

Ab Fab (abdominal strengthening & core control)

By James Bone

Are you confused about abdominal strengthening and core control?

SIT UPS AND SIX PACKS

Is developing a six pack with sit ups good for you or are there other things you can do? Can over doing your core work actually cause you problems?

It can all seem a bit confusing, as there is a lot of information out there about how to strengthen your abdomen, “core”, develop trunk control, and some of it can appear to be conflicting. In fact even the word “core” can be interpreted differently depending upon one’s background ie physios may see it differently to the fitness industry or sports people. So a bit of background here may be helpful.

CORE, CORE, CORE

So what is the abdominal, trunk or “core” area?

The abdomen, trunk and “core” can be seen as having many muscle groups:

- At the front – is the Rectus Abdominis (the 6 pack) – its role being to flex the trunk. Many researchers believe it does not play a major role in spinal protection, but may aid in stability when strong support is needed.
- At the sides – are the External Obliques and Internal Obliques. Both are involved in rotation of the trunk, and possibly the Outer Obliques providing more gross stability, and the Inner’s role is not fully clear, but again is involved with some form of stability.
- Deep within – is a thin flat muscle called the Transversus Abdominis, which has the function of drawing the belly (abdomen) inward. This action is sometimes called abdominal hollowing. This is where there has been a lot of research, indicating that this muscle has a distinct control from the brain and so may be most important in refining the stability of the spine and pelvis. It also aids with breathing out.
- Below – is the muscle of the pelvic floor – giving important support to the pelvis.
- Above – is the respiratory muscle, the diaphragm, aiding inhalation and also inner stability.
- Deep within at the front and next to the spine - lies the Psoas muscle whose

role in stability, if any, is not clear.

- At the back, deep, and next to the spine – is the Multifidus muscle, which again a lot of research has found that it has a unique role in providing refined and local stability to the spine. The situation of stability and control though is even more complex, as research has indicated that there are different roles between the deeper parts of Multifidus and its more superficial parts.
- At the back – are also the big strong Erector Spinae muscles, providing strong spinal extension and outer stability. Some interesting research has also suggested that good endurance of these muscles may have a role in preventing low back pain (more about this in part 2).
- Other accessory muscles – are the Quadratus Lumborum, between the pelvis and ribs, providing stability especially when standing on one leg, and there are others beyond the scope of this article.

STABLE TRUNK

So trunk stability could be seen as 2 mechanisms –

- The LOCAL INNER stability muscles, which include the Transversus Abdominis, Multifidus, Pelvic Floor, Diaphragm - much like an inner corset. This is what most physiotherapists are now calling the “CORE” stability muscles.
- The LARGER OUTER and more GLOBAL aspects (Outer/Inner Obliques, larger back muscles, Psoas etc) to provide both MOVEMENT and a form of stability that may not be optimal, if performed incorrectly. These outer muscles are easy to feel, and so are easier to exercise.

For example, just standing still requires minimal work of the local postural muscles to keep you upright, while lifting a heavy load may require both local and the strong global muscles to provide stability with movement. Specific exercise/s for each would be needed to enhance overall good movement.

CARE

Research is tending to indicate that the LOCAL INNER muscles involved with stability are more likely to be dysfunctioning or inhibited, especially if you have had a history of back injury. These INNER Stability muscles are now being considered as a more effective means of providing stability. Often in the gym or exercise class environment such as Pilates, there can be a lot of emphasis on stability, where people become overly focused on the outer global muscles and not realise the inner stability muscles are not functioning well or even exist. This can lead to imbalances and trunk rigidity, rather than stability, and can even lead to severe injury, or back pain problems.

NEUTRAL SPINE

There have been a number of advocates for “core and abdominal” training over time, calling it different things, from ‘abdominal bracing’ and ‘abdominal hollowing’ to ‘core stabilisation’. Stabilisation was often accompanied with tilting the pelvis backward, as this was considered helpful to bring added stabilisation. The problem was that every one’s structure is different – a little pelvic tilt for some would bring their spine to neutral, while for others it would cause the spine to flatten. Modern research has begun to show that the inner local muscles work best with the spine in neutral, not overly flexed (pelvic posterior tilt), nor extended. Sitting or standing in a neutral upright and lengthened way allows the inner local stabilising muscles to work best. See the Antigravity information below.

PHYSIOTHERAPY SPECIFICITY

“Core stabilisation” probably didn’t come into popular focus until Physiotherapy research back in the last part of the last century found that for some people with back pain, their deeper abdominal muscles, called the Transversus Abdominis, pelvic floor, and/or deep back muscles called Multifidus, were found to be dysfunctioning in normal movement ie contracting too slowly or even wasting away due to inhibition. Research has shown that these muscles play an important role in stabilising the trunk and pelvis.

