SCIENTIFIC
Core Conditioning
Scientific Core Conditioning

by
Paul Chek

A C.H.E.K Institute Publication
San Diego, CA
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How to Complete this Course as CORRESPONDENCE COURSE ONLY

To maximize your learning potential, it is recommended that you complete the course in the following manner:

1. **Review the DVDs.** The first time through, just watch, listen and absorb the information.

2. At this point, you should **read the exam** thoroughly. The purpose is not only to pass the exam, but also to be proficient in applying the techniques. The exam questions will help direct your attention to important concepts and information.

3. **Read the manual.**

4. The second time through the DVDs, **follow along in the manual** and take notes! It is recommended that you stop the DVD - rewind and review - as often as necessary to clarify points that you may not understand.

5. **Perform all the assessments and exercises** you are capable of performing with good form. Repeat this process at least twice - not necessarily on the same day - and if possible, also practice them on a willing friend or family member.

6. Now that you have viewed the instructional DVDs twice and have read the exam, it’s time to **take the exam**. Instructions for completing the exam are found on pages 211-212. The purpose of this correspondence course is not to trick you, but to make sure that you are proficient in the areas of knowledge presented. The exam is designed to direct your attention to the areas of importance. The exam is designed to be taken online; the exam in the back of this manual is for you to practice on and keep for reference.

7. If you cannot take the exam online for any reason, you may complete the exam in the manual and return the exam answer sheet and grading request sheet via mail, email or fax to:

   **C.H.E.K Institute**
   **Exam Grading**
   **380 S. Melrose Dr, Ste 415**
   **Vista, CA 92081**
   **USA**

   Fax: (+1) 760.477.2630
   Email: educate@chekinstitute.com

   **Please note:** there is an additional fee for submitting your exam to be graded by hand. Please see page 237 for details.
Course Objectives

At the end of this course students will be able to:

1. **Explain** the functional anatomy of the abdominal muscles, cervical flexors, psoas and quadratus lumborum.

2. **Explain** the two major support mechanisms a functionally trained abdomen provides to the low back.

3. **Explain** the function of the abdominal wall and its relationship to the entire kinetic chain.

4. **Demonstrate how to assess:**
   - Lumbo-pelvic stabilization mechanism
   - Transversus abdominis function
   - Gross lumbar abdominal strength and stabilization
   - Upper abdominal strength
   - Activation of the thoraco-lumbar fascia system for total body stabilization

5. **Explain** the short and long term effects of poor training technique and **be able** to perform correct exercise technique for core exercises.

6. **Develop** core conditioning programs that progress your clients through the **Stability, Strength and Power** phases of conditioning.
PART I - FUNCTIONAL ANATOMY

External Oblique

ORIGIN: By interdigitating, slips from external surfaces of lower eight ribs.

INSERTION: Fibers from the lower ribs insert into the anterior half of the outer lip of the iliac crest. Remaining fibers insert into the wide aponeurosis of the anterior abdominal wall.

ACTIONS:

• Bends the trunk forward through bilateral stimulation.
• The major influence is on the lumbar spine, tilting the pelvis posteriorly. It is through this action that the external obliques are considered lower abdominals functionally, 38 (Ref.#38 – as noted in Kendall & Kendall).
• Produces ipsilateral side flexion and contralateral trunk rotation through unilateral stimulation.
• Stabilizer on the contralateral side.
• Increases intra-abdominal pressure and assists in forced expiration.
• Ipsilateral rotator when the trunk is anchored.
• Contralateral rotator when the pelvis is anchored.

The external oblique is the largest abdominal muscle.

QUESTION:
How can you assess the relationship between the external oblique and the internal oblique?
Internal Oblique

**ORIGIN:** Lumbar fascia, anterior two thirds of iliac crest and lateral two thirds of the inguinal ligament.

**INSERTION:** Ribs 9-12 and the linea alba.

**ACTIONS:**
- Bends the trunk forward through bilateral stimulation.
- Bends the trunk sideways and rotates it toward the ipsilateral side through unilateral stimulation.
- During lateral bending, the ipsilateral internal and external oblique cooperate. In right rotation, the right internal oblique is synergistic with the left external oblique, and vice-versa.
- Ipsilateral rotator when the pelvis is anchored.
- Contralateral rotator when the trunk is anchored.

![Figure 2: During the throwing motion shown above, there is a synergistic relationship between the external rotators of the right hip, the right external oblique and the left internal oblique.](image)

**ANSWER:**
You can assess the relationship between the external and internal obliques by having your client perform a side flexion over a Swiss Ball.

- Forward rotation indicates a stronger external oblique.
- Rotation back signifies a stronger internal oblique.
Rectus Abdominis

**ORIGIN:** Pubic symphysis and crest of pubis.

**INSERTION:** Costal cartilages of ribs 5-7 and the xyphoid process.

**ACTIONS:**

- Flexes the trunk (as in a sit-up) if the pelvis is fixed.
- Lifts and posteriorly rotates the pelvis if the trunk is fixed.
- Bends the trunk to the ipsilateral side when stimulated unilaterally (minimally).
- Stabilizer on the contralateral side under dynamic conditions or with a heavy load. If someone uses the rectus abdominis to stabilize while under light loads, they most likely have faulty recruitment patterns in the abdominal wall.
- Increases intra-abdominal pressure and assists in forced expiration.

Poor training techniques may shorten the rectus abdominis, which can depress the rib cage and lead to overworking of the muscles of inspiration. This will present as neck pain and trigger points in the scalene and post-scapular levator and may lead to subsequent pain in the quadratus lumborum.
Transversus Abdominis

**ORIGIN:** Internal surfaces of ribs 7-12, thoraco-lumbar fascia and iliac crest.

**INSERTION:** Linea alba.

**ACTIONS:**

- Increases intra-abdominal pressure by applying lateral traction to the middle layer of the lumbodorsal fascia. This traction creates an extension force in the flexed position (such as when lifting an object from the floor).
- Major stabilizer of the lower back.

**INNERVATION:** The transversus abdominis (TVA), multifidus and pelvic floor muscles are on the same neurological loop, therefore if the TVA is not working properly, these muscles also will not function correctly.
Innervation of the Rectus Abdominis and Obliques

The rectus abdominis has eight sources of innervations (T5/6 – T12/11), while the obliques have innervations from T7 – T12. There is partitioning of the musculature in the abdominal wall, as it performs roles as both a stabilizer and a prime mover – often in the same movement. Therefore, good neuromuscular control is essential to be able to carry out both these actions.

Below the umbilicus these muscles are innervated by the ilioinguinal and iliohypogastric nerves (which are predominantly L1 in origin). This is how to separate the upper and lower regions of the abdomen neurologically.

**Psoas**

**ORIGIN:** Ventral surfaces of transverse processes of all lumbar vertebra, sides of bodies and corresponding intervertebral discs of the last thoracic and all lumbar vertebrae and membranous arches that extend over the sides of the bodies of the lumbar vertebrae.

**INSERTION:** Lesser trochanter of femur.

**ACTIONS:**

- Flexes the trunk when the feet are anchored.
- Flexes the hip when the trunk is anchored.
- Unilateral contraction causes lumbar side flexion.
- If unchecked by the lower abs, hypertrophy or hypertonicity of the psoas causes anterior pelvic tilt by approximation of the lesser trochanter and lumbar spine.
- Minor spinal stabilizer when in rotation.

**QUESTION:** Which back muscle may be a flexor of the spine and under what conditions?
Quadratus Lumborum

**ORIGIN:** Iliac Crest

**INSERTION:** Twelfth rib and transverse processes of the lumbar vertebrae

**ACTIONS:**

- Assists the erector spinae in trunk extension from a neutral standing or sitting posture through bilateral stimulation.
- Bilateral stimulation also assists the abdominals with flexion movements from a fully flexed posture.
- Flexes the trunk in concert with the ipsilateral internal and external oblique muscles through unilateral stimulation.

**DAVIS’ LAW:** *If the origin and insertion of a muscle become closer together, the muscle may hypertrophy. If the origin and insertion of a muscle are separated, the muscle becomes taut and may weaken.*

---

**When the psoas becomes shortened, the quadratus lumborum also shortens.**

- Short, tight psoas leads to a _________________ posture.
- Long, weak psoas leads to a _________________ posture.

**ANSWER:**

Quadratus Lumborum – when flexing the trunk under heavy load (e.g. on a crunch machine). As the twelfth rib passes the axis of rotation in the lumbar spine, the quadratus lumborum (QLO) becomes a flexor of the trunk with a poor mechanical advantage. This can often strain the QLO, leading to trigger points, spasms and shortening and tightening of the muscle – causing a hip hike on one side. Goldspink showed that when a muscle is chronically shortened, it will drop sarcomeres and may only regain approximately 85% of the muscle when stressed. (47) Poor training creating a QLO strain may therefore lead to a permanently short muscle.
Relationship Between Hip Flexors and Abdominal Muscles and the Effect of Faulty Training

Poor training techniques and faulty posture can cause the hip flexors to become facilitated, which will then inhibit the abdominal muscles, particularly the lower abdominals. If this is the case, the iliopsoas should be excluded from abdominal exercises until the abdominal wall is re-educated sufficiently to open the pathways. The abdominals can then be trained in a dynamic manner, integrating hip flexors and abdominals.

The lower abdominals are postural antagonists to the hip flexors, but dynamically are synergistic to the hip flexors.

