if you take a bird's eye view). This 10-15° position, known as 'scaption', allows for the natural inclination of the scapulae, which sit at around 10-15° on the rib cage. This position is therefore considered the perfect abduction angle.

Shoulder shrugs

Holding a barbell in front of the body (similar to how you would start the upright row), shrug the tips of the shoulders up towards the ears and down again. This simple movement is in essence an exclusive upper trapezius exercise which spares the shoulder joint from any impinging movement. Shrugs, and not shoulder rolls, should be used. With backwards shoulder rolls, the lifter tends to think about scapular retraction whilst elevating the scapulae. As most gym goers are very internally rotated in the shoulders and protracted in the scapulae, they tend to end up consciously 'forcing' the scapulae into retraction while the upper trapezius is active. The result is that the chin pokes out, the cervical spine extends, closing the facet joints, and is then compressed by the large trapezius contraction. I have treated s gym goers with acute neck injuries from these rolls. Stick to shrugs.

Next issue: The lateral pulldown

Traumatic injury briefing

Seeing stars

David Joyce explains how to spot and then manage sports concussion

Your star player has his head bowed as he stoops to pick up the ball, ready to send it to a team-mate who will surely score. Suddenly an opponent's eyes light up. In slow motion you watch as your player is cleaned out with a well-aimed hip to the head. From the sidelines you hear the sickening thump and are sure you can see a halo of little cartoon birds flapping and twittering above his head.

What comes next is one of the most challenging situations any sports clinician has to face: dealing with concussion in the heat of battle. Concussion during play is common in all the football codes, boxing, martial arts, ice hockey and horse racing. Professional jockeys have the highest rates of concussion of any sports in the world [1]. Yet the condition is often misunderstood and approaches to management vary wildly, from ignoring the incident to mandatory exclusion from sport for a fixed period. Crucially, concussion affects everyone differently, and the type and duration of post-concussive symptoms vary between individuals. Recognising this is key to effective management.

Defining concussion

Concussion is the term used to describe a type of minor head injury. In 2001 in Vienna and again in 2004 in Prague, a conference of the world's foremost experts in sports concussion concluded that

concussion is: 'A complex pathophysiological process affecting the brain, induced by traumatic biomechanical factors' [2].

In detail, they defined the episode thus:
i. Concussion may be caused either by a direct blow to the head, face, neck or elsewhere in the body with an impulsive force transmitted to the head.
ii. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
iii. Concussion may result in neuropathological changes but the acute clinical symptoms largely reflect a functional disturbance rather than structural injury.
iv. Concussion results in a graded set of clinical syndromes that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course.
v. Concussion is typically associated with grossly normal structural neuroimaging studies.

Of special interest here is the fact that an athlete doesn't have to have been knocked out cold in order to be concussed. The vast majority of concussive episodes don't involve any loss of consciousness. Furthermore, a brief loss of consciousness is not a predictor of the severity of the concussion [3].

Paradoxically if a player is knocked out, they may receive better management, because of the more dramatic circumstances of their presentation [3].

This definition also tells us that we don't have to be hit squarely to the head in order to be concussed. What is needed is a blow to the body, neck or head in which the force is transmitted either directly or indirectly, like a whipcrack, to the head. Finally, note that the problem is usually associated with how the neural connections function within the brain rather than damage to the brain tissue itself. We can therefore think of concussion more as a temporary problem with the software, rather than with the hardware.

At their 2004 Prague conference, the Concussion in Sport group divided concussion into two subtypes[4].

- In simple concussion, symptoms progressively resolve over 7-10 days.
- When the athlete is still suffering symptoms, either at rest or with exertion, more than 10 days after the injury, complex concussion is said to have occurred.

How to identify concussion

Knowing when a player is concussed is not necessarily a simple matter. You may not have seen the incident, even if you were pitch-side at the time. Table 1 (above) is a good general guide to the more common signs and symptoms.

Table 1: The concussed athlete, symptoms and signs

Symptoms	Signs
● Headache	● Impaired consciousness (not a pre-requisite)
● Balance problems	● Poor coordination or balance
● Dizziness	● Concussive convulsions/ impact seizure
● Feeling dazed	● Gait unsteadiness
● Visual disturbance – seeing stars, double vision	● Vomiting
● Hearing problems – ringing in the ears	● Slow to respond to questions or cues
● Irritability or emotional changes	● Easily distracted/poor concentration
● Feeling slow or tired	● Emotional volatility or personality changes
	● Vacant stare
	● Slurred speech
	● Decreased playing ability
	● Inappropriate playing behaviour

Immediate management

If you are on the sideline and you see the incident, it is important to get onto the field as soon as safely possible.

The first priority is to exclude the presence of a serious head or spinal injury. If the player is unconscious or you suspect a serious spinal injury, full spinal precautions must immediately apply. If you are qualified to manage this, do so. Otherwise, ensure the game has stopped and call for emergency medical assistance.

The Maddock's Questions [5] can be asked pitch-side, to determine if there is a memory deficit that has accompanied the concussion. The questions are:
1. Which ground are we at?
2. Which team are we playing today?
3. Who is your opponent at present?
4. Which half is it?
5. How far into the half is it?
6. Which side scored last?
7. Which team did we play last week?
8. Did we win last week?

It can test your own memory to ask all the questions, so you may wish to carry a laminated prompt sheet in your run-on kit bag. And make sure you know the answers! There are two main limitations to these questions: they are not appropriate for every sport (but can be adapted without too much trouble for most) and many teams these days have players who may not speak English.

