Postural Screening using the Thomas Test - Part 2

Mark McKean

Each of the Thomas test results as described in the previous issue are associated with a change in the posture of the pelvis and its associated patterns of movement. Let's look at what changes have occurred and what we would do to assist correction of these issues.

Shortness of both 1 & 2 Joint Hip Flexors

Skeletal behaviour

- Knee joints will be slightly hyper-extended (bent backwards)
- Ankle joints may also be slightly plantar flexed (ankles extended)

Muscles tested as longer than ideal

- Abdominals, hamstrings and occasionally the glutes

Muscles tested as shorter than ideal

- Lumbar extensors, Hip flexors & quadriceps. mid thoracic extensors and lumbar extensors may all test short

Other factors to consider

Depending on the posterior lean of the thoracic spine, the spinal extensors may be short further up the spine as well. It is common for athletes with short hip flexors to experience back pain and fatigue in their legs when standing or shooting for extended periods. Unlocking the knees, bending forwards or doing a half squat between shots will help reduce this somewhat as it relaxes these muscles, but it is not a long term fix.

Training approach

Coaches should aim to shorten the long global muscles such as the rectus abdominis, hamstrings and the glutei i.e. the group of three muscles that form the buttocks. This is achieved by doing light static contractions and holding these for 6-10 seconds and repeating exercise 4-6 times. Exercises such as crunches and bridge and holds work well here.

Crunching exercise

Bridge exercise

As well as shortening the long muscles, you will also need to stretch the tight global muscles such as the lumbar extensors, hip flexors, mid thoracic extensors and the quadriceps. The Thomas test position is also a great exercise to stretch the hip flexors and the kneeling quad stretch is great to bring back normal quadricep length and the lunge stretch is a combination of both.

Thomas Stretch

Kneeling quadriceps stretch

Kneeling lunge stretch

Patterns to train

Individuals need to relearn their postural position especially whilst standing. When walking or running they will also need to learn how to increase their swing phase and not allow the short hip flexors to decrease the trail leg follow through. Increasing this in the early stage of training may only occur by increasing the pelvic anterior tilt so be watchful of this behaviour in your athletes. When shooting, it is important that athletes learn to recognise when they fall back into poor posture as much as learning the new correct posture.

Exercise strategy using a fitness centre (with a registered and qualified trainer)

To shorten the long global muscles you will need to include exercises such as leg curls, glut ext/hyperextensions, bridge holds and squats for the hamstrings / glutei. If you do use an incline leg press, be sure to provide lumbar support through the use of a bolster or rolled towel in order to avoid the flattening of the spine when the legs are flexed deep in the pressing action. The lumbar spinal extensors may be stretched severely when the spine is forced into extension in this position and becomes quite unstable if unsupported.

The abdominals also need to be trained to reduce their overall length to assist correction of the anterior tilted posture. Muscles that have been lengthened over time have increased in length by compaction of additional myofibrils in exactly the same way that stretching exercises increase muscle length. Normal

isotonic strength training will increase the strength of the muscles, but not necessarily shorten or reduce muscle length. In order to shorten the muscle the additional myofibrils must be reabsorbed by the muscle learning that it no longer requires them or the length it has achieved by having them.

To achieve this re-absorption of additional muscle fibres, you will need to include isometric holds at various angles of muscle contraction. This allows the brain to learn that the extra fibres are not needed and re-absorbs them over a period of time. This could be included during warm up sets or as alternating sets between the normal work sets. . If we take leg curls as the example, the loading would look like this.

Warm ups—tempo 4020

Set 1 - 6 reps @ 50% with 2 x 6 sec holds at 30^0 & 60^0
Set 2 - 6 reps @ 80% with no holds
Set 3 - Work sets 2-3 times through alternating between
Set 4 - 6 reps @ 90% with 2 x 3 sec holds at 30^0 & 60^0 &
Set 5 - 6 reps @ 100% with no holds.

(All holds or isometric contractions need to be performed during the eccentric phase of the movement)

Certain exercises including back extensions, seated rows and lat pull-downs also need to be used more stringently or avoided completely as the athlete may have difficulty controlling posture whilst performing them and thus revert to old patterns and actions. The athlete will have a tendency to hyperextend his/her lumbar spine and bring in the spinal extensors excessively during these actions. Exercises such leg extensions will increase the strength of the already short strong thigh muscles and should also be avoided initially.

Unsupported abdominal crunch variations or abdominal work that does not lend some support, to the over arched lumbar spine, will either increase use of the strong hip flexors or cause lower back pain. Care should be taken when doing abdominal work so that the initial phase of the movement can be monitored. If the lumbar spine is unsupported the athlete will tend to lift the whole back off the floor in one action rather than progressively rolling off the floor over the lumbar support.

Stretches for the Lumbar extensors, hip flexors and quadriceps, would now be performed. I prefer to do mostly anti gravitational types of stretching to allow the effect of gravity to slowly increase the stretch rather than forcing the muscle length to increase. Muscles that are already short and strong tend to spasm quickly when ever additional force is applied too aggressively. Light tension from the effect of gravity allows a natural response to occur more easily and thus cause less stress.