Figure 6: Layers of the Abdominal Wall
A. Transversus Abdominis
B. Internal Oblique
C. External Oblique
D. Rectus Abdominis
E. Sheeth of Rectus Abdominis

Note: There are three layers to the abdominal wall as the rectus abdominis sits on the same layers as the obliques.
Cervical Flexors

The cervical flexors affect the biomechanical and functional relationship between the trunk and the head-neck complex during abdominal exercises.

The supra and infrahyoid musculature are to the cervical spine what the lower abdominals are to the lumbar spine. They stabilize the head during a crunch or sit-up.

**Infrahyoid Musculature**
Consists of the sternohyoid, sternothyroid (sits behind sternohyoid) and omohyoid muscles.

**ORIGIN:** The manubrium of the sternum.
**INSERTION:** The hyoid bone.

**Suprahyoid Musculature**
Consists of the muscles of the tongue.

**ORIGIN:** Most of these muscles originate from the mandible.
**INSERTION:** The hyoid bone and within the tongue.

---

Figure 7: Cervical Flexor Musculature
The Importance of Tongue Position During Abdominal Exercises

Proper tongue position is essential during repeated trunk flexion exercises against gravity. The physiological rest position of the tongue is the roof of the mouth, just behind the front teeth. If the tongue is not held in this position, as the head (which weighs 7.5% of your total body weight) is lifted during a crunch or sit-up, the only way to lift the head is with the sternocleidomastoid (SCM) muscles and the deep cervical flexors. If the SCM muscles are used for this purpose, they will hypertrophy just like any other muscle being exercised. Because the SCM muscles are extensors of the upper cervical spine and flexors of the lower cervical spine, hypertrophy and hypertonicity can cause a forward head posture.

Another problem with incorrect tongue position is that the deep cervical flexors must play a major role in lifting the head. These muscles are long, thin and slight. They fatigue easily, and excessive fatigue encourages spasms and hypertonicity. If shortened because of poor technique, these muscles flex the cervical spine, straightening it, thus reversing its natural curvature. This creates many unwanted problems.

The supra and infrahyoid muscles have a tremendous mechanical advantage over the deep cervical flexors (which run along the anterior cervical spine). Also, the SCM are extensors of the upper cervical spine and are counter-balanced by the supra and infrahyoid muscles. This is a primary mechanism for maintaining normal posture of the head.

The cervical flexors should be allowed to help stabilize the head during abdominal exercises. This is a natural activity and is taught in this course. If you pull on your head during abdominal exercises, the cervical flexors do not contract. Such inactivity makes them weak and encourages a forward head posture.

To learn how to perform Cervical Flexion Activation tests, see page 50.
PART II - CORE STABILIZING MECHANISMS AND POSTURAL CONSIDERATIONS

INTRA-ABDOMINAL PRESSURE

The intra-abdominal pressure mechanism alleviates between 12% and 36% of the load (A) the lumbar spine at the L4 and L5 levels. As the abdominal musculature contracts against the viscera (B), they are pushed superiorly into the contracted diaphragm and inferiorly into the pelvic basin. The result is elevation of the diaphragm, which through its attachments to the L2 and L3 vertebrae, creates a force decompressing L4 and L5 (C).

THORACO-LUMBAR FASCIA (TLF)

Lateral tension from the transversus abdominis (TVA) and the internal oblique (IO) are transferred into the thoraco-lumbar fascia through the lateral raphe. The lateral raphe is the point where the anterior, middle and posterior layer of the TLF blend. Fibers of the posterior layer of thoraco-lumbar fascia (superficial lamina) travel inferiorly, inserting into the spinous processes of L4 and L5. Fibers from the deep lamina transverse upward to the spinous processes of L2 and L3. This orientation enables lateral traction on the lateral raphe by the TVA and IO to create an extension force on the lumbar spine.
Critical Point

This abdominal mechanism is active during what is called the critical point, which is approximately 90% of maximum lumbar flexion (45 degrees). At the critical point, there is a switch from muscular to ligamentous support (and vice versa when coming from flexion to extension).

During this phase, abdominal support for the lumbar spine is of great importance. If the abdominals are weak or uncoordinated, there is a momentary loss of support for the lumbar spine. This greatly increases the risk of injury.

**Flexion force + Extension force=Stabilization**

HYDRAULIC AMPLIFIER MECHANISM

As the erector spinae musculature contract they expand. Because they are encased in a sheath of thoracolumbar fascia, their expansion creates intercompartmental pressure (ICP). This ICP creates “hoop tension” within the fascial sheath, with the net effect being a pressure or hydraulic erection force.

When the trunk is forward bent to near maximal lumbar flexion, the erector musculature are electrically silent. At this point there is tremendous elastic tension created in the erector musculature. This tension force is added to that of the stored elastic energy of the posterior spinal ligaments, as well as the force created by the abdominals through the thoracolumbar fascia. Intra-abdominal pressure, thoracolumbar fascia gain and hydraulic erection all act as a force couple with the gluteus maximus and hamstrings to perform lifts from a forward bend position.
NOTES
Cervico-Pelvic Interaction
The Abdominal Musculature’s Effect on Posture

POTENTIAL SOURCES OF ALTERED POSTURE
Figure 12:
• Tight upper abdominals
• Weak external oblique (lower abdominals)
• Tight or hypertonic psoas/iliopsoas
• Weak iliopsoas (sway back)
• Weak cervical flexors
• Hypertrophied, short or hypertonic sternocleidomastoid muscles

COMMONLY SEEN POSTURAL EFFECTS
Figure 13:
• Forward head
• Rounded shoulders
• Ligament strains, particularly in long cervical flexors
• Altered lumbo-pelvic relationships
• Respiratory stress
• Altered biomechanics
• Muscle imbalances
• Multiple pain syndromes
• Reduced balance and agility
• Altered aesthetics
Posture, Curves and Exercise Selection

Posture is the position from which movement begins and ends. **Ideal posture** is that state of muscular and skeletal balance which protects the supporting structures of the body against injury or progressive deformity, irrespective of the attitude in which these structures are working or resting (See Figure 14). It is during a state of ideal posture that the muscles will function most efficiently.

Figure 15 shows the effects of **imbalance between the trunk flexors and trunk extensors**. As the abdominal musculature become progressively stronger than their antagonists, the following postural aberrations may be seen: **A)** short and tight upper abdominal musculature, **B)** a depressed sternum, **C)** a forward head, and **D)** an increased thoracic kyphosis, often with it’s apex at T7-9.

The **Lower Cross Syndrome** is shown in Figure 16. In this case there is shortening of the lumbar erectors, iliopsoas, rectus femoris and tensor fascia latae with lengthening of the lower abdominal musculature, hamstrings, thoracic extensors and superficial cervical flexors. This posture is frequently seen in exercisers who spend a lot of time in the gym exercising with imbalanced programs.

The **Sway Back Posture, or Layered Syndrome** is shown in Figure 17. Here the hamstrings and lower abdominals are short and tight, while the lumbar erectors, rectus femoris and iliopsoas are long and may be weak.

**To correct these cases of faulty alignment, the long weak muscles must be shortened and strengthened, while the short tight muscles must be stretched.** The stretching should take place first.
Abdominal – Sacroiliac Interaction

Abdominal-sacroiliac joint interaction is responsible for sacroiliac joint stability. As shown in Figure 18, the force couple actions of the abdominal and hamstring musculature (F & F') work to posteriorly rotate the ilium on the sacrum. This serves as a tightening mechanism for the sacroiliac, sacrospinous and sacrotuberous ligaments, providing stability at the sacroiliac joints.

As one bends forward, the line of gravity moves forward. This encourages sheering of the sacrum between the ilium. If the abdominal wall (APS) is working correctly, the ilium is rotated posteriorly and the supportive ligaments are appropriately tightened (Figure 15). This will stop the sacrum falling through the pelvis. If the abdominal wall is dysfunctional, there may be sheering in the sacroiliac joint(s), often resulting in pain. The lower abdominal wall also activates during gait to stabilize the pelvis.

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Flexor/Extensor Imbalance

Many fitness enthusiasts want the beauty of a washboard abdomen. This goal drives them to perform a tremendous amount of abdominal exercises to the neglect of their back muscles. If continued for a long time, back pain is inevitable.

Today, more than ever, people make their living at a seated workstation. Prolonged seating encourages flexion of the lumbar spine and allows the back muscles to become weak. If you combine strong abdominals with a weak back, you have a muscle imbalance. The result is that your beautifully developed abdominals are not being adequately counter-balanced by your back, which facilitates a flexed posture and back pain.

**Effects of abdominal muscle imbalances include:**
- Forward head (Fig. 20A)
- Depressed chest (Fig. 20C)
- Narrowed sterno-costal angle (Fig. 20B)
- Altered respiratory excursion of the ribs and diaphragm
- Middle thoracic kyphosis with flexion hypermobility (Fig. 20D)
- Middle thoracic kyphosis with flexion hypermobility (Fig. 20E)

Shortened abdominal musculature is often associated with weak erector spinae muscles. These are easily identified by the prominence of the spinous processes – a naked spine. This condition may eventually cause a dowagers hump if left unattended for extended periods of asymmetrical training.

**NOTE:** This may also result from shortening of the thoraco-lumbar fascia. Thoraco-lumbar fascia shortening may result from long-term postural stress on the low back (hyper-lordosis), hypertonicity of the internal obliques and the transversus abdominis.

**SPECIAL NOTE**
Care must be taken to consider training volume in relation to flexor and extensor exercises, training intensity of exercises used, and postural alignment. Postural alignment is the key evaluation method because posture never lies!
A Balancing Act – Flexion vs. Extension Loading

POINTS OF CONCERN

The true balance of the body can be fairly accurately discerned from assessment of static and dynamic posture. It is important to prevent unnecessary muscle imbalances through proper program design.