A player who gives all correct answers is not necessarily precluded from having sustained a concussion. But any incorrect answers can be taken as a sign that the player should be removed from the field – easy enough to state but can be much harder to achieve in practice. Conversation with a mildly concussed player often features the following responses:
'I'm fine, Phys.'
'No, really Phys, I'm fine.'
'Just give me a minute, Phys...'
...player runs off to rejoin play. [6]

It can take some perseverance to ensure the correct clinical judgement is made. You cannot assume the player is fit to play simply because they keep saying they are OK. If they just run off, a good rule of thumb is to trust your gut instinct. You may well risk general unpopularity if you take a player off, but this is a small price to pay when the bigger picture is painted.

If the decision is made to take the player from the field, do not leave them unattended, as a subtle deterioration in consciousness level or speech may indicate a serious head injury. In the vast majority of cases this will not occur and the athlete can be sent home with someone responsible and with a verbal and written briefing about what to look for in terms of deterioration.

Further symptoms can occur even as late as 48 hours after the incident, including:
- headache that worsens
- very drowsy or can't be woken
- can't recognise places or people
- repeated vomiting
- unusual behaviour or apparent confusion; very irritable
- seizures
- weak or numb arms or legs

- unsteadiness on feet
- slurred speech.

Should the player or anyone close to them notice any of these symptoms, they should be taken to hospital for a more thorough examination [7].

The meaning of rest

If a player has been taken from the field with concussion, they should not be allowed to return. The risks of returning to play too soon include worsening of symptoms, incurring another injury and, of course, poor performance.

McCrory stated that the cornerstone of concussion management is 'masterly inactivity' [8]. This is now understood to mean absolute rest after a concussive episode until all symptoms have disappeared. This means more than rest from playing. It means a rest from work, from all exercise, reading and even PlayStation. A premature return to these activities tends to prolong the duration of post-concussive symptoms.

One of the trickiest problems of managing concussion is that it can be an 'invisible' state. It is mostly associated with normal imaging and, outside of the acute post-concussive period, there are no external signs such as we might see with, for instance, an ankle ligament strain. This is difficult for the therapist – who likes to see improvement from session to session – and can also be a source of significant stress to the athlete, coach and employers. It's easier to accept your athlete/employee being out of action if you can see they are still limping!

One of the most constructive things the clinician can do, therefore, is to educate the athlete, coach, employers, partners, etc, to ensure the athlete is not put under pressure to return to physical or mental activity before it is appropriate. Johnson et al sagely noted that: 'within the context of concussion, we (and the athlete) are left to wonder why an investment of four months to rehabilitate a high ankle sprain is considered acceptable, whereas four months for brain rehabilitation is considered untoward.' [9]

Rehabilitation

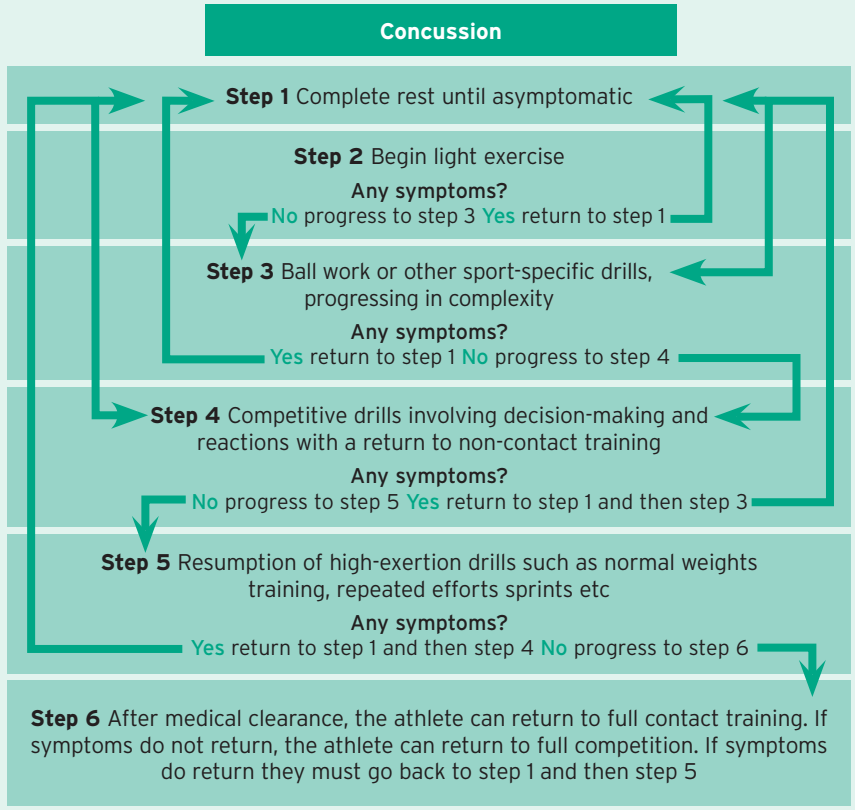
We must wait until the athlete is completely asymptomatic before moving on to the next stage of active rehabilitation. Unlike an ankle or a shoulder injury, there can be no blurring of the lines when it comes to progression between phases of rehab.

Once the athlete is asymptomatic and has demonstrable evidence of return of full higher-order mental processing – as determined by neurophysiological testing – they may resume light activities, graduating towards full training as symptoms dictate. If neurophysiological testing is not available, the athlete should wait until they have been given clearance by experienced medical personnel prior to resumption. This is especially important with complex concussion.

Initially tasks should be kept simple, such as straight-line running, gradually progressing towards sport-specifics that include reaction- and decision-making drills as well as integrated multi-stage tasks that require good memory. We need carefully to evaluate the athlete's performance in these drills, with particular attention to hand-eye coordination, reaction times and appropriate decision making. Should the athlete begin to complain of any symptoms, such as headache, nausea or dizziness, the rehabilitation must be stopped and the athlete rest again until fully asymptomatic.

Figure 1 (above) gives a simple flow diagram for staged rehabilitation.