You could use the Thomas test position to stretch the hip flexors and quadriceps as the weight of the limb would be enough over 30-60 seconds to produce a good anti gravity type stretch. There has always been argument over the order of training in cases like this. Should you stretch first then strengthen or strengthen and then stretch? In cases like this where you are retraining muscles and patterns of movements linked by these muscles, I believe you should strengthen the weaker muscles first in the training session and finish with stretching the shorter stronger muscles at the end.

I have seen situations where a client started with stretching exercises first and follow those with strengthening exercises resulting in problems with postural control as the tight muscles, which were

providing some degree of postural control was taken away and the weaker longer muscles being trained had no way of providing the required support.

Lengthened 1 Joint Hip Flexors

Skeletal behaviour
- Lumbar spine flattened / straight
- Hip joints extended
- Knee joints extended
- Ankle joints slightly plantar flexed

Muscles tested as lengthened
- One joint hip flexors and occasionally the back muscles

Muscles tested as shortened
- Hamstrings

Other factors to consider
Abdominal muscles may appear weak, but not short due to change in rib cage position.

Training approach
Coaches should aim to shorten the hip flexors and allow the lumbar curve to return to its deeper curve rather than appearing too straight. This can be achieved by the seated hip lift exercise using a swissball as shown in the picture below. You will also need to stretch the hamstrings.

Patterns to train
Individuals need to relearn their neutral hip position and regain the natural shape of their lumbar curve. The hip flexors need to be actively trained in the forward swing action of the leg when walking and running. There is a tendency for the quadriceps and ITB to take over this role so coaches need to watch the action of hip flexion while in movement and be sure that the hip flexors are dominant rather than secondary movers in this action. In shooting, athletes with this condition tend to sag through the hips allowing the hips to move forwards thus creating a backward lean of the upper body. This can cause complications with the position of the shoulders and head and with the angle of sight for the pistol.

Exercise strategy using a Fitness Centre (with a registered and qualified trainer)
To shorten the hip flexors you will need to ensure that the lumbar curve is maintained at all times and in some cases actively exaggerate the curve so as to train the hip flexors to become involved. An example of an exercise that I would use for this purpose is the seated knee lift as shown in the two pictures below.

To perform this exercise, the athlete sits on a bench or swissball if he/she has good balance. The lumbar curve is increased so that the athlete achieves an anterior tilt of the pelvis. The leg is allowed to fall slightly out to the side (image 1) so as to improve the line of pull through the Iliopsoas muscles. Then while maintaining the lumbar curve, the leg is lifted off the floor as shown in image 2. This is then held for an isometric hold for a period of time. The loading pattern for this type of exercise may be as follows.

Week 1: 3-4 times each day of 6x3 sec holds.
Weeks 2-4: 3-4 times daily of 6x6 sec holds
Weeks 3-6: 2-3 times daily of 10x10 sec holds.

Remember that the hip flexors are long and weak and some athletes will attempt to cheat in this exercise. Cheating occurs when the lumbar curve is allowed to flatten so as to increase the starting length of the Iliopsoas muscles and thus create more tension, which allows the athlete to the lift the leg higher. Stand side on to the person performing the exercise with your hand on his/her lumbar curve to ensure that this doesn't happen.

I am also a big believer in retraining the abdominal muscles to work whilst maintaining the natural position of the lumbar curve. This is achieved by using a body bolster for all abdominal work. I believe that flattening the lumbar spine in cases like this teaches a poor pattern of involvement in the sequence of abdominal muscle contractions and I am not in favour of the lumbar spine flattening to perform crunches and sit ups for people with a flat lumbar spine. I get all my clients with this type of weakness to do their ab work with the lumbar supported to maintain the correct curve.

To stretch the hamstrings, again I would use an anti-gravitational type of exercise instead of an active or dynamic type of stretch. My preferred option here is to raise the leg up against a wall and allow the heel rest against it. A partner can also help as shown in the image but you can sue the wall instead of the partner to rest the leg against in a similar way. As the person's flexibility improves, slowly wriggle your hips closer to the wall until you have over time achieved 90-90 range of motion and the lower back and sacrum remain flat on the floor throughout the exercise and the leg is straight up against the wall.

Exercises that I would avoid in this process or ensure that they are done under strict control include deep leg presses, deep squats, high step ups and leg curls.

I would avoid the deep leg presses because of the inability of the athlete to maintain sacral pressure on the bench. The tight hamstrings will drag the hips forward as the press reaches the deep position, the sacrum will tilt off the bench, and the weak flat lumbar spine will thus be the centre of pressure of the force used to perform the pressing action. Deep squats and high step ups produce a similar pelvic action earlier than the correct pattern requires and hence, places loads into the weakened lumbar spine before the hips have reached a position that allows the hamstrings and glutes to unload the quads.

With short hamstrings this action occurs earlier than it should and places the pelvis into a compromised position. Leg curls will strengthen the already strong and short hamstrings and allow the hips to increase pelvic tilt because the hamstrings will pull on the hips early in the movement and there will be no opposing muscle group in the hips and lower back to prevent this further flattening of the spine in the leg curl action.

If you consider that it takes 8-12 weeks to achieve improved flexibility, remember that it will take at least that amount of time and possible more to achieve postural correction. It is imperative that the shooter understands at all times what good alignment and positional control is and that retraining is exercised in a shooting position as much as possible and under coach's supervision. The more frequently such exercises can be completed by the athlete in one day, the more likely it is that the new patterns will be achieved without the old ones coming back through laziness or too much time between efforts.