The following factors should be considered when designing core-conditioning programs:

A. Volume, flexion vs. extension.

B. Intensity, flexion exercises vs. extension exercises.

C. Volume/intensity relationships between exercises being used now and in the past several months or as long as training may have been contributing to muscle and postural imbalances.

D. Estimated total time under tension.

E. Posture. The body never lies!

For extension exercises, see Paul Chek’s Gym Instructor, Volume 1, Part 2. Back and Ball Training DVD.
Sterno-Costal Angle

The sterno-costal angle begins where the manubrium and the xyphoid process meets and angles out from there along the inside edge of the rib cage (the costal angle of the rib).

A normal sterno-costal angle of 90 degrees is the result of balanced tension within the abdominal musculature.

A sterno-costal angle greater than 90 degrees can be seen in rare cases of internal oblique hypertonicity. A unilateral, internal oblique shortness is often associated with scoliosis (which can distort the rib angle).

Shortened rectus abdominis and external oblique muscles likely cause a narrow sterno-costal angle.
NOTES
Be Aware of Your Posture

Look at your posture. From the front you should have a level pelvis (belt line). Your head should sit on your neck in a straight line from your shoulders.

From the side, your ankles are the reference point. The body is designed to function best when your knee, hip, shoulder and ear all line up with each other (from a side view). If you do not meet this criteria for good posture, your exercise program should be reviewed by a reputable therapist who can give you the guidance to correct your posture.

Posture is the beginning and ending point of all movement. If you begin in the wrong place you’ll most likely end in the wrong place!
Abdominal Training Myths

MYTH 1: Abdominal exercises reduce your midsection
There is no direct metabolic pathway from the muscle cells in your midsection to the fat cells surrounding them. For the abdominal muscles to use stored fat for energy, your body must first send it to the liver. The liver converts this fat into fatty acids and sends it back to the abdominal muscles to be used as fuel.

Unfortunately, the stored fat the abdominal muscles use first may not be from the abdominal region. (In fact, it’s possible the energy to perform an abdominal exercise may come from the fat stores in your arms.) This is because your body uses it’s fat stores such that the last place you added fat to is the first place you will lose it. This order is genetically determined and influenced by sex and age. For example, the females in one family may tend to store fat on their hips, while the males tend to store fat on their waist.

MYTH 2: Train the abdominals daily
The abdominals are a striated, skeletal muscle group and are under voluntary control, behaving just like any other muscles you work in the gym. Therefore, you do not want to overload any specific movement pattern and the fibers responsible for that pattern. Training the entire abdominal region daily will most likely lead to strains, poor performance and adaptive shortening from repeated micro trauma. Adaptive shortening of the abdominals can also disturb the normal respiratory excursion of the ribs, increase the workload on the accessory respiratory muscles and encourage poor posture. However, different parts of the abdominal musculature can be trained on successive days, i.e. lower abdominals one day and obliques the next day.

A daily maintenance program, where the entire region is trained on the same day, may be implemented only after the desired level of strength is achieved. During a maintenance phase, you should exercise only to fatigue, not failure. It is also important to train the abdominals in the correct order in regard to the chain of optimal neurological progression.

Lower Abdominals – Obliques – Upper Abdominals

MYTH 3: There are no lower abdominals
The separation of the upper and lower abdominal region has been documented as far back as 1934 by Joel E. Goldthwaite in his book Body Mechanics in Health and Disease. The rectus abdominis is innervated by eight sources, with a distinct separate innervation below the umbilicus. It can therefore act as a prime mover at one end and a stabilizer at the other. A client can have well-conditioned upper abdominals and even show muscle definition above the belly button, yet display poor tone and a “pooch” belly below the navel. This is particularly common in females after a caesarean section or hysterectomy.
Part III - ASSESSING CORE FUNCTION

**Note:** The goal is to test your client’s natural movements, therefore, do not educate her about what you are doing before performing any evaluation test.

**Cervical Flexion Activation**

1. Stand beside your client with one hand supporting her upper back and the other on her forehead.
2. Ask the client to relax and let her tongue hang loose in her mouth.
3. Apply constant pressure to her forehead to get a sense of how strong the cervical flexors are.
4. Ask the client to swallow and hold her tongue in the position it ends up in – on the roof of the mouth behind the front teeth.
5. Repeat the test and assess her strength with the tongue in position.

**RESULTS**

<table>
<thead>
<tr>
<th></th>
<th>Tongue loose in mouth: approximate lbs. of pressure</th>
<th>Tongue in physiological rest position: approximate lbs. of pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cervical Flexor/Trunk Flexor Interaction

1. Have your client lie over a Swiss ball and perform crunches in whatever way is natural to him.

2. Determine about how many crunches your client could do in this manner. You do not need to have him perform as many as he can, just have him estimate the amount he feels he could do.

3. Make any needed modifications to his technique so that he is performing the exercise correctly. Have your client hold his fingers in his ears, creating an axis. Then ask him to draw the belly button inward, hold the tongue on the roof of the mouth and roll the head on the axle as he crunches up one vertebra at a time.

4. Have your client do as many crunches as he can with correct form.

5. Once his neck is fatigued, allow your client to hold his head as he continues doing crunches.

6. Determine how many more crunches your client can do while holding his head vs. non-supported. The larger the difference, the greater the imbalance between the neck flexors and the abdominals.

When performing the Swiss ball crunch as an exercise, you will want to use the neck as the limiting factor. As soon as the neck fatigues and he can no longer perform the exercise with correct form, it is time to stop.

<table>
<thead>
<tr>
<th># of Crunches</th>
<th>Client 1</th>
<th>Client 2</th>
<th>Client 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct Form</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supporting Head</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imbalance Ratio*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Number of crunches performed with correct form : Number of crunches performed holding head.
For example, 1:5 (please simplify your ratio).
Techniques for Charging the Thoracic and Abdominal Cavities

To assess your client’s natural breathing, have him take a deep breath. Watch to see if his belly goes out, like a young child breathing. This would indicate that he is taking a diaphragmatic breath, allowing maximum air uptake. Most people do not breathe this way naturally, so you may need to instruct your client on breathing technique. You will want to discourage your clients from overusing the accessory respiratory muscles while breathing. An EMG device can be used to monitor scalenii muscle activation. Teach your clients to take deep diaphragmatic breaths, not activating the scalenii muscles until the final 2/3 of the breath.

Once he begins breathing correctly, have your client take a deep breath and then draw the belly button in. This will activate the TVA and move the viscera up into the diaphragm and down into the pelvic floor, creating a solid non-compressible cylinder. This will allow forces to dissipate through the body and into the ground instead of being placed on the spine. The breath is then released through pursed lips as he goes through the sticking point of a lift.
Forward Flexion Activation Test

PERFORMING THE TEST
1. Place one finger in the umbilicus, and with the other hand, place one finger above and one finger below L3, Figure 29.

2. Ask client to bend forward naturally, as though picking up an object off the floor. You may get better results by having him actually pick something up.

3. Notice any movement that occurs in the abdominal wall.

![Figures 28A and 28B: Forward Flexion Activation](image)

CORRECT ACTIVATION
As the client’s spine/hip angle approaches 45°, you should feel the umbilicus draw inward toward the spine (Figure 28A). In other words, the fingers on the back and abdominals move closer together. When the TVA works correctly, it will always draw the umbilicus inward, as its fibers are located in the transverse plane.

INCORRECT ACTIVATION
Should the umbilicus finger either go forward (Figure 28B), away from the finger located at L3, or maintain its position, you can be assured the transversus abdominis (TVA) is not firing correctly.
FORWARD FLEXION ACTIVATION TEST RESULTS

<table>
<thead>
<tr>
<th>Fingers Move</th>
<th>Closer</th>
<th>Stay the Same</th>
<th>Farther Apart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client 3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Positive Result** – Client does not pass the test being given, indicating an imbalance may exist that must then be addressed.

**Negative Result** – Client has normal function of the element being tested.

* When using the terms “positive” and “negative” in the medical profession “positive” means you have tested positive for the dysfunction or disease you are testing for, such as HIV positive. It means you tested positive for the disease. If your test results were negative for HIV it means you do not have it. Therefore testing positive for forward flexion activation means you tested positive for the imbalance the test is looking for and the TVA is not activating properly. A negative test would indicate there is no sign of the dysfunction and the TVA is firing properly.
Transversus Abdominis Strength Test

PERFORMING THE TEST
1. Lie prone on the floor, with a blood pressure cuff placed under the umbilicus.
2. Inflate the cuff to around 40 mm Hg. (Note: Richardson and Jull recommend inflating the cuff to 70 mm Hg, but Paul Chek prefers using 40 mm Hg as he has found it is more comfortable for the client.)
3. With the client lying completely relaxed, ask him to draw his umbilicus upward, off the cuff.

NORMAL STRENGTH
The pressure in the cuff should decrease by at least 10 mm Hg.

WEAK TVA
Any pressure drop less than 10 mm Hg will represent the percentage of lost function. If your client can only decompress the cuff 4 mm Hg, it is safe to say that the client has only 40% normal TVA function.