Fig 1: Staged rehabilitation after sports concussion



Return-to-play tests

As therapists, we always like to have objective measures to assess the severity and improvement of an injury, but this can be difficult with concussion. It has been stated that symptoms can resolve before cognitive function has fully recovered [10]. At the start of the decade, computerised cognitive tests such as CogSport were just being developed; these are now seen as the gold standard. CogSport is a series of computerised tests that examine simple choice and complex reaction times, memory and attention. These higher order cognitive tasks have been shown to be disrupted after concussion [11].

The battery of tests is administered pre-season to establish a 'normal' baseline; should a player then be concussed, they are not allowed to return to competition until they have recovered that baseline. Such tests are seen as being more sensitive than the Digit Symbol Substitution Test (DSST) in detecting cognitive impairments in minor cases of concussion, but they are also expensive and therefore in reality are only used in high-risk sports.

The DSST examines information-processing speed, in a task that requires the athlete to substitute a symbol for a random set of numbers in a 90 second period. While not as sophisticated as CogSport-type testing, at all but the elite level the DSST may be a more appropriate test to conduct pre-season. These tests have the added advantage of providing an objective measure that the therapist can use to communicate with coaches when discussing an individual's return to play.

In low-risk sports, management according to clinical guidelines is still the most common method of assessing return to play. For complex concussion, it is advisable to seek a neurology opinion before return to sport.

Mandatory exclusion

Many sports have made it compulsory for a concussed player to be excluded from competition for a specific period, usually seven to 10 days. While most concussion injuries do indeed resolve within this time frame, McCrory points out that this approach is difficult to endorse from a scientific standpoint, as every individual will respond differently to each event [1]. It cannot be stressed enough, therefore, that each case must be judged on its own merits. The risk of a formulaic approach is that players with complex concussion may return too soon and risk prolonging their post-concussion symptoms. The only mandatory exclusion from competition should be if the player is still symptomatic or not back to their baseline scores on neuro-psychological testing.

Summary

Concussion is a common, usually minor injury, particularly in collision sports. For the sports therapist, the most challenging but important responsibilities are to recognise the signs and symptoms and be prepared to make the hard call to remove a concussed player from the field. In the vast majority of cases, the athlete will recover along a predictable course, but we must be prepared to refer on to the hospital if the athlete has sustained severe concussion or deteriorates after the event.

The cornerstone of management is complete physical and mental inactivity until asymptomatic, plus a step-wise return to sport, graduated in terms of physical and cognitive demands. The player must be able to get through each phase of this rehabilitation and remain symptom-free before they are allowed back to play.

References

1. McCrory, P (2002). Sports concussion. In P Brukner and K Kahn (eds) *Clinical Sports Medicine* (3rd edition). McGraw-Hill Professional. Sydney.

2. Aubry, M, Cantu, R, Dvorak, J, et al (2002). Summary and agreement statement of the First International Conference on Concussion in Sport, Vienna, 2001. Recommendations for the improvement of safety and health of athletes who may suffer concussive injuries. *British Journal of Sports Medicine*, 36: 6-10.

3. Kissock, J and Johnson, KM (2005). Return to play after concussion – principles and practise. *Clinical Journal of Sports Medicine*, 15: 426-431.

4. McCrory, PM, Johnson, KM, Meeuwisse, W, et al (2005). Summary and agreement statement of the Second International Conference on Concussion in Sport, Prague 2004. *Clinical Journal of Sports Medicine*, 15: 48-55.

5. Maddocks, DL, Dicker, GD, and Saling, MM (1995) The assessment of orientation following concussion in athletes. C*linical Journal of Sports Medicine*, 5: 32-35.

6. Pitch Side Immediate Trauma Care Course. (2007) Rugby Football Union, Twickenham, London.

7. Standardised Concussion Assessment Tool, (2004). Summary and agreement statement of the Second International Symposium on Concussion in Sport, Prague, 2004.

8. McCrory, P (2001). New Treatments for concussion: the next millennium beckons. *Clinical Journal of Sports Medicine*, 190-193.

9. Johnson, KM, Bloom, GA, Ramsay, J et al (2004). Current concepts in concussion rehabilitation. *Current Sports Medicine Reports*, 3: 316-323.

10. Maddocks, DL and Saling, M (1996). Neuropsychological deficits following concussion. *Brain Injury*, 10: 99-103.

11. Collie, A, Makdissi, M, Maruff, P, Bennell, K, McCrory, P (2006). Cognition in the days following concussion: comparison of symptomatic versus asymptomatic athletes. *Journal of Neurological and Neurosurgical Psychiatry* 77: 241-245.

Therapeutic techniques

Hold, contract, release and bounce

There's so much more to stretching than just stretching. **Jane Johnson** compares, contrasts and debunks

Stretching has become a science. A growing understanding of the physiology of stretching means sports support professionals now have a huge variety of methods to use with clients for training, injury prevention and rehabilitation. This article gives an overview of some of the most popular types of stretching, their advantages and disadvantages, in order to help therapists and trainers select the most relevant forms for their clients. I have used the description of a hamstring muscle stretch in every instance to illustrate the different techniques.

Active stretching (static)

Popularised in the 1980s by Bob Anderson[1], an active stretch is one in which the client performs the stretch unaided. There is little or no movement as the controlled stretch position is maintained for about 30 seconds, then sometimes repeated. Inherent to the practice of yoga, physiologically this type of stretch has been termed 'a form of visoelastic myofascial release'[2]. Put simply, muscles and their associated fascia begin to lengthen slowly in response to a gentle and continuous load.

In therapeutic terms this physiological response is a property of muscle and fascia known as 'creep'. The fact that the load applied is constant and gentle is key to the effectiveness of active stretching.

Many people mistakenly believe that active static stretching can aid warm-ups and cool-downs, reduce DOMS, reduce injury, and enhance athletic performance. There is little evidence to support these beliefs [3].

How to do it

A **static active hamstring** stretch might be done by lying supine, clasping the hands behind an extended knee and flexing at the hip to create the stretch. Hold the position steady for approx 30 seconds before releasing and optionally repeating.

