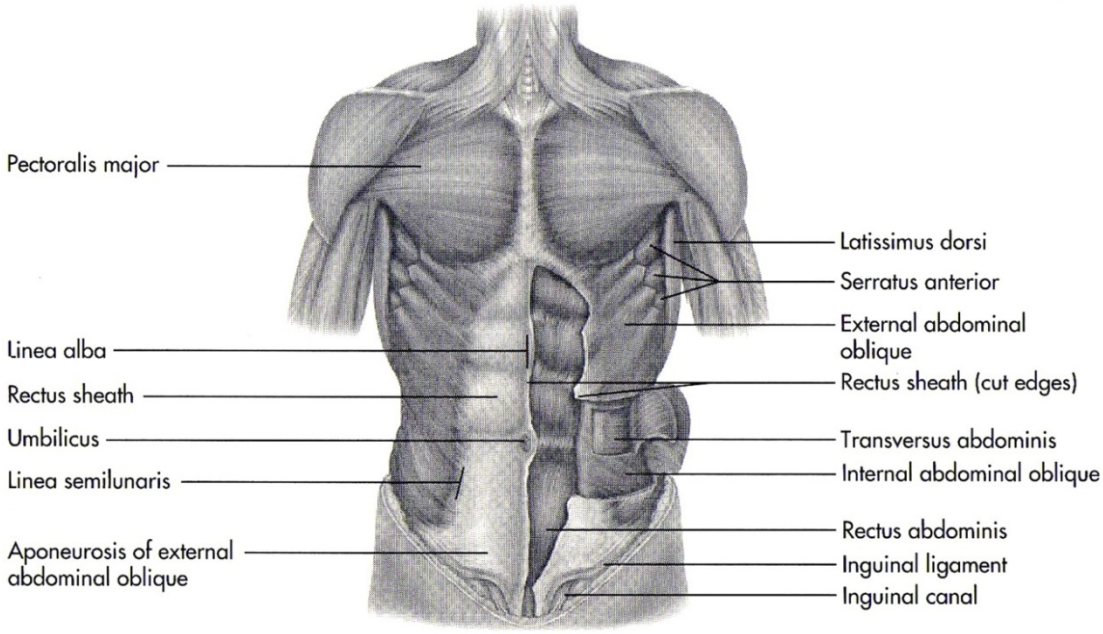
Core Stability

Introduction

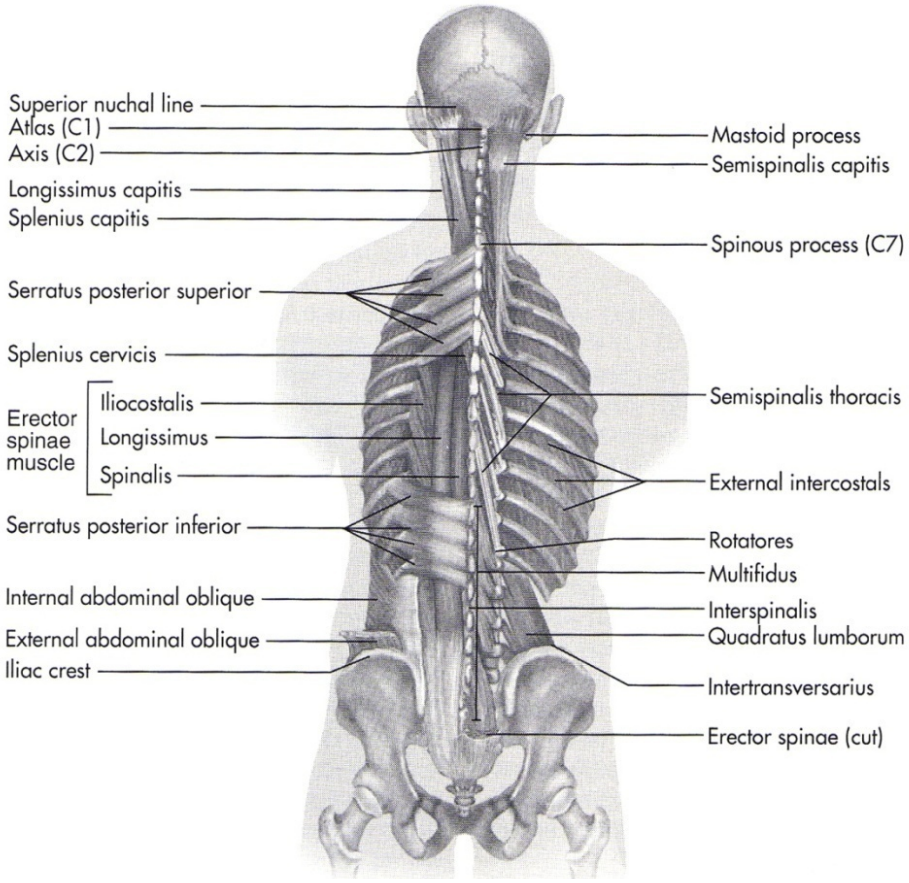
Core stability is rated as the top 5 trends of health fitness trends in 2007 & 2008 (ACSM). The reason for all the hype because core stability or also known as lumbo-pelvic complex is believed to be very important in daily functional activities such as walking, running, lifting objects and daily chores. Athletic performance may also be significantly improved through better control of the lumbo-pelvic complex. Athletes and physical trainers may apply training regimes for purposes of improving performance or for rehabilitative purposes. It is reported that 85% of the general population suffer from lower back pain.