NOTE: When applying the TVA Strength Test, there are a number of cheat mechanisms employed by clients in an attempt to pass the test. Look carefully for the following cheat mechanisms:

• Activating the hip flexors. Identified by increased pressure on the floor with the knees.
• Pressing on the floor with the shoulders to create a cavity under the trunk.
• Rolling to one side of the cuff.
• Flexing or extending the lumbar spine. The spine should always remain in a neutral posture.
• Coming up onto the toes.
TVA STRENGTH TEST RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Starting Pressure</th>
<th>Ending Pressure</th>
<th>Difference in Pressure</th>
<th>Cheating Mechanisms (if any)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client 3</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Deep Abdominal Wall Exercises

A. Prone Tummy Vacuum with Blood Pressure Cuff

PERFORMING THE EXERCISE
1. Perform exactly as when administering the TVA Strength Test.
2. Have the client hold the contraction for ten seconds, relax for ten seconds, and repeat the process ten times for a full set.

PROGRESSIONS

<table>
<thead>
<tr>
<th></th>
<th>Hold</th>
<th>Rest</th>
<th>Reps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>10 sec</td>
<td>10 sec</td>
<td>10</td>
</tr>
<tr>
<td>Level 2</td>
<td>10 sec</td>
<td>5 sec</td>
<td>10</td>
</tr>
<tr>
<td>Level 3</td>
<td>Build up to 120 sec. continuous work</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NOTES
B. Four Point Kneeling Tummy Vacuum

This exercise is especially useful for those clients who are unable to activate the TVA in a prone position; they most likely have sensory motor amnesia of the TVA. In order for them to be able to activate the muscle, the sensory awareness in the muscle must be heightened.

PERFORMING THE EXERCISE

1. Kneel on hands and knees and let the visceral contents rest against the abdominal wall. This will put a pre-stretch on the TVA.

2. Holding neutral spinal alignment, take a deep diaphragmatic breath.

3. Exhale, activate the TVA and draw the umbilicus upward toward the spine, maintaining a neutral spine. Do not flex the spine or posteriorly rotate the pelvis.

4. Hold the umbilicus against the spine for ten seconds. Relax for ten seconds and repeat the process ten times.

5. Progressions are the same as for the Prone Tummy Vacuum.

C. Standing Tummy Vacuum

1. From a bent over row position, with hands resting on knees, breathe deeply, allowing the viscera to drop down onto the abdominal wall.

2. As you exhale, draw the umbilicus toward the spine.

3. Hold the contraction for ten seconds and then relax for ten seconds. Repeat the process ten times.

ADVANCED VERSION

1. The advanced version is performed in the same manner, with the exception that you draw the umbilicus toward one side and then the other.

2. As you get better, try moving the contraction of the deep abdominal wall into as many positions as possible.

Once you have good TVA control, you should begin integrating it into all exercises.
Thoraco-Lumbar Fascia Activation Test

PERFORMING THE TEST

1. Ask client to stand in front of you and raise one hand, as though preparing to push an object forward.

2. Apply pressure to the hand he has held up.

3. Take note of the amount of pressure needed to destabilize the shoulder joint and transverse plane stability of the trunk.

4. Have the client take a deep diaphragmatic breath, hold the breath and draw the umbilicus inward. With the TVA activated, repeat the push test, attempting to destabilize the shoulder and torso again. Record the amount of pressure needed this time for destabilization.

CORRECT ACTIVATION

Activation of the thoraco-lumbar fascia mechanism through proper activation of the TVA should significantly add to the stability of the shoulder joint and transverse plane of the trunk.

NOTE: If the person you are testing is very large and/or very strong and you are a small person, have the client stand on the leg opposite the hand he chooses to put forward (as in Figure 32). This will destabilize him enough to magnify the test results and not over-work the tester. If the client is still too strong, have him stand on the same leg as the hand he chooses to put forward, or simply instruct him to stand on “the right leg and raise the right hand.” This will destabilize the body to a greater degree, making it even easier for the tester to overcome the client’s stabilization threshold.

RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Approximate lbs. of Pressure: Natural</th>
<th>Approximate lbs. of Pressure: TVA Activation</th>
<th>Stance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client 3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 32: Thoraco-Lumbar Fascia Activation Test
Oblique Muscle Balance Test

PERFORMING THE TEST
1. With the client side-lying over a Swiss ball, ask him to side flex his trunk.
2. Pay attention to his ability (or lack of) to maintain a pure frontal plane movement.

CORRECT ACTIVATION
The client should be able to side flex and stay in the frontal plane, without rotating and flexing or extending the spine.

INCORRECT ACTIVATION
Inability to maintain frontal plane alignment will often be the result of muscle imbalance between the internal and external oblique musculature. This is often a neuromuscular recruitment problem and can be fixed by proper cueing. Should your client be suffering from a work or sport-specific muscle imbalance, you will need to modify his exercise program, putting emphasis on the muscles that have weakened.

ASSESSMENT TIP
An imbalance between the internal and external oblique muscles can often be found in workers who predominately work in jobs requiring one-sided rotation, i.e. supermarket check-out clerks.

<table>
<thead>
<tr>
<th></th>
<th>Rotation/ Flexion</th>
<th>Rotation/ Extension</th>
<th>Stays in Frontal Plane</th>
<th>Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Client 3</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Lower Abdominal Strength Test

Most individuals begin strengthening their lower abdominals with exercises that are too demanding and require complex movement patterns that they cannot perform. As a result, they end up primarily exercising the iliopsoas. It is important to assess strength and coordination of the lower abdominals in order to start at the appropriate level of conditioning.

THE TEST
1. Lay the client supine and place your hand under her back at the level of L3 (the umbilicus).

2. With the legs held perpendicular to the floor, ask your client to produce firm pressure on your fingers and maintain the same amount of pressure throughout the test.

3. The client slowly and steadily lowers her legs.

4. Stop the test at the point where the spine begins to rise off your fingers.

NORMAL STRENGTH
See Figure 10. Most therapists assess normal lower abdominal strength for adult males as 100%, adult females as 80%, and adolescents as 70-80%. Females tend to have a higher percentage of body weight located in their lower body, hence the lower test requirement. However, they still have to use their lower abdominals to stabilize their own legs, so a more useful test outcome would be 100% for males and females.

<table>
<thead>
<tr>
<th>Degrees Reached</th>
<th>Client 1</th>
<th>Client 2</th>
<th>Client 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Normal Strength</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lower Abdominal Coordination Test

Coordination of the lower abdominals must be assessed to assure proper neuromuscular development. If you do not have the coordination to exercise with perfect form, those exercises will cause poor neuromuscular motor patterning and become the genesis of a cumulative trauma disorder.

The coordination test is similar to the strength test, except the knees are relaxed (bent). This significantly reduces the load that the abdominals have to stabilize and turns the test from a strength requirement to one of neuromuscular coordination.

PERFORMING THE TEST
1. Starting position is the same as the lower abdominal strength test, except the knees are fully bent.
2. The test is initiated with the command “flatten your back against my fingers and hold the pressure as you lower your legs.”
3. Once again you are feeling for the moment the spine begins to move off the fingers.

NORMAL COORDINATION
The legs will lower all the way to the floor, maintaining constant pressure on your fingers.

POOR COORDINATION
If the spine arches before the feet touch the floor, it indicates that the lower abdominals cannot stabilize the lumbar spine and pelvis (against the pull of the iliopsoas and rectus femoris). Failure may not be from a lack of strength, but from the message not getting to the lower abdominals because it is being overridden by the psoas. Failure may also be from emphasizing sit-ups with one’s feet anchored. Unfortunately, the process of facilitating the psoas begins in grade school and is further promoted in the military and college.
Trunk Stabilization Testing

Today, more than ever, we virtually swim in controversy regarding abdominal wall function. The abdominal musculature plays a major role in spine stabilization and thus prevention of spine injury.

Now that you know how the stabilizer mechanisms work and have several techniques for improving their function, we need to know why testing the stabilization threshold is necessary and how to do it.

Why Should You Test Stabilization Threshold?

The ability to stabilize one's spine against both intrinsic and extrinsic forces will determine how fast the spine wears out and the likelihood of injury at times of unexpected or traumatic loading.

With the tests outlined in this section, the exercise and/or healthcare professional can effectively determine the level of stabilization at the present moment and the current level of ability or skill the client possesses with regard to protecting their vital structures from injury. The tests outlined below are best done at initial evaluation to determine current levels of stability. The tests should be re-administered every 2-4 weeks, depending on time availability and degree of motivation for correcting the deficit(s).

Focus on the tests most relevant to the client’s condition, position of injury and specific needs.

Using a piece of string as a biofeedback mechanism

At the C.H.E.K Institute, we have found that using a piece of string as a biofeedback mechanism is very useful for both our clients and practitioners. You may use any type of string, or a shoelace, something soft is best. Tie the string around your client’s waist so that it is loose with TVA activation, but will feel tight when the rectus abdominis is activated instead.
A. Forward Ball Roll Test

PERFORMING THE TEST
1. Kneel behind a Swiss ball and place your hands on top of the ball.
2. Maintaining a neutral lumbar curve, activate the TVA and roll forward with the ball.
3. Stop and return to the starting position as soon as loss of correct spinal position occurs.

Key Points:
As the forward ball roll is initiated, the administrator should pay careful attention to the point at which the following events take place:

- Loss of neutral spinal position. This may occur in two ways:
  - The point at which the lumbar spine (being referenced from the L3 spinous process) sheers forward, resulting from spinal extension under load by the hip flexors and latissimus dorsi.
  - The point at which the spine is flexed in response to added intrinsic loading.

