

## Core stability training program

The structure of the lumbar region is inherently unstable. In practical terms this means the lumbar spine relies upon sufficient support from the muscles that actively support the area. The active support comes from four mechanisms; tension from the thoracolumbar fascia, the intra-abdominal pressure mechanism, the role of paraspinal muscles and the role of deep lumbar extensors. If sufficient support is not attained injury will result. Before providing you with information on the exercises to complete to increase core stability it is important to understand some of the theory behind the support mechanisms listed above.

### Thoracolumbar Fascia

The thoracolumbar fascia (TLF) can provide a tensile support to the lumbar spine via deep-trunk muscle activity. The Transversus Abdominis (TA) and the Internal Oblique (IO) muscles both attach to the TLF. This fascia 'wraps' around the spine connecting the deep trunk muscles to the spine. When the TA contracts it increases the tension in TLF which, in turn, transmits a compressive force to the lumbar spine which enhances its stability. In addition the increased tension of the TLF compresses the Erector Spinae (ES) and Multifidus (MF) muscles, encouraging these to contract and resist spine flexion forces.

### A pressurised balloon

The intra-abdominal pressure mechanism (IAP) can provide a supportive effect to the whole lumbar area. A co-contraction of the pelvic floor, TA, IO and lower back muscles increases the IAP. In turn, this exerts a tensile force on the rectus sheath. This sheath encloses the Rectus Abdominis (RA) muscle and attaches to the IO and TA, surrounding the abdomen. The tension of the rectus sheath increases the pressure within the abdomen, like a pressurised balloon. This supportive 'bag of air' reduces the compression and shear forces acting on the spine. Research shows that IAP increases before and during lifting heavy objects or weightlifting exercises (Zatsiorski, 1994) and also increases during running (Lewis et al, 2000) endorsing the idea that it plays a crucial role in lumbar stability.

### Deep Extensor Muscles

Research also shows the significance of the paraspinal muscles and deep lumbar muscles as important stabilisers. It is likely that these paraspinal and deep lumbar muscles act with a static contraction, to resist any lumbar extension and rotational forces. The paraspinal muscles - Interspinalis and Intertransversarii - provide an individual stabilising effect on their adjacent vertebrae, acting in a similar way to ligaments. The deep lumbar muscle - multifidus (MF) - has been shown to be active throughout a full range of motion of the lumbar spine and during movements of the lower and upper limbs (Richardson et al 1990).

From this brief explanation of the anatomy and research into the muscles of the lumbar trunk area, it is clear that the deep-trunk muscles - TA, MF, IO, paraspinal, pelvic floor - are key to the active support of the lumbar spine. The co-contraction of these muscles produce forces via the TFL and IAP mechanism which stabilise the lumbar spine, and the paraspinal and MF muscles act directly to resist the forces acting on the lumbar spine.

### Specificity of training

Having identified the key muscles and how they act, the next step is to establish how best to train these muscles. As with any type of strength and conditioning training, the training protocol for improving the function of the deep-trunk muscles must be specific to the task required. This specificity of training must take into account the type of contraction, the muscle fibre type and the anatomical position required.

By definition, the deep-trunk muscles act as 'stabilisers' and are not involved in producing movements, but instead involve static, or isometric, contractions. Furthermore, they must act as stabilisers continuously throughout everyday activities as well as fitness and sport activities, and so require very good endurance of low-level forces. These muscle do not need to be very strong, but they must be correctly co-ordinated and capable of working continuously. In addition, we want these stabiliser muscles to act by holding the lumbar spine in the neutral position, which is the correct alignment of the pelvis that allows for the natural S-curve of the spine. These characteristics underpin the following deep-trunk muscle training programme.

### The basics

#### Step 1

Start by lying on your back with knees bent. Remember your lumbar spine should neither be arched up nor flattened against the floor; but aligned in the neutral position with only a small gap between the floor and you lower back.

- \* Breathe in deeply
- \* Relax all your stomach muscles.
- \* Breathe out and as you do so:
- \* Draw your lower abdomen inwards as if your belly button is going back towards the floor.