The lumbo-pelvic complex can be described as a box inside of the mid section of a human trunk. The top of this 'box' would be the diaphragm, the bottom; pelvic floor muscles, the front; transverses abdominis and rectus abdominis, the back; erector spinae and quadratus lumborum and finally the sides; internal and external abdominal obliques. It is where the center of gravity is located and where every movement begins. This is the fundamental reason why the core is very important.

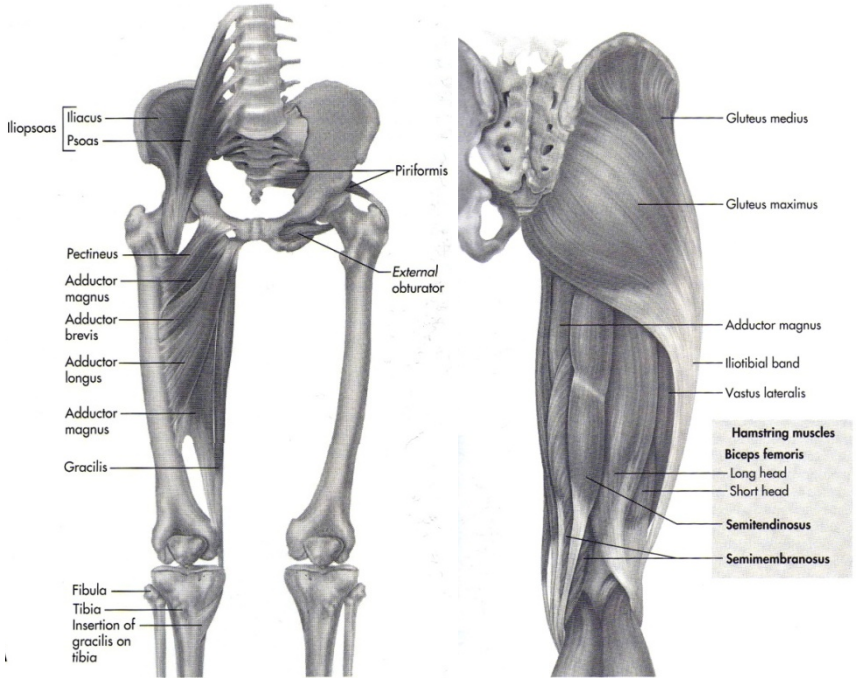


Anterior view of the Core Musculature

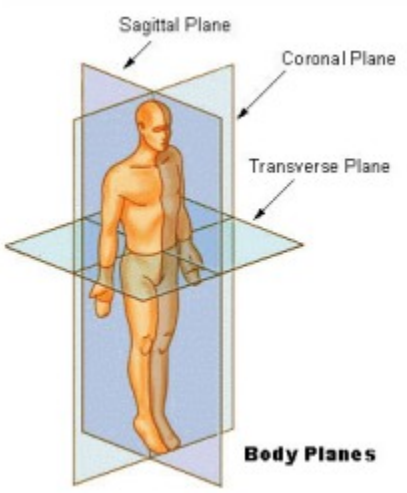
This part of the human body is considered highly complex and important because it works in various synchronization patterns to keep the body in its 'center of gravity' at all times, regardless of the body's position whether static or dynamic. When dynamic, the core muscles integrate to help stabilize the body for optimum performance whether the body is moving in either one of the planes of motion, be it sagital, frontal/coronal or transverse plane of motion or more planes of motion (e.g. sagital & transverse plane).