- Activation of the rectus abdominis

_The later the rectus abdominis fires, the better the function of the deep abdominal wall. If you cannot differentiate the activation of the deep abdominal wall and the activation of the rectus abdominis, deep abdominal wall strength and control are most likely very poor. As strength and coordination improve, the amount of intrinsic load needed to activate the rectus abdominis will be greater, as evidenced by further progression into the exercise._

To record your client’s progress, measure the distance between the knees and the ball at the start of the test and at the point when the rectus abdominis is activated. As your client’s stabilization threshold increases, so will the distance he can roll out on the ball while stabilizing primarily with his TVA.
B. Squat Test

Have your client perform a squat with little or no weight. The sooner the rectus abdominis is activated in terms of extrinsic load, the weaker the stabilizer mechanism. The later the client crosses the stabilization threshold the better. The test can be monitored by viewing or palpating the rectus abdominis. A piece of string may also be used to indicate rectus abdominis activation. If your client can perform a squat using the beginning weight without activating the rectus abdominis as a stabilizer, slowly progress the weight until you find his threshold.

C. Dead Lift Test

Follow the same guidelines as given for the Squat Test above. The sooner the rectus abdominis is activated in terms of extrinsic load, the weaker the stabilizer mechanism. For example, if your client can only deadlift an empty Olympic bar off the blocks before there is rectus activation, the level of stabilization is considerably less than the person who can perform the same lift with an additional 30 kg. load. The later the client crosses the stabilization threshold, the better!
NOTES
D. Overhead Press Test

Of particular importance is the point at which you see either striation of the lumbar multifidus musculature and/or forward shear of the lumbar spine. The later the rectus abdominis fires as a stabilizer, the better. If the client’s stabilizer system is working well, they should be able to lift as heavy a weight as they could possibly move without signs of instability. The test can be quantified by the load applied.

E. Standing Push Test

This test is performed in virtually the same manner as the Thoraco-Lumbar Fascia Activation test found on page 66. The only difference is that now you want to quantify the stabilization threshold via the use of some objective means; a medical grade cable column system works well. Using the same progressions as described for the Thoraco-Lumbar Fascia Activation test, simply quantify the point at which the rectus abdominis is activated in terms of pounds or kilograms load applied to the working extremity and the exact position used. Common cheat mechanisms include pushing off the legs and using the shoulder to apply force.

Variations:
- Split stance
- Ipsilateral stance
- Parallel stance
- Single leg – Contralateral
- Single leg – Ipsilateral
NOTES
F. Standing Pull Test

This test is similar to the Standing Push Test, using a medical grade cable column system. Quantify the point at which the rectus abdominis is activated in terms of pounds or kilograms load applied to the working extremity and the exact position used.

Variations:
- Split stance
- Ipsilateral stance
- Parallel stance
- Single leg-Contralateral
- Single leg – Ipsilateral

G. Swiss Ball Four Point Multi-Directional Lumbar Stability Test

PERFORMING THE TEST
1. Your client should be positioned with hands on the Swiss ball, knees on a weight training bench and spine horizontal. Use a Swiss ball, allowing your client to remain as close as possible to a perfect horse stance position.

2. Once in position, the assessor begins moving the Swiss ball in each plane (sagittal, frontal, and transverse), taking note of which plane(s) the client can and cannot stabilize her spine effectively.

3. Once you have identified the planes of weakness, they should be conditioned in the same manner.

The method of quantifying stability will have to be subjective, unless you have a hand-held dynamometer. It is best to compare one side against the other in most cases.
**Janda’s Upper Abdominal Strength Test**

**PERFORMING THE TEST**

1. Ask the client to lie supine with her knees bent to 15° and the balls of her feet resting in the assessor’s fingertips. The ankles should be plantar flexed (toes pointed).

2. Ask the client to keep constant pressure on your fingertips as she performs a trunk curl (lift shoulders 2-3 cm. off the floor).

3. A positive test result is when the client cannot keep pressure on your hands and her feet lift up.

**TEST RESULTS**

- The test is graded as follows:
  - Completion of full spinal flexion with arms outstretched = 60% normal strength
  - With arms across chest = 80% normal strength
  - With fingertips touching mastoid processes = 100% or normal strength

<table>
<thead>
<tr>
<th>Normal Strength (Check all that apply)</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
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<tbody>
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<td>Client 3</td>
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</table>
Lumbar Curve – Too Much or Too Little?

Both flat back and sway back postures are being seen more frequently in our society. These postures are more common among sedentary, seated workers than exercise enthusiasts.

The flat back posture is often a compensation for a lumbar disc herniation. The regular exerciser tends to develop adequate strength in the iliopsoas, a muscle that helps maintain a normal lumbar curve. Those with excessive lumbar curvature must avoid exercising the iliopsoas while improving the strength and coordination of the lower abdominals. Those with insufficient lumbar curvature must increase the tone (and often coordination) of the iliopsoas.

Flat back and sway back postures can be identified by standing with your heels, glutes, back and head against a wall. With a normal lumbar curve, your hand should just fit between the wall and your spine. You lack sufficient lumbar curvature if you cannot slide your fingers and palm between the wall and your back. You have excessive curvature if you can slide the hand through behind the back.

*Please note this is a subjective test, as someone with large glutes could show signs of an excessive lumbar curve, when it is simply their glutes pushing them away from the wall.

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![Figure 42: Flat back posture (left) Sway back posture (right)](image)

![Figure 43: Wall Standing Test](image)
Exercise Positioning for Clients with a Flat Back

To prevent postural degeneration and help restore normal lumbar curvature, individuals with a flat or sway back should use a blood pressure cuff or towel roll under their lumbar spine when performing crunch exercises. The towel roll should be about the thickness and width of the palm of the hand when compressed. The legs long and hook lying positions are recommended (as are standard sit-ups) in this case (provided there are no orthopedic contraindications) because the iliopsoas are more active.

**Note:** These exercises should not be used by those with excess lumbar curvature as the condition is likely to worsen, further distorting posture and increasing the potential for back pain.

The Swiss ball crunch with a blood pressure cuff may also be used by someone with a lumbar disc bulge. For someone with a posterior disc bulge, you will want to avoid lumbar flexion, therefore you can use the blood pressure cuff as a feedback mechanism. Start lying over the ball with the blood pressure cuff inflated to about 40 mm Hg and placed under the spine at the level of L3. Begin the crunch as normal. Stop the crunch motion at the point when the dial begins to move, indicating spinal flexion.

### Results of Lumbar Curve Test

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Flat Back</th>
<th>Hyperlordosis</th>
<th>Modifications</th>
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<td>Client 3</td>
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</tbody>
</table>
NOTES
Are You Getting Back Pain When Exercising Your Abdominals?

You might experience back pain while performing abdominal exercises. Here are a few reasons for this:

1. Short, facilitated lumbar erector spinae. This is commonly found concomitant with increased pelvic tilt/lordosis. Stretching the back before and after abdominal exercise often stops the pain.

2. Those with flat back or sway back postures may be suffering from a lumbar flexion syndrome. If so, there is usually pain when bending forward or rising from a forward bent position (like when you brush your teeth). Correction requires professional assessment and a corrective exercise program.

3. A strain of the quadratus lumborum, specifically while using abdominal machines. This requires a consultation with a professional therapist.

4. Poor technique, which is the most common culprit.

5. A pre-existing or prodromal (budding) back injury.

6. A latent disc herniation present, in which case trunk flexion may be pushing the nucleus out onto a nerve root.

Programming Tips

1. Strength of the upper and lower abdominals must be assessed.

2. Coordination must be assessed.

3. Follow this training order for best results.

   a. The lower abdominals should always be trained first. These exercises require maximal coordination and synergistic support of the upper abdominals.

   b. The obliques should be trained next. These exercises also require maximal coordination and the synergistic support of the upper abdominals.

   c. The upper abdominals should be trained last. They involve simple movement patterns and are generally the strongest group in the abdominal region.
4. Train abdominals at the end of a workout to ensure having full functional capacity during the program. You do not want to fatigue the abdominals prior to performing more complex exercises.

5. Use a higher rep range (i.e. 12-30) for corrective phases. A lower rep range (i.e. 8-12) should then be used.


The abdominals are a striated, skeletal muscle group. They are under voluntary control and behave just like any other muscles you work in the gym. Therefore, they require the same work/rest ratio as any other muscle group of this type. Training all regions of the abdominals daily will most likely lead to strains, poor performance and adaptive shortening from repeated excursion of the ribs, increase the workload on the accessory respiratory muscles and encourage poor posture. A daily maintenance program can be implemented only after the desired level of strength is achieved.

An effective abdominal training program always begins with re-establishing coordination (motor control). This is particularly important in the muscles performing lower abdominal functions. Coordination exercises are best performed at low intensity and higher volumes (12-30 reps per set). Neuromuscular exercises may be performed daily, providing the client doesn’t develop post exercise muscle soreness. Post exercise muscle soreness is an indication of protein breakdown in the muscle and indicates the need for more rest in between sessions. If multiple abdominal muscle groups are to be strengthened in one session, the progression should always be from lower to oblique and finally to upper. In general, it is best to only condition one specific region of the abdominal wall per training session. This helps maintain quality and allows greater focus on any given area, which results in greater overall strength development. Careful observation of volume and intensity of movement patterns that heavily utilize the abdominals should also be considered when determining the training dosage of abdominal exercises. For example, a landscaper who swings a pick ax several hours a day is more likely to over-train the abdominals with an added abdominal program than a firefighter on the same program.

A beginner should start with one set to fatigue. When you can complete an abdominal workout with minimal or no soreness, the following day you can add a second set. The same principle should be used to add a third set. The intermediate and advanced level exerciser may work the strength exercises to functional failure (fatigue, not form loss). Because of the abdominal musculature's importance to posture and stabilization of the trunk, failure means stopping just before your form breaks. Because the abdominals are multi-functional, always use a variety of exercises.