Advantages

- Client can perform the stretch themselves at home or after exercise to maintain joint range.
- Gives the athlete control over their own rehabilitation or flexibility routine.
- Useful if the athlete does not have access to a therapist or trainer.
- Can be done almost anywhere and at any time.
- No equipment is needed.
- Is relatively easy.
- Strengthens agonistic muscles (see below).
- Is known to enhance range of movement.
- Is reportedly safe.
- May be used in early-stage rehabilitation.

Disadvantages

- Inexperienced clients may adopt an incorrect position and fail to stretch the intended muscle.
- The athlete may not hold the stretch position for long enough.

- The technique requires strength in the agonistic muscles, which may be a problem for inactive clients or those with muscle atrophy (although arguably it is also good for them – see key benefits below).
- It's boring.
- Most sporting movements are ballistic in nature, so for many athletes there may be little practical benefit from increasing static flexibility.

Key benefits

- Useful in a clinical setting where flexibility is being limited by weakness in the agonist muscles being used to bring about the stretch (for instance, a sportsperson needing to gain knee extension after knee surgery or a hamstring injury where maintenance of quadriceps strength is as important as hamstring rehabilitation).
- Combined with controlled breathing, it may be useful within a relaxation programme.

Passive stretching

While an athlete may perform passive stretches unaided, by using a piece of equipment, the term is commonly used to indicate that a second person is required to help bring about the stretch. This person is often another team player, the trainer or a therapist. No muscles are contracted in order to bring about the stretch.

How to do it

A **passive hamstring stretch** might be done lying in supine, using a towel hooked around the thigh to help bring the hip into flexion in order to stretch the hamstring muscles without deliberate contraction of quadriceps. Alternatively in supine, a trainer uses the straight leg raise position to stretch the client's hamstring.

Advantages

- Makes stretching less effortful, as the client relaxes into a position that enables the trainer to facilitate the stretch.
- When performed as part of a team activity, may make stretching more enjoyable, facilitate concern for fellow team members and enhance feelings of progress.
- Is relatively easy to do.
- Can be performed almost anywhere.
- No equipment is needed.

Disadvantages

- Unless equipment is used, a stretching partner is needed.
- There is a danger of the athlete being overstretched by an inexperienced partner.
- The athlete must trust their partner.

Key benefits

- Passive partner stretching is a good option when flexibility is limited by the elasticity of the muscle/s to be stretched.
- Also useful therapeutically when the agonist is too weak to bring about an effective active stretch.

Active (ballistic) stretching

The stretched muscles are used as a kind of spring to help the athlete bounce repeatedly and rhythmically in and out of the stretch position, in effect making many small stretches. Muscles are not allowed to remain in the stretched position even for a few seconds. Instead, the athlete uses momentum to stretch into and beyond their end of range position with the intention of increasing range of movement (ROM) with subsequent movements.

The degree to which ROM is expected to improve with each stretch is not specified in research, nor is there a recommended number or range of stretches required for each targeted muscle (contrast this with AIS below).

Ballistic stretching can significantly increase tendon elasticity[4], a useful finding given that tendon elasticity seems crucial to the release of stored energy used in many sports.

Nick Grantham[5] has previously pointed out the similarities between ballistic stretching and the newer variant of **dynamic stretching** where controlled arm and leg movements are used to help take the limb to the limits of the associated joint range. He notes that in the latter case, movements are gentle and controlled, whereas in ballistic stretching they are forceful and less controlled.

Plyometrics is another form of ballistic training. It utilises the elastic recoil of the muscle-tendon unit after a sudden stretch of the muscle to enhance muscle power and is thus useful in explosive sports. For example, after a jump, the muscle-tendon unit of the ankle plantarflexors is stretched as the plantarflexors (gastrocnemius and soleus) are eccentrically contracting to help slow the body once the feet hit the ground and the ankle begins to dorsiflex. As Sean Fyfe explains[6]: '…this stretch-upon-impact can result in the muscle developing greater elastic force in response to the stretch.'

From a safety point of view, ballistic stretching is controversial on the grounds that it does not allow adequate time for tissue adaptation and carries a relatively high risk of injury if poorly executed. A sudden stretch may stimulate the stretch reflex, muscles contract, muscle tension increases and tissues become more difficult to stretch, defeating the object of the activity. However, advocates of plyometric training argue that, properly controlled, it plays an important role in late stage rehabilitation, as plyometric movements (running, jumping and throwing) occur widely in sport[6].

How to do it

A **ballistic hamstring stretch** might be done standing, flexed at the trunk. With straight legs. Make small bounces up and down, trying to touch your toes (this also affects spinal extensors, not just hamstrings).

Advantages

- Reportedly useful for sports with a ballistic component, such as kick boxing.
- Helps develop dynamic flexibility, so can be used to increase training specificity.
- Performed after static stretching, it seems to contribute to increased flexibility.
- Clients can do this at home or after exercise.
- Gives an athlete control over their own flexibility routine.
- May be done almost anytime, anywhere.
- Does not require any equipment.
- Is relatively easy.

Disadvantages

- Critics believe the ballistic movement is more likely to damage muscles, as there is not enough time for creep to occur in soft tissues.
- Cannot be used in early-stage rehabilitation.
- The sudden stretch stimulates the stretch reflex, increasing muscle tone and making it harder to stretch the muscle.
- Should not therefore be relied upon to achieve developmental flexibility or permanent lengthening of tissues, as fast/high-force stretching tends to increase muscle stiffness.
- If tissues are stretched too rapidly in one movement, they may tear, resulting in soreness and limited ROM.
- Because of a lack of research (ethically it is difficult to test potentially damaging forms of stretching), it is not clear what effect ballistic stretching has on range of movement.