Posterior View of the Core Musculature



Anterior & posterior view of the core musculature in the lower extremity



Body Planes of Motion

Core training concepts

Most of individuals who train tend to mainly focus on developing strength in their extremities (e.g; legs and arms) and tend to ignore or forget importance of developing spinal stabilition and strength – ultimately the bigger picture. An imbalance of forces generated will lead to poor movement due to the insufficient force production from the core. Weakness in the core predisposes an athlete to injury. Metaphorically, the body can be exchanged by a wheel with its core being its hub and spokes which gives ultimate strength to the wheel.

A lumbo pelvic-hip complex training program should be design to improve strength, neuromuscular control, power and endurance of the muscles comprising of the core. This will lead to more efficient movement, ability to counter-act againts excessive forces developed (internal or external) which may lead to injury. This also ensures that there are no weak links in the entire kinetic chain.

Importance of neuromuscular efficiency

Neuromuscular efficiency is a combination of static and dynamic alignment and strength of stabilization that enables the body to absorb gravity and momentum at the right joint, point and plane of motion. This allows for better balance in the function of the entire kinetic chain. In contrast, if the neuromuscular system is not efficient, the body will be unable to cope of movements, espcially ones that are functional of nature, hence compensation from other bodyparts such as muscles, joints and ligaments may be injured. Imbalanced, underdeveloped musculature and also fatigue may lead to poor posture. This places high levels of stress being placed on muscles and connective tissue which lead to microtrauma, abnormal biomechanics and eventually, injury.

Assessment, Guidelines & Exercises

Prior to starting an exercise program for the core, a thorough assessment has to be done on the athlete. This includes determination of muscular imbalances, deficiencies in muscular movement, control of the core and overall kinetic function. A good evaluation of the athletes problem/weak

links is crucial as only that will help the athletic trainer determine what type of program and exercises may benefit the athlete the most to enhance the training or rehabilitation process. Outcomes as tests and be used as a measure to determine if an individual with higher risk of injury this allowing for prevention via improve core strength/stability (Peate, 2007). There are various tests with the same goal of testing endurance of the core musculature. The most simple one is as follow;

- Prone bridge
- Lateral bridge
- Torso flexor
- Torso extensor

The outcome is measured by seconds and can be compared to normal value. This is shown in the appendix.

The athletic trainer should look to create the program comprehensively by including training principals which must be systematic, progressive and functional (focusing on concentric, eccentric and isometric contractions). The athlete should begin his/her training program at the point in the progression continuum where it is most challenging but controlled environment.

Selection of exercises depends on training variables and may be altered alongside exercise progression for to reap the maximum benefits of training while avoiding boredom and burnout. However, the general rule for exercise selection remains, that it must be safe, challenging, able to stress multi planes, proprioceptively enriched and activity specific. The variables of training with progression are shown below;

1. **Plane of motion** – starting with single plane of motion, progressing to multiple plane
2. **Range of motion** - small, progressing to larger
3. **Loading parameter** - tubing, med ball or weights
4. **Body position** – sitting to standing to unilateral standing
5. **Speed of motion** – slow to fast
6. **Amount of control** – Stable to unstable surfaces
7. **Duration** – short to long
8. **Frequency** – low to high

There are 4 stages, similar to a periodization program for the core. Each athlete would have to go through the four stages, progressing from exercises that they can handle (able to stabilize through optimal neuromuscular control). Starting from the first to the last listed. Examples of exercise for these various stages are also given;

- **Stabilization** - bridging, quadruped drawing-in manouvre, diagonal crunch and superman
- **Stabilization & Strength** – Bridge + Leg Extension, prone hip extension, Stability ball wall squat and stability ball push-ups
- **Integrated Stabilization & Strength** – Medicine ball pull-over on stability ball and weighted ball chest rotation pass
- **Explosive stabilization** – med ball single leg jump,medicine ball overhead throw and weighted ball forward squat jump.

The logic of this progression pattern is to make exercises more dynamic and functional, requiring more muscles to work together, in proper synchronization to complete the exercise task given. This, at end would contribute to good development of overall aspects of lumbo-pelvic hip complex stability.