There are so many abdominal training gimmicks on the market, you must be careful! The ab roller, for example, is marketed as being easier on the neck. This is a problem. Since the device supports the head, an imbalance is created between the abdominals and the neck. This increases one's risk of cervical injury. The flexor chain (neck flexors and hip flexors) must be properly conditioned for optimal function.
PART IV - CORE CONDITIONING EXERCISES

The exercises in the following section can be seen on the DVD “Scientific Core Conditioning: Abdominal Training”

Lower Abdominal Strength/Coordination Exercises

Lower abdominal exercises LA1, LA2 and LA3 improve coordination, which by itself often improves strength. Muscle strength can improve by 25% simply by improving the nervous system’s recruitment capability. No other abdominal exercises recruiting the iliopsoas should be performed until normal coordination and lower abdominal strength have been achieved. Insufficient coordination and lower abdominal strength are common denominators in postural degeneration and back injury. Please take the time to do these exercises correctly so you can lead by example!

Stay as relaxed as possible when doing any of these coordination exercises.
Concentrate on finesse – do not force anything!

LOWER ABDOMINAL #1 (LA1)

1. Lie flat on your back, on a firm surface.

2. Perform the exercise by activating the TVA and rolling your pelvis backward, slightly flattening your back against the floor and creating pressure on your fingers.

3. While maintaining pelvic stabilization, breathe deeply through your belly as you hold your back flat against the floor. This requires you to contract the external obliques while simultaneously relaxing the rectus abdominis.

4. Hold pressure against the floor for ten seconds. The pressure should be enough to feel, but you do not need to push full-force.

5. Relax and repeat.

6. Perform this exercise for up to two minutes, as many as six times per day.
LOWER ABDOMINAL #2 (LA2)

1. Lie on your back with your knees bent and feet flat on the floor. If the floor is not firm where you’re lying, place your hands under your low back so you can feel your spine.

2. Now raise one leg up until the knee is pointing to the ceiling (lower leg relaxed). Roll your pelvis back until you feel your low back lightly pressing on your fingers.

3. From this starting position, lower the leg to the floor without arching your back and releasing the pressure.

4. If your back begins to arch, stop and return the leg to the starting position.

5. Repeat the exercise for the other side.

6. Always use good breathing technique and keep your neck relaxed as you perform this exercise.

7. This exercise should be performed two minutes at a time, up to six times per day.

ADVANCED VERSION

When you can raise and lower your leg and maintain a constant pressure on your fingers, increase the difficulty by opening the angle at the knee.

USING A BLOOD PRESSURE CUFF
Ref: Richardson and Jull and modified by Paul Chek

All the lower abdominal exercises can be performed with a blood pressure cuff placed under the back at the L3 level. This is a useful feedback tool that ensures the exercise is done correctly.

- Inflate the cuff to provide a firm lumbar support, usually around 40 mmHg.
- Increase the pressure by 30 mmHg by activating the TVA, drawing the belly button towards the spine.
- Maintain this pressure while performing the exercise. The needle should not vary by more than +/- 5 mmHg.
LOWER ABDOMINAL #2B (LA2B)

1. Start in the same position as with LA#2, except this time lift both feet off the floor so that the knees are pointing to the ceiling.

2. Lower one foot to the ground, maintaining constant pressure of the spine on the floor.

3. Raise leg to starting position and repeat with the other leg.

LOWER ABDOMINAL #2B STANDING (LA2B STANDING)

1. Stand against an upright support or a wall near a corner on one leg with good posture.

2. Activate your TVA and press your spine against the upright.

3. Holding the pressure constant, move the free leg forwards and backwards. Ensure the spine does not flex or extend as the leg moves.
NOTES
LOWER ABDOMINAL #3 (LA3)

This is similar to the previous exercise, except it is performed with both legs at the same time. It is also the coordination test. Normal coordination between the psoas and abs allows you to hold your back flat against the floor (or your fingers) while simultaneously lowering your feet.

ADVANCED VERSION #1

Progressively extend your legs. This modification makes the exercise more difficult by increasing the length of the lever arm (and thus the load counterbalanced by the lower abdomen).

ADVANCED VERSION#2
STRAIGHT LEG LOWERING

Final progression is the point where you can pass the lower abdominal strength test. As shown here, the strength test position is also an effective strength and coordination exercise. When you can perform 30 continuous reps, you are ready to begin a maintenance program. This is also a good time to progress to the more vigorous exercises, such as the reverse crunch on incline or the hanging reverse crunch.
LOWER ABDOMINAL #4 (LA4)

1. Lie on your back, point your knees to the ceiling and flex your hips to 90 degrees.

2. Pretend your knees have strings that connect them to the ceiling. Roll your pelvis back, flattening your spine and pretend the strings are being pulled as if you were part of a puppet.

3. Try to lift your knees 1-2 cm, allowing only vertical movement of the thighs.

4. Keep your neck relaxed and belly breathe. It’s not as easy as it looks!
REVERSE CRUNCH ON BENCH

The reverse crunch places the initial load on the lower abdominals as the pelvis rotates posteriorly. The start position requires you to flex your hips until your back begins to flatten; this has an inhibitory effect on the psoas. Your arms should be placed above your head for balance. Begin by rolling the pelvis backward (posteriorly) like a wheel until the abdominal muscles are fully contracted – no further. Don’t move your legs past the point of full abdominal contraction as this strains the neck.

After about ten degrees of posterior rotation, the load is progressively transferred upward through the abdominal muscles.

NOTE: The knees to shoulder technique cannot be used as a reference point because people have different torso lengths.

SWISS BALL REVERSE CRUNCH

Position your back over the ball, sacrum and scapula touching the ball. Hold onto a solid support. Curl legs up, until abs are completely contracted. Release slowly to start position. The exercise is made more challenging by moving the pelvis further down the side of the ball, i.e. moving from on top of the ball to a more inclined position.

Variations

- Two hand – two beam hold
- Two hand – single beam hold
- Single hand hold – alternating single arm hold
Oblique Exercises

WOOD CHOP EXERCISE VARIATIONS

Grab the handle with the outside hand and place the other hand on top. Draw the bellybutton inward and face forward. Keeping the arms fairly straight, pull the cable diagonally across the body. The movement should finish with the hands just outside the furthest foot.

- Seated on bench - Isolation
- Seated on Swiss Ball - Isolation
- Kneeling – fixed pelvis - Isolation
- Standing – fixed pelvis - Isolation
- Seated on Swiss Ball - Integration
- Standing - Integration
- Kneeling on Swiss ball - Integration/Stabilization/Nervous system training

![Figure 56: Seated Wood Chop](image1)
![Figure 57: Standing Wood Chop with Integration](image2)
MEDICINE BALL WASHING MACHINE

This exercise trains high-speed rotational movement in the torso. Stand with your knees bent about 15°. Draw in your belly button and start by slowly rotating your torso from side to side. Progressively increase your speed and stop the exercise as soon as your speed begins to drop off.

Variations:

- Parallel stance
- Split stance
- Alternating legs during movement

Figure 58: The Washing Machine
RUSSIAN TWIST EXERCISE VARIATIONS

A. Lower Body
Lie in a supine position with your legs raised perpendicular to the floor. Rotate the legs to each side, keeping a 90° angle at the hips and trunk. You may hold the inside leg to control the movement. Being able to rest the thigh and opposite shoulder on the ground is considered normal range of motion for this exercise.

Variations:
• No weight added, legs on Swiss ball
• Weight added between knees, legs on Swiss ball
• Straight legged
• Straight legged with weight added between knees or feet

B. Swiss Ball Upper Body Russian Twist
From a sitting position on a Swiss ball, roll down so that your shoulders rest on the middle of the ball. Keep your pelvis up and the tongue on the roof of the mouth. Grasp your hands together and raise the arms so that they are perpendicular to your torso. Start off by slowly rotating your trunk to each side, gradually increasing the speed. Make sure to keep good form throughout.

Variations:
• No weight added
• Weight added
TWISTER

Place a small medicine ball between your knees. Rotate your torso and lower body in opposite directions as you go down into a squat. Once you have learned the movement pattern, increase your speed. Stop the exercise as soon as your speed starts to decrease.

Figure 62: Twister

CABLE CRUNCH WITH FLEXION AND ROTATION

Line a bench up at a 45° angle with the cable. Sit on the bench and place the handle over one shoulder. Flex and rotate your torso to the opposite side that the cable is over.

Figure 63: Cable Crunch with Flexion and Rotation
**DUMBBELL SIDE FLEXION**

Hold a dumbbell in one hand. Side flex to the side holding the weight. Make sure to stay in the frontal plane, without rotating and flexing or extending the spine. If you feel a pinching sensation, slightly rotate the spine forward to decompress the facet joints.

**STANDING CABLE SIDE FLEXION**

This exercise is similar to the Dumbbell Side Flexion, but performed with cable resistance.
CROSS CRUNCH WITH PELVIC COUNTER ROTATION

This advanced oblique exercise requires extensive rotation in the low back. Those who currently have, or have had, back problems should avoid it.

Begin with the hips flexed to the point at which your low back just touches the floor. Allow the pelvis and legs to rotate until the legs rest on the floor, but do not change the hip angle. Begin by rotating the pelvis and legs toward neutral (vertical) while simultaneously performing a cross crunch (or bringing the opposite elbow toward the knees). This exercise is best performed to fatigue on one side and then the other.