Think of the key muscles acting like a corset as you 'suck your belly button in'. Or think of scooping the lower abdomen back towards the spine. Alternatively think of struggling into a tight pair of jeans by sucking your belly in and zipping up.

Practise achieving this 'hollowing' action by holding the contraction for 10 seconds and repeating. During which you must

- \* Stay relaxed.
- \* Ensure you breathe in and out as normal.
- \* Hold the tension only in your lower abdomen.
  - \* Repeat 5-10 times.

Sounds dead easy? Well maybe for some not so for others, particularly those with weak backs or those that have done loads of abdominal work. It is absolutely vital that you perform this abdominal hollowing correctly otherwise you will not recruit those all-important Transversus abdominis & Multifidius muscles effectively.

Note the following guidelines:

- \* Do not let the whole stomach tense up or your upper abdominals bulge outwards lifting your rib cage, as this means you have cheated by using your large rectus abdominus muscle (the six-pack) instead of the Transversus abdominis & Multifidius.
- \* Do not brace your Transversus abdominis & Multifidius: just a gentle contraction is enough. Remember it is endurance not maximum strength you are trying to improve.
- \* Do not hold your breath, as this means you are not relaxed. You must learn to breathe normally and maintain the co-contraction of the Transversus abdominis & Multifidius muscles.

You may find it useful to do the following at least initially:

- \* Place one hand under your lower back to ensure that you do not tilt your pelvis nor arch or flatten your back, as this means you have lost the neutral position you are trying to learn to stabilise.
- \* Use your fingers to feel for tension in your lower abdomen, which indicates tension in the Transversus abdominis. Do this by placing your fingers an inch in towards your belly button from the bony protrusion of your pelvis and an inch down towards your groin.

Once you have mastered the abdominal hollowing, or zipping up, while lying on your back, practise it lying on your front, sitting and standing. Progress by holding the tension for longer. In each position ensure that your pelvis and therefore your lumbar spine is in the neutral position before you perform the hollowing movements. If you are finding this difficult try the following exercise:

### **Level 1: Four Point Kneeling**

Kneel on all fours, hands beneath shoulders and shoulder width apart.

1. Knees beneath hips.
2. Top of head lengthening away from the tail bone.
3. Pelvis and spine in the neutral position.
4. Relax and let the belly hang down.
5. Then draw the belly button up, hollowing the belly.
6. This should be a controlled contraction.

Progress by maintaining and holding the contraction for 10 seconds. Further progression by extending one arm out level with the ear. Repeat 30 times and using the other arm.

Once you find this very easy progress to the next level

### **Level 2 Bent Knee Fall Out**

Lie on your back with your knees bent. Ensure your back is in neutral as described previously.

1. Breathe in and out performing abdominal hollowing as you do so - sucking the belly button in - control the contraction.
2. Continue breathing normally.
3. Put the fingers of one hand on to your pelvic bone.
4. Let one knee fall out to the side.
5. The pelvis must not move, feel for movement with the fingers
6. The knee should go half way to the floor.
7. Repeat 30 times each side.
8. Progress by holding the heel of the dropped knee 1" off the floor.

### **Level 3 Isometric Contraction**

Lie on your back with your knees bent. Ensure your back is in neutral as described previously.

1. Breathe in and out performing abdominal hollowing as you do so - sucking the belly button in - control the contraction.
2. Place one hand on the knee on the same side.
3. Push the knee into the hand but do not let the knee move - isometric contraction.
4. Hold this contraction for 10 seconds.
5. Place the other hand beneath the lower back to check for pressure. Do not let the back arch or collapse, maintain abdominal hollowing. Repeat with the other leg.

Hip Flexion Control Level 4 - Level 9. This is a series of exercises that gets progressively more testing. You should only progress to the next level when you are sure you are not cheating and not in any discomfort.

#### **Level 4**

Lie on your back with your knees bent. Ensure your back is in neutral as described previously.

Breathe in and out performing abdominal hollowing as you do so - sucking the belly button in - control the contraction.