Variation

A variant of active/ballistic stretching known as active isolated stretch (AIS) involves stretching one isolated muscle at a time by repeatedly contracting the opposite muscle for just 2 seconds, up to 10

times. For each contract/relax, the resistant point is exceeded by 1-4°. Alter [3], in his literature review of AIS, found 10 almost identical variants on this form of stretching, each with a different name, and differing only on the matter of the 2-second protocol.

AIS (also called the Mattes Method after its developer, Aaron L Mattes) seems to differ from ballistic stretching in two ways: it is formulaic in its protocol, and in ballistic stretching the stretch is not held but simply 'bounced' out of.

PNF stretching

Developed in the 1940s as a physical therapy to help rehabilitate victims of paralysis, there are many forms of proprioceptive neuromuscular facilitation (PNF), all of which employ active muscle contractions.

Probably the most familiar is the 'single plane' PNF technique, where an athlete's muscle is taken several times to a point of resistance and the athlete contracts the muscle isometrically (often using a training partner or therapist as resistance), before the muscle is then stretched either actively by the client or passively by the partner. One of the most comprehensive and well known books on the subject is by McAtee and Charland [7].

How to do it

To perform a PNF hamstring stretch, in supine the hamstrings are taken into mild stretch. The athlete then isometrically contracts the hamstrings, while the partner provides resistance. There is no consensus on how long to hold or how powerfully to contract the stretching muscle. Generally PNF contractions are stronger than those used in MET (see below). After an agreed time, eg, 6 to 10 seconds, the athlete relaxes the hamstrings and the muscle is actively or passively eased into a lengthened position, where the stretch is repeated.

Advantages

- More enjoyable and less boring than simple static stretching.
- Improves range of movement.
- Advocates claim many other benefits including increased strength, improved joint stability, enhanced co-ordination, improved endurance, improved blood circulation.

Disadvantages

- Usually requires a partner.
- As there are many variants, athlete and partner / therapist / trainer need to be clear about which protocol they are using.
- There may be more tension in the muscle being stretched than occurs in active stretching, increasing the potential danger of the technique.
- Done incorrectly, can cause injury, eg, from over-stretching by a zealous partner.
- May not be suitable for hypertensive clients, as there is a possibility of the valsalva phenomenon occurring during isometric contraction (client holds their breath after deep inspiration, raising systolic pressure).

Key benefits

- Good for highly motivated individuals and to aid team-building, where team members are encouraged to stretch each other.
- Specific forms can be useful therapeutically where active movement is not possible because of pain or weakness, or ROM severely limited.

Variation

PNF can also involve **spiral diagonal** patterns of movement, on the basis that muscles tend to spiral around bones; this form of stretch aims to optimise natural movement patterns.

MET stretching

Muscle energy technique (MET) originated in the late 1950s/early 1960s as an osteopathic technique, from the work of people such as TJ Ruddy and Fred Mitchell Snr. The main differences between MET and PNF lie in their origins, coming as they do from two different disciplines. This gives rise to different terminology, which is widespread anyway within the subject of stretching – helping to add to the confusion.

In practical terms, the force of contraction exerted by a client using MET is low compared to PNF. The use of submaximal contractions has been shown to be just as beneficial as maximal contractions at improving hamstring flexibility in subjects unable to reach 70° of hip flexion, and may therefore be safer in early-stage rehabilitation of muscle and tendon injuries [8].

There are numerous variations and applications of MET [2]. At its simplest, the therapist takes a client's muscle to a point of mild tension, where the client contracts it isometrically (up to 20% of their force), while the therapist provides resistance.

The muscle can be lengthened either after contraction, once the client relaxes (known as post-isometric relaxation stretching, PIR); or during contraction (an isolytic contraction, in which the muscle is having to contract eccentrically). In this second form of MET, rather than matching the force of the client's contraction, the therapist overcomes it, increasing ROM at the associated joint, thereby stretching the contracting muscle.

MET is gentle and may be used without the stretching component. The very low-level contractions involved in the technique may be helpful in early stage rehabilitation, to help develop or maintain muscle strength when tissues are in the initial stages of repair.

How to do it

To perform a MET hamstring stretch in supine, the client actively flexes the hip to its maximum with knee flexed, then extends the knee until they reach a point of mild stretch/restriction (therapists may refer to this as the 'point of bind' or 'first barrier'). The therapist maintains this position while the athlete attempts to flex the knee by contracting the hamstrings, using up to 20% of their force, creating an isometric contraction resisted by the therapist for 7-10 seconds. The client relaxes and on exhalation, the therapist gently extends the knee to the new barrier position. This position is held for 10-30 seconds and the procedure repeated.

Advantages

- Stretches muscle and soft tissue.
- Strengthens muscle.
- Relaxes muscle.
- Helps regain correct muscle function.
- Enhances local circulation.
- Helps to de-activate trigger points.
- Unlike PNF, one of the goals of MET is joint mobilisation.
- Advocates claim there are no contraindications.

Disadvantages

- There are many different forms of this technique and training is required to learn how and when to use them.

Key benefits

- MET is used to treat many patterns of muscular dysfunction. Chaitow [2] describes in detail the use of eight variations on the basic MET technique and when they might be applied.

Soft tissue release stretching

Used by physiotherapists, this involves 'locking' a passively shortened muscle close to, or on its origin prior to stretching the muscle. By forming a false origin, the stretch can be applied specifically to areas of fibrotic tissue.

Advantages

- Pressure and stretch are believed to facil-

continued on page 12

Research Review *by Nick Grantham*

All about gluteus medius

Why it weakens, how it strengthens

A weak gluteus medius muscle is often linked to injuries such as patellafemoral pain, anterior cruciate ligament injuries, iliotibial band syndrome, ankle injuries and Achilles tendinopathy. Researchers based in New Zealand and Australia recently reviewed the available literature linked to glute med function and conditioning, to explain how this muscle can be the root cause of so many lower extremity injuries, and to offer some guidance on rehabilitation **(Gluteus Medius: Applied anatomy, dysfunction, assessment, and progressive strengthening. *Strength and Conditioning Journal* 2008; 30 (5): 41-53)**.