WARNING: Those with an injury to a spinal disc should get medical clearance before attempting advanced oblique exercises. Torso rotation may encourage radial tearing of the annular rings of the disc, as shown in Figure 67. Although the risk is minimized when lying horizontal, due to reduced intra-discal pressures, any axial loading with rotation presents a substantial risk factor. Many of the seated torso rotation machines fall into this category.
SWISS BALL SIDE FLEXION

The side sit-up requires simultaneous contraction of the internal and external obliques, as well as the quadratus lumborum. The quadratus lumborum is often involved in a variety of different back conditions. If this muscle is exercised excessively, or in the presence of even a mild back condition, it can be the genesis of substantial back pain. When in spasm, the quadratus lumborum frequently creates a leg length discrepancy that increases musculoskeletal imbalance. Although this is an effective strengthening exercise for the obliques, the exercise specialist should carefully screen clients before exposing them to this exercise.

Lie sideways across a Swiss ball, feet apart on the floor to balance. Side flex up, maintaining the movement in the frontal plane, as in the Oblique Muscle Balance Test.

Progressions:

- Static holding for frontal plane postural endurance
- Dynamic
  - Arms at side
  - Arms across chest
  - Finger-tips to mastoid processes
  - Arms in the air
  - Added weight
Upper Abdominal Exercises

SWISS BALL CRUNCH

Lie supine over the Swiss ball, head resting back on ball. Ensure the tongue is in the physiological rest position. Curl up from the head, one vertebrae at time until the rectus abdominis is fully contracted. Slowly reverse the curl, ending with the neck and head.

Progressions:

• Arms out
• Arms across chest
• Arms above head
• Weighted

**CAUTION:** Ask your client if they get dizzy or nauseous when looking up at airplanes flying by, or when reaching for things from an overhead cupboard. If they do, be cautious about extending their head back on the Swiss Ball, as they may have a vertebral arterial occlusion, which could lead to a stroke if the blood supply to the brain is compromised. Refer the client to an orthopedic physical therapist for evaluation.

SWISS BALL CRUNCH WITH LENGTH/FORCE ALTERATIONS

This exercise is performed as the Swiss Ball Crunch above, except the feet are raised and the body moves further over the ball. As the feet are progressively elevated, the point of maximum loading is progressively lower in the abdominal musculature.
CABLE CRUNCH OPTIONS

Place a Swiss ball between the cable column and your spine. The apex of the ball should be against your lumbar spine. Start with your torso extended against the ball and flex the trunk one vertebrae at a time, as you did with the crunch on a Swiss ball. Extend, attain one vertebrae at a time, until you reach the starting position.

Variations:

• Swiss ball supported
• Standard cable crunch from knees

FULL TRUNK FLEXION – CABLE COLUMN RESISTED

This exercise is performed as above, except standing with the cable held over the head. Start in a fully upright position and flex the trunk one vertebrae at a time. Extend, again one vertebrae at a time, until you reach the starting position.

STRAIGHT ARM LATERAL PULL DOWN

With this exercise, the abdominals must stabilize the force generated against the lats. Draw your belly button in and keep a neutral spine as you stand in front of the lateral pull down. With your arms out straight, slowly lower the weight.
PART V - BACK AND BALL TRAINING

Exercises from this section can be seen on the “Scientific Core Conditioning: Back and Ball Training” DVD.

Back Extension Exercises

BACK EXTENSIONS

To best strengthen the extensor chain, position the hipbones level with the end of the pad. With arms across chest, extend the torso until the body is parallel with the floor by activating the hamstrings, gluteals and back muscles.

Progressions:

During the previous exercise, maximum loading occurs when the torso is parallel to the floor and the muscles are shortened. This is not the best time to load a muscle, as the actin and myosin filaments are not as strong when they are fully contracted. To change the maximum loading zone, hold onto a medicine ball or weight plate. Start off by bringing the weight to the chest. Slowly extend the weight out while lowering the torso to the starting position. Bring the weight back towards the chest while extending the torso. This technique will give the maximum muscle load at its mid-range and provide a more even load throughout the exercise.
REVERSE HYPEREXTENSIONS

Reverse hyperextension exercises reverse the recruitment pattern used in the back extension exercises. Instead of loading the extensor chain with the weight of the torso (about 60% of one’s body weight), you will now be loading with the weight of the legs (either one or both).

Progressions:

- Knees bent-alternating legs
  - This will isolate the glutes more than in the back extension exercises.
- Legs straight-alternating legs
- Both legs
- Add weight (i.e. a medicine ball or dumbbell between the feet)

Figure 75: Reverse Hyperextensions
Swiss Ball Core Exercises

REVERSE WOOD CHOP

Performed as the Wood Chop, but from the lower position to the upper position, working the extensor/rotation pattern. Be sure to extend the thoracic spine.

Variations:

- Seated on bench – Isolation
- Seated on Swiss ball – Isolation
- Kneeling-fixed pelvis – Isolation
- Standing-fixed pelvis – Isolation
- Standing – Integration
- Kneeling on Swiss ball – Integration/Neural

To test your client’s thoracic extension, have him raise his arms above his head. If his thoracic extension is limited, he will not be able to fully raise his arms. The Reverse Wood Chop should not be performed by anyone who is unable to extend his or her thoracic spine, as it can lead to shoulder injury.
PRONE BALL ROLL

Technique Cues:
- Start on the knees and place the sternum on the apex of the Swiss ball.
- Wrap the arms around the ball.
- Slowly roll from side to side, taking care not to trap the fingers under the ball.
- Hold the end position. As you gain more strength and stability, roll further out.
- Tempo: 212 for stabilization, 101 for strength, moving to XOX for power development.

Progressions:
1. Perform the exercise from your toes.
2. Lift one foot off the floor as you roll.

Benefits:
- Improves balance, coordination, core stability and strength
- Improves power when performed at a fast tempo
- Works the anterior oblique sling system

Variations:
- From knees
- On toes
SUPINE LATERAL BALL ROLL

Technique Cues:

- Place the middle back between the shoulder blades, on the top of the ball and relax the head on the ball.
- Elevate hips until the torso is flat and the knees are directly over the ankles.
- With the tongue on the roof of the mouth, the arms held straight out from the shoulders and the palms facing up, slowly roll laterally. Allowing your feet to move with the body as you roll, yet always keep the hips in line with the knees and shoulders.
- Arms and hips should be kept parallel to floor; do not allow the shoulder or hip to drop as they move away from the ball. A wooden dowel rod placed across the shoulders or hips is a useful cueing tool. Do not flex the neck.
- Only go as far as you can with correct form and hold for one second. Return and roll out to the other side.
- Tempo - 212. For stabilizer training use a 10 count, with 10 reps on each side. The intensity will need to be kept around 40%, with just a small movement.

Progressions:
1. Roll further across the ball, so head and shoulder are unsupported.
2. Hold for a count of three at end of movement on each side.

Benefits:
- This exercise is one of Paul Chek’s “Big Bang” exercises. It conditions in all planes, as you must concurrently stabilize the neck, shoulder girdle and torso.
- Since so many muscles are working at once, this exercise is a big calorie burner.

Big Bang Exercise - Exercises that require force generation in multiple planes of movement and also challenge multiple biomotor abilities (such as balance, coordination, strength and power) at the same time. Examples are the Forward Ball Roll with one arm, the Supine Lateral Ball Roll and the Supine Hip Extension with Knee Flexion on one leg.
SUPINE HIP EXTENSION: FEET ON BALL

Technique Cues:

• Lie supine with calves on the ball. Arms are held perpendicular to torso, with palms facing upward to properly activate the shoulder musculature.
• Gently draw the belly button towards the spine to activate the Transversus Abdominis and avoid over extending the spine.
• Extend the hips towards the ceiling until the ankle, hip and shoulder joints are all in a straight line. Ensure that both sides of the gluteals are evenly activated. Avoid extending beyond this point as it may place excessive stress on the cervical spine.
• The feet should stay pointed towards the ceiling during this exercise rather than turning out to the sides.
• Tempo - 333. Three counts up, hold at the top for three counts and slowly lower for three. Come to a complete stop at the bottom before starting another rep.

Modifications:

• For beginners, one leg can be placed on the ball, and the other leg on the floor for stabilization.
• A smaller ball (45cm Swiss ball or basketball) can be used if there is cervical damage or pain.

Progressions:

There are two ways to increase the challenge of this exercise:

a) Change the lever length:
   - Move the ball under the calves (easier)
   - Move the ball under the feet (harder)

b) Change the base of support:
   - Arms out from the shoulders, palms up
   - Arms by the sides, palms up
   - Hands touching body (as shown)
   - Arms across body, completely off floor
   - Use one leg on the ball, and one in the air, but only if you are strong enough to keep the pelvis level.

Benefit:

• Strengthens the extensor chain in an unstable training environment
TORSO TWIST

This exercise starts from the push-up position with the feet on a Swiss ball. Grip the ball with your feet. Keep a neutral spinal position, with the belly button in. Roll the ball laterally, starting off with small movements and progressing to larger ones.
FORWARD BALL ROLL

Technique Cues:

• Kneel in front of the Swiss ball and place the forearms on the ball. There should be a 90° angle at the hip and 90° at the shoulder.
• Draw the belly button inward and roll forward, moving the arms and legs in unison.
• Keep the head in line with the rest of the spine. Hold a neutral lumbar curvature at all times. Do not hyperextend, or flex the spine. Stop before you lose perfect form and the rectus abdominis begins to take over stabilization. Roll back to the starting position, with the arms and legs finishing the movement at the same time.
• Tempo – 202. To increase stabilizer strength, use a 232 tempo and hold perfect form at all times.
• For beginners or those who need more stabilizer conditioning, use a two minute hold. Find a position the client can hold for 30 seconds, then gradually decrease the lever arm as the tire?, bringing the ball gradually closer to the body.