Place your hands as described above, one under your back checking for pressure and the other checking for tension in the lower abdomen. Breathe in and relax. Breathe out, and as you do so perform the abdominal hollowing - sucking up the belly button. This ensures that the Transversus abdominis & Multifidius muscles have co-contracted first. Once you have established some tension in these muscles, slowly lift one foot off the floor and bring towards the chest. Ensure that the knee is pointing towards the ceiling.

Maintain the lumbar spine in the neutral position throughout this movement otherwise you will not be training the core-stability muscles effectively. Repeat the exercise with the other leg, building up to 3 x 30 each leg.

#### **Level 5**

Start in the same position as level 4 but this time slide one leg out into extension keeping in contact with the floor until it is straight and then slide it back to the starting position. Repeat the exercise with the other leg, building up to 3 x 30 each leg.

#### **Level 6**

Repeat level 5 but this time raise one foot 1" off the floor and extend and return as in level 5 but keeping the foot off the floor during the exercise, building up to 3 x 30 each leg.

#### **Level 7**

Repeat level 6 but this time raise both feet 1" off the floor. But extend and return one foot only keeping both feet off the floor during the exercise, building up to 3 x 30 each leg.

#### **Level 8**

Proceed as in level 7 but this time alternate extending and returning each leg again with both feet off the floor, building up to 3 x 30 each leg

#### **Level 9**

Proceed as in level 8 but this time extend both the legs at the same time, building up to 3 x 30.

### Getting functional...

The ultimate aim of core-stability training is to ensure the deep-trunk muscles are working correctly to control the lumbar spine during dynamic movements, e.g., lifting a heavy box or running. Therefore it is important that once you have achieved proficiency of the simple core exercises, you must progress on to achieving stability during more functional movements. I have chosen two examples.

#### (1) The lunge

A classic exercise, but done slowly and with care it can teach you a great deal about body awareness and core stability. Interestingly, it is used by Alexander Technique teachers to help establish better movement patterns.

1. Stand with feet hip-width apart in front of a mirror. Ensure your lumbar spine is in neutral and your back is tall with your shoulders back and head up.
2. Lunge forward and bend your knee only half way down. Ensure that your front knee is in line with your toes and your back has remained upright with your lumbar spine in neutral and your hips level.
3. Push back up, initiating the movement by pushing down into the floor with your front foot. The force from your legs should bring you back up quickly and easily to your start position. Your back should have remained totally still and your hips level as you performed the push back.
4. Many people wrongly initiate the up movement by pulling their heads and shoulders back first; this extends the lumbar spine, losing the neutral position. Others have problems keeping their pelvis level while performing the lunge. You must learn to use your deep trunk and gluteal muscles to hold your lumbar spine in neutral and pelvis level as you perform the movement up and down. The movement should only come from the leg muscles.

#### (2) The press up

Another classic exercise, but more often than not it is performed with questionable core stability. Start from your knees - even if this means it is easy for your upper body - to learn the correct technique.

1. Your hands should be slightly wider than your shoulders and your head must be in front of your hands.
2. Lift your hips so that there is a straight line from your knees through your pelvis and lower back, through your shoulders and all the way to your head. Ensure your lumbar spine is in neutral, using a mirror or a partner/trainer to help you.
3. To maintain a neutral spine and a straight back during the exercise, the trunk muscles must provide active support. Slowly lower down, bending your arms all the way to the floor. Keep your head still with your neck straight relative to your back.

4. Push up, initiating the movement by pressing down into the floor with your hands. Your back should remain still, straight and your lumbar spine in neutral throughout.
5. Many people allow their lumbar spine to arch and sag downwards as they perform the press up; this is because they are not using their trunk stabilisers enough to support the body.

These two exercises, used in a non-traditional manner, enable you to learn core stability while performing dynamic movements. By reducing the resistance - i.e., doing only half lunges and knee press ups - you are able to focus on the trunk stabilisers and achieving perfect technique rather than working the major muscle groups. The whole essence of core stability training is quality of movement and relaxation. The more you practise, the easier it becomes until you can control your lumbar stability at all times and during complex movements.