Exercises

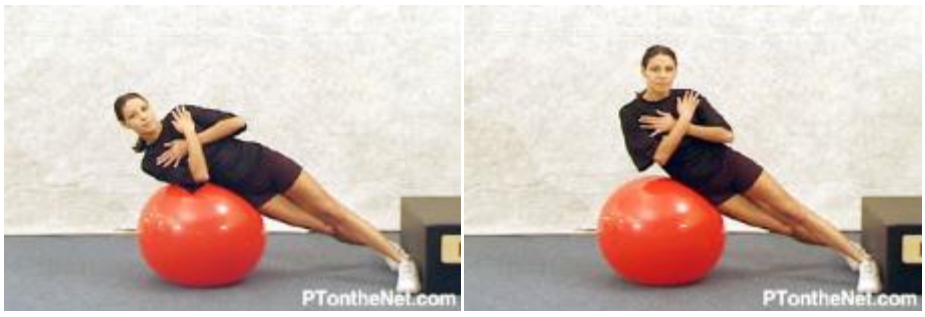
There is a vast variety of core exercises that can be done. The foundations are the same for each exercise and can be progressed through; **1**) having less contact area (e.g. standing on one foot instead of two, **2**) reducing stability (e.g. move from a stable surface – floor – to unstable surfaces such as rocker board or bosu ball. Progression can also be made by; **3**) increased recruitment of muscle fibre activation (e.g. dynamic movement) and **4**) mode of contraction (e.g. controlled to explosive). Examples of the 'foundation' core exercises are as below;

- Prone bridge (knees or toes)
- Supine bridge
- Lateral bridge (knees or feet)
- Superman
- Abdominal crunch
- Leg raises
- Quadruped draw-in manoeuvre

Conclusion

Good lumbo-pelvic stability is crucial for both athletes and the general population alike. It serves the purpose of improving functional capacity both in sports and performance, as well as in activities of daily living. Before beginning a core training regime, through assessment has to be done to evaluate weak links or muscles and how it is affecting the individual. Prescription of exercises needs to be science based while progression has to be constantly made. Variation of exercises may also play a part in keeping exercise fun and exciting while avoiding burn-out.

Appendix



Lateral flexion (stability ball)

Reverse Crunch

Bridge on Stability ball (cross leg)

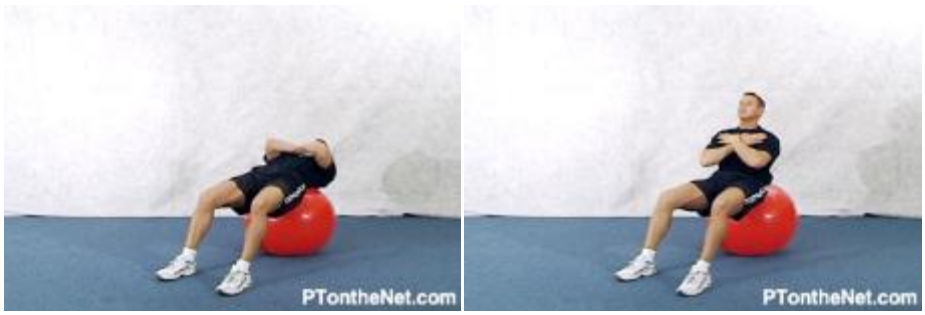
Draw-in Manoeuvre

Bridge

The Cobra

Prone Planks & Prone Plank with Hip Extension

Prone Plank on Stability Ball



Stability Ball Crunch

Lateral Plank with Hip Abduction

Twist with Stability Ball

Dumbbell Wiper

Lunge & Anterior Reach

	Men	Women
Extension	161	185
Flexion	136	134
Right side lateral plank	95	75
Left side lateral plank	99	78
Flexion/extension ratio	0.84	0.72

Mean endurance times (seconds) and flexion/extension ratio in young healthy adults (21 years)

References

Prentice, W.E. (2004). 4th ed. Rehabilitation Techniques for Sports Medicine & Athletic Training. New York: McGraw Hill

Brukner, P. (2007). 3rd ed. Clinical Sports Medicine. Australia: McGraw Hill

www.ptonthenet.com – Exercise library (photos)

www.fitsync.com – Exercise library (photos)