First, a refresher on glute med anatomy and function. The muscle originates from the outer surface of the ilium between the middle and posterior gluteal lines and inserts on the lateral surface of the greater trochanter of the femur. It has anterior and posterior fibres, is curved and fan-shaped, and tapers into a strong tendon.

Glute med abducts the hip joint, the anterior fibres contribute to hip flexion and hip internal rotation, and posterior fibres aid hip extension and external rotation. It helps prevent the opposite side of the pelvis from dropping during the stance phase of gait and plays a vital role in providing frontal stability for the entire pelvis during walking and other functional activities.

How can such an important muscle become weak? Several factors can contribute:

- medical – hip rotator tears and congenital dislocation of the hip
- lifestyle – standing predominantly on one leg with the pelvis swayed sideways and hip joint adducted
- simply sleeping on your side with the top leg flexed and adducted over the other leg, maintaining an elongated position for sustained periods can weaken the glute med.

The researchers developed their own exercise model based on current strengthening guidelines. The progressive strengthening programme they developed includes a total of 17 graduated exercises. We thought you might like the full benefit of the rehab tool they have put together, so we've included it this month (see over).

Weak buttock, bad knee?

We still don't know exactly what causes patellofemoral pain syndrome (PFPS), but researchers have put forward numerous risk factors. It has recently been suggested that there is an association between PFPS and hip muscle weakness or motor control impairment. Poor hip control may lead to abnormal patellar tracking, increasing patellofemoral joint stress and causing wear on the articular cartilage. In particular, poor eccentric hip abductor and lateral rotator muscle control can result in femoral adduction and medial rotation during weight-bearing activities, predisposing the athlete to lateral patellar tracking as the femur medially rotates underneath the patella. With this in mind, a possible treatment for PFPS could include improving the function of the hip abductors and lateral rotators.

A group of Brazillian scientists completed a study to establish whether additional strengthening of hip abductor and lateral rotator muscles in a strengthening quadriceps exercise rehabilitation programme would work in patients with patellofemoral pain syndrome **(The effect of additional strengthening of hip abductor and lateral rotator muscles in patellofemoral pain syndrome: a randomized controlled pilot study, *Clinical Rehabilitation* 2008; 22: 1051-1060)**.

Fourteen patients with PFPS were randomly assigned to the intervention group (strengthening of quadriceps plus strengthening of hip abductor and lateral rotator muscles) or to the control group (strengthening of quadriceps). Both groups took part in a six-week home exercise protocol.

The researchers found that perceived pain during functional activities improved only in the intervention group; this group also increased their gluteus medius electro-myographic activity during isometric voluntary contractions. They concluded that supplementation of strengthening of hip abductor and lateral rotator muscles within a strengthening quadriceps exercise programme provided additional benefits in pain reducttion for PFPS patients. So that's a big thumbs up for some specific glute med conditioning!

Weak buttock, painful heel?

Achilles tendinopathy is particularly prevalent in distance runners. As we have seen above, weak gluteus medius could predispose athletes to developing Achilles problems.

A multinational research team from South Africa and Ireland recently looked at the kinetics, kinematics and muscle activity in runners with Achilles tendinopathy **(Biomechanical variables associated with achilles tendinopathy in runners. *British Journal of Sports Medicine Online First*, published on October 23, 2008 as 10.1136/bjsm.2008.0534212008)**. During each trial, the researchers measured kinetic and lower limb kinematic data, along with EMG data from six muscles: tibialis anterior, peroneus longus, lateral gastrocnemius, rectus femoris, biceps femoris and gluteus medius.

They found that knee range of motion (heel strike to midstance) was significantly lower in injured runners than uninjured runners. Similarly pre-activation before heel strike of tibialis anterior was lower for injured runners. Rectus femoris and glute med IEMG activity after heel strike was also lower in the injured group. These results suggest that altered knee kinematics and reduced muscle activity are associated with Achilles tendinopathy in runners. Note also the gluteus medius results; the researchers found that glute med strengthening helped reduce pain associated with Achilles tendinopathy. While this does not confirm whether glute med weakness contributes to Achilles tendinopathy, some preventive strengthening is not going to go amiss.

Research Review Extra *by Nick Grantham*

Gluteus medius: exercises and protocol

What follows is our interpretation of the 17-exercise programme for gluteus medius rehab and conditioning described in this month's Research Review **(Gluteus Medius: Applied anatomy, dysfunction, assessment, and progressive strengthening; Presswood L, Cronin J, Keogh J and Whatman C; *Strength and Conditioning Journal* 2008; 30 (5): 41-53)**. The research report merely lists the source references for the exercises, so we have sought out the originals, which in some cases has meant filling in gaps, if the information given was particularly sparse. Where any major guesswork has been involved we have flagged that up for you!

Each exercise has a grading to denote its difficulty/complexity, and the progressive programme splits into three main stages plus two additional sub phases. The researchers drew up a progress chart with milestones (see Table 1, opposite). They recommend a relatively high repetition range (15 reps) at first. Once technique has been established and milestones achieved, the range can be lowered and resistance added to help develop strength and power.

The exercises

Phase 1

Bent knee turnout (Grade 1a)

- Lie on your side with knees bent 90° and hips flexed to 45°; soles of feet should be in line with spine.
- Raise top leg, keeping feet together without rotating at the lumbar spine.
- The hips and shoulders should remain in line, one over the other, and all the motion should come from the hip.

Hands and knees leg lift (Grade 1b)

(Our guesswork from bare minimum of information):

- Kneel on hands and knees.
- Raise opposite hand and knee off the floor, keeping the leg bent to ensure emphasis is placed on the glutes.
- Lower hand and knee under control and switch to opposite sides.

