

ABDOMINAL FUNCTION: DO WE NEED TO RE-THINK OUR APPROACH?

All too often the thought of “training” the abdominals comes as an afterthought in the fitness program. Frequently done at the end of the exercise session or as an active recovery between sets of other body part training, we think 3 or 4 sets of endless abdominal crunches will provide the necessary impetus to strengthen the abdominals adequately. Much of recent literature discusses the multi-joint, multi-planar movements in functional training, should we re-think our approach to training of the abdominals to benefit their optimal function?

Human Movement Traits

Characteristics of human motion encompass movement within a three dimensional environment. Nearly all the joints and muscles in the body move in the sagittal, frontal, and transverse planes. Each movement has a degree of flexion/extension (sagittal plane motion), abduction/adduction (frontal plane motion) and rotation (transverse plane motion). Some actions have more influence of one plane versus another, but nonetheless, at each joint there is motion in all three planes during free motion. Based upon this premise, exercise and training programs should incorporate movement patterns in the three planes of motion and not isolate a joint or muscle group in only one plane of motion. Any time we limit action of an exercise to one plane of motion, the exercise is not functional in respect to human movement within all three planes of motion.

Re-Thinking Muscle Actions in Motion

All muscles have similar actions that must decelerate motion before it can accelerate motion, and in most activities needs to overcome gravitational forces. When examining human function, muscles do not create motion, but muscles decelerate or control actions while they are being lengthened or loaded. As the lengthening occurs, energy is stored as the muscles are being “primed” for a propulsion or acceleration of movement. In reality, the muscles act to control the motion during the entire cycle of events, but do not necessarily initiate the action. For example, if a person is going to jump, he or she often takes a short step and allows gravity to cause them to dorsiflex at the ankle, flex at the knee and hip, spinal flex slightly, all to prepare the body for flight. As this preparation is taking place, the muscles are decelerating the downward force of the body weight caused by gravity, and storing energy as they are eccentrically lengthening or “pre-loading”. The body must be able absorb the downward forces from gravity as well as the weight of the body itself, and simultaneously create a reaction from the pressure placed against the ground as the player transforms into a leap. During the

transformation, the player must react from a deceleration phase and convert the stored energy into an acceleration phase and allow the muscles to react by concentrically shortening muscles that propel him or her upward. The plantar flexion of the ankle, knee and hip extension, along with spinal extension are a concentric moment that propel, unload, and accelerate. Without the “pre-load” in all three planes of motion, the player will not “unload” with an efficient and forceful leap. Imagine trying to jump without the pre-load phase, it would be weak, inefficient, and non-functional.

Muscle Actions in Different Planes and Transition

The movements in the sagittal plane are flexion and extension, while the frontal plane movements are abduction and adduction. The actions within these planes must overcome the resistance of perpendicular forces of gravity upon the body, in other words, the downward forces of gravity. In many instances, the forces of the load and gravity as well as the bony structural restrictions in the range of motion limit the action. In the transverse plane, movement occurs perpendicular to gravity and the exerciser must decelerate the action through pure muscle strength and without the effects of gravity before they transform into the propulsive phase of the work.

Abdominal Integration

As these important aspects are imperative for optimal movement patterns, most traditional abdominal exercises do not embrace the above characteristics of human motion. Much of the traditional methods of training has occurred in the sagittal and frontal planes and is done in the supine position. Most abdominal exercises are performed in non-functional positions, isolate the abdominals from the rest of the body, and often do not integrate the hips and spinal stabilizers within the exercise itself. If the majority of activities are done from the standing position, the adaptation of abdominal training can and should mimic some actions in human motion.

Traditional curricula have taught us the abdominals cause spinal flexion. In the isolated, open chain that is true. However, like all other muscles in function, the abdominals are most efficient when they first pre-load or eccentrically lengthen, then unload or concentrically contract. The physiology of muscle function reflexively contracts more forcefully and efficiently when it lengthens before it shortens. Yet, most of the traditional training of the abdominals, i.e. abdominal crunches, has been to only shorten and not lengthen when performing. The abdominals are the “command central” when performing any movement pattern as they are actively involved in walking, running, cycling, swimming, jumping, turning, pushing, pulling, bending, extending, reaching, throwing, or lifting. In each of these activities, the abdominals go through a lengthening phase and then shortening phase all within three planes of motion.

When viewing the abdominal group, one can see the arrangement of the fibers in all three planes. To demonstrate the action of the abdominals in walking, imagine the left foot swinging forward. When the heel strikes the ground, the pelvis anteriorly tilts (sagittal plane action) which lengthens the abdominals to the front and downward.

Simultaneously, the left arm swings back, which causes the left shoulder to move posteriorly as the thoracic spine rotates to the left (transverse plane action). This causes the abdominals to lengthen up and backward. As the weight of the body begins to pass over the left, and now supporting leg, the left hip hikes up while the right hip drops down. This causes a “pulling” of the abdominals laterally (frontal plane action). As these reactions are occurring, inherent to this action is the rotation of the hips, shoulder, and back through the transverse plane adding additional lengthening and tension to the abdominals to allow a more forceful and efficient reaction. The reaction will reflexively create the opposite actions to the right side. The chain reaction associated with walking causes the abdominals to lengthen prior to shorten as they function to stabilize the torso within all three planes of motion.

Effective training of the abdominals does not necessarily require a “separate” exercise alone. Effective abdominal training should incorporate many of the larger movement patterns, often positioning the performer in stances of gaits that mimic the desired action, should involve a degree of rotation. Additionally, the movement should include a pre-loading or lengthening phase followed by an unloading or shortening phase. This “pre-load/unload” cycle will create an efficient and forceful reaction that can enhance performance, no matter what the activity may be. However, careful attention must be given to ensure the client has adequate range of motion in the pelvis and thoracic spine to fully allow the abdominals to fire. If limitations are present in the pelvis and/or thoracic spine, these regions should be stretched as this will integrate into improved abdominal function and reduced risk of muscle strain and back injury.

Look for future articles on our website addressing issues along the anatomical flexibility superhighway. Also, be sure to check out our products page for our Functional Integrated Abdominal Training video, a 42 minute program demonstrating and explaining 16 different integrated exercises that provide a super workout for the abdominals and great training for the lower and upper extremities as well. And don't forget to see Human Motion: A Pictorial Guide to Functional Integrated Movement Patterns, a book that shows step-by-step functional movement patterns, with photos to view the start and end of each exercise. These are a MUST HAVE for the fitness professional!