## Swiss Ball Exercises For Development of Core Body Strength

The following eight stability-ball exercises are designed to improve flexibility, balance, and coordination as well as core strength. They'll also help stabilize your spine to prevent injury to the lower back and hips.

Do these exercises on a day you cross-train, or as a warmup for running, or as a cooldown. Start by doing five repetitions of each exercise, gradually working up to as many as 30 (15 for the Body Arch).

### Abdominal Curls

Sit on the ball and walk your legs forward while leaning back until the ball is under your lower back. Place your hands on your shoulders or behind your head. Curl your upper body forward in a crunch motion, then return. You can alternate left and right curls to target the side muscles (obliques). As you get stronger, challenge the obliques more by moving your feet closer together.

Benefit: Strengthens front and side abdominals to stabilize your midsection, including your lower back.



### Body Arch

Start in a deep squat with the ball against your back. Slowly reach your arms over your head as you extend your legs. Let the ball roll along your spine as you stretch back to form a comfortable arch. Hold for 1 second, then return slowly to the starting position. Repeat.

Benefit: Works the hip flexors, abdominals, and pectorals to increase chest capacity and flexibility in the front of your body so you can run more comfortably with an upright posture.



#### Airplane

Lie facedown with the front of your hips on the ball and toes on the floor. Relax your arms, letting your hands touch the floor. Slowly raise your chest and shoulders upward, while spreading your arms up and out to the side and tightening your buttocks. Pause and return to the starting position.

Benefit: Strengthens the muscles in the mid and upper back to stabilize your trunk and complement the front-of-body strength and flexibility gained in the Body Arch.



#### Body Tuck

Lie facedown with your thighs on the ball and hands on the floor, your arms perpendicular to your body. Slowly tuck your legs toward your arms by flexing the hips and knees, letting the ball roll toward your shins. Pause, reverse the motion, and return to the starting position.

Benefit: Strengthens the hip flexors and stretches the lower back and buttocks to make you less injury-prone in those areas. Also increases your range of motion, which helps open up your running stride.



#### Pushups

Start in the same position as the Body Tuck, with arms extended to the floor. Keeping your body straight, bend your elbows to lower your chin to the floor. Pause and return by straightening your elbows. (You can make this exercise easier by locating the ball closer to your hips, or harder by moving it toward your feet.)

Benefit: Strengthens your chest and arms to improve your arm carriage for more comfortable and efficient running.



#### Triple Move

Lie on your back on the floor with your knees bent and feet resting on the ball. Press your feet into the ball and lift your hips until your body is completely straight from head to foot. While balancing one foot on the top of the ball, bring the opposite knee toward your chest, then return. Bring the other knee toward your chest, then return. Finally, return to starting position on the floor.

Benefit: Another combination move, this exercise strengthens and stretches the quadriceps (front of thighs), hamstrings, lower back, and abdominals to improve running efficiency and overall body strength.



#### Hand-off

Lie on your back on the floor with your knees bent at about 90 degrees and the ball resting between your feet. Extend your arms above your head. Squeeze the ball between your feet as you lift it while doing an abdominal crunch, reaching for the ball with extended arms. Take the ball in your hands and lie back flat with arms and ball above your head. Pause, then reverse the motion by grabbing the ball with your legs.

Benefit: This combination strengthens the inner thighs, hip flexors, abdominals, and shoulders for strong, stable, upright running posture.



#### Wall-squat

Stand with your back about 3 feet from the wall, feet pointed forward about shoulder-width apart. Place the ball between your lower back and the wall. Slowly lower yourself as you bend your hips and knees, allowing the ball to support your back as it rolls toward your shoulders. Don't exceed a 90-degree bend at the knees. Return to the starting position.

Benefit: Strengthens the quadriceps muscle group, which will help you on long runs and hilly courses, and help prevent knee injury.



#### Conclusion

Players need to ensure the basics are well established before moving into the more complex activities using the swiss ball. It is imperative the players complete the training log listed below – doing this permits the coaching staff identify strengths and weaknesses and make adjustments to the program.