Side lying leg lifts (Grade 1b)

- Lie on your side with upper body supported on your forearm and lower leg bent.
- Keep hips perpendicular to the floor and upper leg in line with body.
- Lift upper leg slowly straight up about 8in, then slowly lower it. Push away into the heel as you lift the leg. Do not twist. Rotate leg to keep your foot parallel to the ground.
- Lower leg under control.

The appliance of science

For attention of

Sports therapists	
Strength and conditioning coaches	
Coaches and trainers	

Significance

Adds to previous knowledge	
Cutting edge	
Confirms best practice	
Too early to say	

Phase 2

Standing hip abduction (Grade 2a)

- Use either a hip abduction machine or length of elastic tubing anchored at the ankle.
- Holding on to a fixed object to help you stabilise, raise leg as high as possible to the side then lower back.

Single-leg stance hold with medicine ball press (Grade 2a)

- Stand on one leg, hold medicine ball.
- Press ball straight out in front of you.
- Return the ball back to the starting position and repeat.

Trunk twist in single leg stance (Grade 2b)

- Stand on one leg and hold a medicine ball out in front at ribcage level.
- Rotate leftwards until you feel the muscles on your back right side begin to stretch, then return to start.
- Repeat on opposite side.

Phase 3

Cable kickback (Grade 3a)

- Using a cable pulley machine, attach the cable end to the front of the ankle of the leg that is to be worked.
- Stand so that when the leg is raised, with the thigh slightly below parallel, the cable is vertical.
- Straighten the leg and pull down and back towards the ground.
- This exercise can also be performed using a length of elastic tubing.

Single leg squats, machine (Grade 3a)

- Position body in the leg press machine to achieve a 90° or slightly greater angle at the knees.
- Foot position on the foot-plate should have toes pointing straight up, or slightly turned out.
- Maintain neutral spine.
- Push against the plate until leg is almost straight.
- Pause, then flex knee and hip to return to start position under control.

Single leg squats: supported rear foot (Grade 3b)

- Start in a forward lunge position, rear foot resting on a bench or box, at approx 18in height.
- Keep torso erect and weight over the front foot.
- Lower until front thigh is parallel to floor and back knee almost touching the floor. You will feel a stretch in the rear hip flexor.
- Return to start.

Phase 4

Single leg squat: standing (Grade 4a)

- Stand on a box, holding light dumbbells by your sides, and squat down until thigh is parallel with floor.
- As you begin to squat, raise dumbbells straight out in front to shoulder level; this facilitates sitting back on the heel.
- Concentrate on keeping the weight through the heel.

Single leg hops/lunges (Grade 4a)

Single leg hops

- Stand on one foot and jump forward.
- Stick the landing, maintaining slight bend at knees and hips.

Lunges

- Stand with feet hip width apart.
- Step forward with right foot (far enough to feel a stretch of the hip flexors of back leg).
- Return to start by driving off lead leg.
- Alternate legs.

Step downs (Grade 4b)

- Use a 4-in (10cm) platform (this is the height specified by the researchers, but if you can complete the exercise with

good technique, there is no reason why you cannot progress to deeper steps).
- Start on top; slowly step one foot off.
- Step down very slowly and with full control until the foot stepping down just touches the floor. Support leg remains in contact with the box at all times.
- Forcefully push off with the foot on the floor back to the start position on the platform.
- Repeat until you have completed all of the repetitions, then switch legs.

Phase 5

Monster walks (Grade 5a)
- Loop a small length of elastic tubing around thighs, just above the knees.
- Bend knees slightly and start stepping sideways, taking small steps.
- Avoid excessive motion: shoulders should stay over hips and avoid any see-saw type action.
- Change direction and repeat.

Single leg resisted lateral jumps (Grade 5a)
- Attach a bungee cord/elastic tubing around waist, at left hip.
- Stand on the left foot.
- Jump sideways on to your right foot (side hop).
- Step back to start position; repeat.
- Switch resistance cord to opposite side and switch legs to work other side.

Lateral jumps, both legs (Grade 5b)
- Jump sideways with both feet, landing with good form, knees slightly bent.

Table 1: Gluteus medius exercise progressions and milestones

	Stage 1	Stage 2	Stage 3
Level 1	Non-weight-bearing (Grade 1a)		
Milestone for progression to Level 2 In side lying, client can hold their straight leg in full hip abduction with external rotation and extension for 10 seconds without posterior rotation of pelvis			
Level 2	Non-weight-bearing (Grade 1b)		
Level 3	Level 2 plus weight-bearing exercises at Grade 2a		
Level 4	Grade 2a plus weight-bearing at Grade 2b		
Milestone for progression to Stage 2 In single leg stance, client can hold pelvis level without lateral trunk shift, for 30 seconds, keeping stance knee in line with second toe			
Level 5	Grade 2b	Compound exercises (Grade 3a)	
Level 6		Compound exercises at grades 3a and 3b	
Level 7		Compound exercises at grades 3b and 4a	
Level 8		Compound exercises at grades 4a and 4b	
Milestone for progression to Stage 3 Client can squat on one leg, keeping pelvis level, knee over second toe, without lateral trunk shift			
Level 9		Grade 4b	Functional exercises at Grade 5a
Level 10			Functional exercises at grades 5a and 5b
Level 11			Functional exercises at grades 5b and 6a

Phase 6

Single leg ball throw against wall (Grade 6a)
- Stand on one leg facing a wall.
- Throw the ball at the wall and catch it on the rebound.
- Repeat, varying the angle of the throw.

Basic kicking: diagonal (Grade 6a)
- Imagine kicking a football.
- Stand on left leg.
- Starting with right foot just behind the body, swing right leg in a diagonal movement across centre line of body.
- Increase the difficulty of this exercise by attaching elastic tubing to the ankle of the swinging leg for resistance.