Following this, there was a wave of change in the fitness industry towards “core stabilisation” including more use of the Swiss ball (though again these had been around for years previously), unstable surfaces, more free weights and new big emphasis on trunk stability, using plank lie practices, Pilates, abdominal hollowing, and many other related practices. This is great, but as stated above, it is important that the practices are performed correctly and with a balanced approach.

The interesting thing is that physios use this concept in regard to rehabilitation, not for general health or fitness. In other words a person is assessed to see if specific muscles are dysfunctioning, and then if so, they give people practices to help return normal function and movement. These practices are quite refined and subtle and require time, patience, and checking to see that they are being performed correctly. In a class situation, or if “core” is being taught by poorly trained people, then problems can occur, as people doing the practices may be doing them in an imbalanced way – emphasising too much outer global stability muscles, and not enough checking to know if the inner local muscle systems are working properly.

There has been continued research to answer many unanswered questions about abdominal strengthening and “core stabilisation”. For example, some research has shown that “core stability” may reduce the risk of lower limb injury, such as for runners. Others are investigating its role in sport. The problem has still often been what is specifically “core” muscle training, as mentioned above.

ANTIGRAVITY GRAVITY

One line of interesting research has come about from studies on astronauts who have spent long periods in space. What was found was that astronauts who spent time in space, where there is little effect of gravity, came back to earth and were found to have big problems with back pain and other postural related pains. It was found that they had wasting of certain muscles in their body, which were concerned with supporting the body structure against gravity. These findings began to refocus the idea of “core stability” for some physios and researchers. Perhaps the system of trunk control could better be seen in terms of 3 different groups: muscles which hold us up against gravity (deeper antigravity or postural muscles), the deep inner “CORE” muscles (the inner corset made up of the Transversus Abdominis, Multifidus (especially deeper parts) and pelvic floor), and outer larger MOVING muscles concerned with movement, and stronger stability, if needed.

Interestingly, further research has begun to identify this postural antigravity function is not just confined to the area of the trunk, but to hips and lower limbs and also possibly the neck, and may play a big role in injury prevention, reducing wear and tear, so helping to reduce arthritis, and aiding in bone health and strength, so helping to reduce osteoporosis.

From an experiential point this idea is quite easy to understand – what does gravity tend to do? It causes us to slump and collapse – we can all relate to this when we are tired. So what happens when you lift yourself up tall? Those of you who practise Yoga or Tai Chi may be familiar with the idea of a string attached to the crown of your head, lifting you tall and upward....

TRY THIS ACTION NOW

Stand up with your hands on your lower belly or around your waist. Lift tall through the crown of the head. Avoid lifting the chin and extending the spine backward (sometimes we think extension is the same as lengthening). Can you feel the waist thin or draw inward – the action of just lifting up against gravity has automatically brought in some of your “core” muscles. (NB - if it didn't, you may be doing the action incorrectly or actually have a muscle dysfunction, in which case you need to see your physio about it).

WHILST WALKING AND ‘CHAIRING’

Now try going for a walk – how long can you hold the action? Do you find you get tired, or forget, and end up slumping again? Do the same thing, but this time, try getting out of your chair without using your hands or extending your spine. Lift tall, bend from your hips, and stand up using your thighs. Can you feel the difference?

LIFT TALL

Now compare trying to just draw the belly in, or tilting the pelvis back, or bracing the whole trunk (like being punched in the belly) – how do they feel? Compare these with the experience of just lifting tall. I myself prefer the

approach of lifting tall to also aid stability. It provides stability without rigidity, and is pretty easy to do. You need to think about *one* thing – lifting upward or lengthening your crown from your tail (something we advocate in Yoga with the *asana* (yoga postures) practice – a practice should have both *sthira* (stability) and *sukha* (ease).)

CARE – do the lifting tall practice **GENTLY** – overdoing anything can cause problems – more does not always mean better.

Professor Caroline Richardson, one of the pioneers of research in the area of deep “core” stability has started a program to enhance health based upon the antigravity model and deep “core” stability models. For more information about this go to her website www.gravityfit.com

RESEARCH vs YOUR OWN SELF AWARENESS

These ideas from a research point of view are new and there is still a lot we don’t know. However, there is a lot of experience about these things from past traditions like Yoga and Tai Chi. Hopefully in the future, research and tradition will marry together and we will get a bigger picture of how to do these things really well, and learn the best ways to help people with dysfunctions.

What is important is to tune into your own body – feel what happens with different practices. Seek professional advice if you are not sure about this. But don’t just do something because it is fashionable or trendy, or because every one else does it. It is better to approach it from both paths: scientifically – western science (from without) and eastern science (from within).