Original sources for exercises

1. Chmielewski TL, Hodges MJ, Horodyski M, Bishop MD, Conrad BP, and Tillman SM. Investigation of clinician agreement in evaluating movement quality during unilateral lower extremity functional tasks: a comparison of 2 rating methods. *J Orthop Sports Phys Ther* 37:122-129, 2007.
2. Delavier F. *Strength Training Anatomy* (2nd ed). Champaign, IL: Human Kinetics, 2006. pp. 123-127.
3. Fullem B. Beating the band. New treatment for It band syndrome yields results. *Running Times* 316:12-13, 2004.
4. Geraci MC and BrownW. Evidence-based treatment of hip and pelvic injuries in runners. *Phys Med Rehabil Clin* N Am 16: 711-747, 2005.
5. Heller M. Ilio-sacral diagnosis and treatment, part three. Gluteus medius, piriformis and pubic symphysis postural release and rehabilitation. *Dyna Chiro* 21: 44-46, 2003.
6. Kendall F, McCreary E, Provance P, and Rodgers M, Romani W. *Muscles Testing and Function with Posture and Pain* (5th ed). Baltimore, MD: Lippincott Williams and Wilkins, 2005. pp. 19-22, 35.
7. Mascal CL, Landel R, and Powers C. Management of patellofemoral pain targeting hip, pelvis, and trunk muscle function: 2 case reports. *J Orthop Sports Phys Ther* 33:647-660, 2003. 33.
8. McCurdy K and Conner C. Unilateral support resistance training incorporating the hip and knee. *Strength Cond J* 25: 45-51, 2003.
9. Page P and Ellenbecker T. *Strength Band Training*. Champaign, IL: Human Kinetics, 2005. pp. 1-11, 86-87, 159-186.
10. Thien-Nissenbaum J and Orzehoskie JC. Lower extremity exercises with elastic resistance. In: *Scientific and Clinical Application of Elastic Resistance*. P. Page and T. Ellenbecker, eds. Champaign, IL: Human Kinetics, 2003. pp. 69-98.
11. Tyler TF, Nicholas SJ, Mullaney MJ, and McHugh MP. The role of hip muscle function in the treatment of patellofemoral pain syndrome. *Am J Sports Med* 34: 630-636, 2006.

continued from page 8

itate a lengthening of soft tissues and an increase in range of movement [9].
- Certain stretches may be performed either actively or passively.
- Relatively easy to apply.
- Performed actively, the only equipment required is a tennis ball.
- Can easily be incorporated into a massage sequence, so may be useful where massage is indicated as part of a rehabilitation or maintenance programme.
- Helps de-activate trigger points.

Disadvantages

- Therapists need to learn the technique, which can take several forms.
- Cannot be used on all clients (eg, those who bruise easily or have fragile skin).
- May result in soreness, similar to DOMS.

Key benefits

- Useful where a client cannot take a joint through a full range because of injury, or with hypermobile clients where starting a stretch at the end point may not be desirable.
- Valuable for targeting areas of fibrotic tissue within muscles that would otherwise not be stretched with gross active stretching.

Conclusion

This overview is not intended to be comprehensive – there is no space here, for instance, to cover techniques such as tractioning, neural mobilisation and non-traditional forms of stretching. All forms of stretching may be used within a sports-specific flexibility routine; it is up to the support professional to understand the repertoire available to help optimise the benefits to their client.

References

1. Anderson B (1981) *Stretching*.
2. Chaitow L (2001) *Muscle Energy Techniques*. Churchill Livingstone.
3. Talter, Michael J (2004) *Science of Flexibility*. Human Kinetics.
4. Witvrouw E, Mahieu N, Roosen P and McNair P (2007) The role of stretching in tendon injuries, *Br J Sports Med* 41: 224-226.
5. Grantham, Nick (2008) Dynamic flexibility, *Sports Injury Bulletin* 77, March.
6. Fyfe S (2007) Why you should put plyometric into rehab, *Sports Injury Bulletin* 71 July/Aug.
7. McAtee E and J Charland (1999) *Facilitated Stretching*. Human Kinetics.
8. Feland JB and Marin HN (2004) Effect of submaximal contraction intensity in contract-relax proprioceptive neuromuscular facilitation stretching, *Br J Sports Med* 38 e18.
9. Sanderson M (2002) *Soft Tissue Release*. Corpus Publishing.

Contributors to this issue

Nick Grantham is a strength and conditioning coach who has worked with elite athletes for the past 10 years. He has trained many of the country's elite athletes including Olympic and Paralympic finalists, and professionals in a multitude of sports. He now heads the Strength and Conditioning team at GENR8 Fitness.

Fares Haddad BSc MCh (Orth) FRCS (Orth) is a consultant orthopaedic surgeon at University College London Hospital and editorial consultant to *Sports Injury Bulletin*

Jane Johnson is a chartered physiotherapist with an interest in musculoskeletal injuries and massage. She is co-director of the London Massage Company.

David Joyce is a senior physiotherapist at the English institute of Sport and national lead physiotherapist for the Great Britain Taikwondo squad.

Chris Mallac has been head of Sports Med at Bath Rugby and head physio at Queensland Reds Super 14. He is currently in private practice in Brisbane, Australia.

Illustrations by **Viv Mullett**

SPORTS INJURY BULLETIN
is published by P2P Publishing Limited.
Reg. office: 33-41 Dallington Street, London EC1V 0BB
Printed by PLP Printers,
3-7 Mowlem Street, London E2 9HE, UK.
Sports Injury Bulletin is a trading name of P2P Publishing Limited; Reg. office: 33-41 Dallington Street, London EC1V 0BB, UK. Reg. no: 06014651.
Editor Jane Taylor **Publisher** Jonathan Pye
Email: sib@sports-performance.com
www.sportsinjurybulletin.com

ISSN1472-0442