BREATHING

I would like to add one further point about stability exercise. “Core” work when over done, especially with over emphasis on the outer global muscles, can lead to overly drawing the belly, or holding it tight, so that the abdomen becomes rigid. It doesn’t allow the breathing muscle (the diaphragm) to descend properly, so it can lead to over emphasis on upper chest breathing. This type of breathing has been identified with stress breathing and can lead to anxiety and other stress related problems or feelings. Inner local stability muscles allow for natural breathing and adjust for the breathing cycle. It may also be helpful to finish any “core” routine you do with some relaxed abdominal breathing and relaxation, to allow the system to normalise – just as is usually done with Yoga.

THE FUTURE IS POSSIBLY BALANCE

The future of “core” may be one of balance. Perhaps future research may show that it is neither purely one set of muscles, strength, endurance, stability or flexibility, which is the key, but one of motor control between all the muscles, correct sensory information coming in, good processing by the brain and the correct balance reactions. Just like when you strain your ankle it can

become weak and unsteady to keep your balance, so the trunk requires good balance mechanisms to allow it to work properly, and a balance between flexibility and stability.

Future “core” and antigravity practices may include use of vibration, more antigravity type of exercises like Yoga, walking up hills, and on unstable and soft surfaces, and possibly even more fun things like dance.

I am beginning to see abdominal strength and “core stability” not as something hard and rigid, but as something graceful and controlled like you see in a dancer or superb athlete.

This is what I like about Yoga – a Yoga practice is wholistic – integrative practices, awareness of posture and breathing, balance work, strength, flexibility, mental emotional balance – (because stress and the mind can also affect posture and how our muscle system works.)

Stay tuned to part 2 where I will go into some specific practices about antigravity, safe abdominal exercise and deep “core stability”.

Bibliography

- www.gravityfit.com - for about the gravity and the postural muscles
- Allison G T, Morris S L “Transversus abdominis and core stability: has the pendulum swung?”
British Journal of Sports Medicine 2008;42:930-931
- Bliss LS, Teeple P. “Core stability: the centerpiece of any training program”
Curr Sports Med Rep. 2005 Jun;4(3):179-83.
- Borghuis et al “The importance of sensory-motor control in providing core stability: implications for measurement and training” *Sports Med.* 2008;38(11):893-916.
- Brumagne et el “Persons with recurrent low back pain exhibit a rigid postural control strategy” *Eur Spine J.* 2008 September; 17(9): 1177–1184.
- Cheri et al “Surface Electromyographic Activity of the Abdominal Muscles During Pelvic-Tilt and Abdominal-Hollowing Exercises” *Journal of Athletic Training* 2004;39(1):32–36 www.journalofathletictraining.org
- Christopher et al “Expert Opinion and Controversies in Musculoskeletal and Sports Medicine: Core Stabilization as a Treatment for Low Back Pain”. *Arch Phys Med Rehabil* Vol 88, December 2007
- Hibbs et al “Optimizing performance by improving core stability and core strength” *Sports Med.* 2008;38(12):995-1008.

- Hides J, Gilmore C, Stanton W, Bohlscheid E. "Multifidus size and symmetry among chronic LBP and healthy asymptomatic subjects" *Man Ther.* 2008 Feb;13(1):43-9. Epub 2006 Oct 27.

- Paul Hodges "Transversus abdominis: a different view of the elephant"

British Journal of Sports Medicine 2008;42:941-944;
doi:10.1136/bjism.2008.051037

- O'Sullivan et al "The effect of different standing and sitting postures on trunk muscle activity in a pain-free population" *Spine.* 2002 Jun 1;27(11):1238-44.

- Pel, Spoor, Pool-Goudzwaard, Hoek van Dijke, and Snijders "Biomechanical Analysis of Reducing Sacroiliac Joint Shear Load by Optimization of Pelvic Muscle and Ligament Forces" *Ann Biomed Eng.* 2008 March; 36(3): 415–424.

- Reeve A, Dilley A. "Effects of posture on the thickness of transversus abdominis in pain-free subjects" *Man Ther.* 2009 May

- Richardson et al "Lumbo-pelvic joint protection against antigravity forces: motor control and segmental stiffness assessed with magnetic resonance imaging" *J Gravit Physiol.* 2004 Jul;11(2):P119-22.

- Sato K, Mokha M. "Does core strength training influence running kinetics, lower-extremity stability, and 5000-M performance in runners?" *J Strength Cond Res.* 2009 Jan;23(1):133-40.

- Sapsford RR, Richardson CA, Maher CF, Hodges PW. "Pelvic floor muscle activity in different sitting postures in continent and incontinent women". *Arch Phys Med Rehabil.* 2008 Sep;89(9):1741-7.

- Willson et al "Core stability and its relationship to lower extremity function and injury" *J Am Acad Orthop Surg.* 2005 Sep;13(5):316-25.