Progressions:
1. Start exercise with the ball closer to the body and the hands lower down on the ball.
2. Start exercise on toes, with body held straight.
3. Try one arm at a time.
4. Use two balls, one under the feet and the other for the arms.

Benefits:
• Integration of pelvis, abdominals, thoracic spine and shoulder girdle
• Can be used to test stabilization threshold (see Paul Chek’s Advanced Swiss Ball Training for Rehabilitation DVDs or Scientific Core Conditioning Correspondence Course)4
• An excellent “Big Bang” exercise especially when using one arm
ALTERNATING SUPERMAN

Technique Cues:

• Lie face down over the Swiss ball. Bend one arm and the opposite leg to 90°.
• Slowly lift the arm, thumbs up and the opposite leg. Keep the upper arm in line with the lower trapezius muscle.
• Keep the shoulder girdle and glutes firm. Maintain activation of Lower Abdominals.
• The head should be in line with the spine. Do not overextend the lumbar spine.
• Start with the weaker side and perform as many reps as possible before the form fails. Then repeat this number on the stronger side.
• Tempo – 212 (a 232 tempo can be used to increase stabilizer muscle stress)

Progressions:

1. Straighten the arm and leg being raised. Bring the arm out to a 45° angle from the head with thumbs up (see Figure 27).

Benefits:

• Strengthens back stabilizers in a cross extensor pattern.
• This exercise is good for someone who has had back surgery. Being on an unstable object, such as a Swiss ball, is equated by the brain as a threatening situation. This can help the brain activate muscles that have been shut off for some time due to past traumas.
THE SUPERMAN

The Superman exercise is performed in much the same manner as the Alternating Superman, but with this more advanced version you lift both arms and both legs up at the same time and balance on the ball.

THE BRIDGE

Start in a push-up position with your feet on a Swiss ball. Keep a neutral spine and with the bellybutton in, raise one arm out to the front. Hold your position with the arm out in front. To progress, move the raised arm around the side until it reaches your back. This is a very challenging exercise, so go slowly and concentrate on keeping good form.
SEATED POSTURE TRAINER

Sit on a properly sized Swiss ball (your thighs should be parallel or slightly above parallel with the ground.) Tip your pelvis slightly forward, maintaining a neutral lordosis in the lumbar spine. Maintain optimal posture – cheekbone over collarbone with chest up.

**Progressions:**

- Have someone push on the ball from different angles
- Pelvic tilts (front to back and side to side)
- Figure eights (front to back and side to side)
- Reduce base of support:
  - Raise one leg at a time
  - Place a medicine ball under one foot and lift the other
  - No feet

KNEELING ON A SWISS BALL

Place your hands on the ball and slowly roll forward, keeping your shins on the ball. Once you feel balanced, let go with your hands and straighten up your posture. Maintain optimal posture as you kneel on the Swiss ball. When you are comfortable kneeling on the ball, begin moving from side to side, front to back, and doing figure eights.
PART VI - CORE POWER TRAINING

Introduction

The high performance core conditioning exercises taught in these programs are designed to challenge advanced-level athletes. We define an athlete as being anyone who faces a physically demanding environment. This includes firefighters, nurses and construction workers as well as those we typically think of as athletes - the sports person. A person who has completed at least one year of continuous conditioning and has excellent core coordination and strength is classified as advanced.

These advanced exercises are not designed for the novice or beginner. You and your client can get hurt performing these exercises if you do not have a solid base of strength and coordination, especially in the core. It is important to assess your client’s core function before designing an exercise program.

Before attempting high performance exercises, it is important to be familiar with basic core conditioning exercises. It is vital that the athlete has already progressed from core isolation exercises to core integration exercises that work the inner and outer units together, as well as the extremities.

When performing high performance core conditioning exercises, the following considerations must be made:

- Increased speed of movement results in increased loading of tissues.
- Eccentric loading is increased when speed of movement increases. This can significantly increase post-exercise soreness.
- Client qualification: has your client achieved adequate conditioning in the stability and strength phases to undertake core power training?
Program Design Considerations

PLANES OF MOTION
The difference between high performance exercises in this course and the common abdominal exercises that many athletes are using today is that the exercises described in this course condition the trunk musculature in all planes of movement. This is very important when you consider that most sports and physically demanding jobs are performed in more than one plane. The very popular crunch, for example, only conditions the core in the sagittal plane and is not effective for training rotational movements. The most dominant plane, the transverse plane, is not commonly trained.

When training on a Swiss ball or wobble board, you have a significantly reduced and highly mobile base of support. Therefore, your body is free to move in all planes of motion. During any exercise using one of these tools, your upper and lower body is always engaged together. This provides a training environment that is much more realistic to the real world, and has a greater carryover to functional activities.

**Sagittal Plane:** A vertical plane through the longitudinal axis of the trunk dividing the body into two portions, right and left.

**Frontal Plane (Coronal Plane):** A plane parallel with the long axis of the body and at right angles to the median sagittal plane dividing the body into front and back portions.

**Transverse Plane:** Plane that divides the body into a top and bottom portion.

SPEED
To obtain the most effective carryover to your work or sports environment, you need to train at a speed close to that in which you need to perform. If a kick-boxer is training his core by doing all exercises at a slow tempo, he is not getting a very effective carryover to his sport. If you need to be quick and explosive, you need to train that way. Tornado Ball and many medicine ball exercises will enable an athlete to train their core at the high speeds needed to optimally benefit their performance.

SURFACE
When designing a conditioning program for your client, take into account the type of surfaces they will be working on. A track athlete, who runs on a flat, even track will have fewer core demands than a skier, who faces unpredictable surfaces. Try challenging your clients who work in more unstable environments with some high performance Swiss ball or wobble board exercises.
Type of Reflexes

**Righting reflexes** are used to keep the body upright any time you move across a stable object, such as a pommel horse in gymnastics, street curb or even when walking across the ground.

**Tilting reflexes** (also called equilibrium reflexes) are used to keep your body upright when atop a moving surface, such as a moving sidewalk at the airport, or a surfboard.

Most gym exercises require the use of righting reflexes, but there are very few situations in traditional gym training environments that develop tilting reflexes. The Fitter, wobble board and Swiss ball are excellent tools to activate tilting reflexes. The Swiss ball can also be used to develop righting reflexes if the exercise only requires that you move across the ball, with the ball being relatively stable. Choose the dominant reflex profile for your client and make sure to include exercises that will address that type of reflex in their training.

**Example of exercises that activate righting reflexes:**
Examples of exercises that activate tilting reflexes:

Figure 94: Fitter™

Figure 92: Medicine ball toss standing on wobble board

Figure 93: Kneeling on a Swiss ball

TOOLS AND IMPLEMENTS
A worker who uses any type of tool, especially power tools, will have a high demand for good core control. This is also true for an athlete, such as a discus or hammer thrower. These objects create centripetal rotational forces that must be counterbalanced by the trunk.

CLOTHING AND PADDING
Many people perform their jobs or sports with heavy or bulky clothing or pads. Excess baggage is another variable that increases the demand on the core.

VISION
A decrease in vision requires increased abdominal activation. Examples include smoke, fog or mist, darkness, driving rain or snow.
IMPACT
The higher the velocity and higher the amplitude, the more demand is placed on the core to protect the spine and extremities.

| High velocity/low amplitude: boxer’s punch |
| High velocity/high amplitude: hit in hockey or rugby |

CLIENT ABILITY
Some individuals are genetically more athletically inclined and will likely progress quickly. Qualify your client’s ability and be aware of this as he progresses to more advanced exercises.

PREVIOUS INJURY
A client, who has had a past spinal injury, or any injury that impaired proprioception or movement ability, must be advanced carefully. If you do not understand a particular injury, make sure to consult a professional before taking any questionable steps with your client.

EXERCISE ORDER
As with other core exercises, do not perform high performance core exercises at the beginning of a program that includes heavy lifting. You do not want to exhaust your stabilizing system prior to heavy lifting. Many of these exercises are very demanding on the nervous system. It may be appropriate to have the client perform the high performance exercises at the beginning of their program if the other exercises are less demanding.

FREQUENCY
Give your body time to recover from advanced exercises. If you perform these high performance exercises without adequate rest, you will be increasing your chance of injury, fatigue and motor control problems. Cycle the exercises, emphasizing different planes on different days.

KEY REMINDERS ON FORM
It is very important to follow the form principle while doing high performance exercises. Stop any exercise before your form breaks down to reduce the risk of injury and to avoid faulty motor programming.

• Hold good spinal alignment.
• Activate the Transversus Abdominis (TVA) by drawing your bellybutton inward towards your spine.
• If the exercise is being performed at a fast or explosive tempo, stop before you slow down.
Core Power Training Exercises

FITTER™ EXERCISES

While performing the Fitter™ exercises, remember the following key points:

- Activate the deep abdominal wall by drawing the belly button inward.
- Keep a neutral spinal alignment, do not allow the spine to over-extend or flex.
- Stop the exercise before you lose your form.

Variations:

- Prone transverse plane – upper body
  - Feet on the floor
  - Feet on a Swiss ball
  - Feet on a Swiss ball with counter rotation
- Prone sagittal plane – upper body
- Combine transverse and sagittal plane movement
- Standing lateral – frontal plane (Fig. 95)
  - With or without external support
  - Increase speed
- Standing front to back – sagittal plane (Fig. 96)
- Different angles
- One leg
Chop Patterns

A. EXPLOSIVE WOOD CHOP

The explosive wood chop is performed with the same form as an integrated wood chop exercise. Hold the ball with both hands, draw your belly button inward and face forward. Keeping your arms fairly straight, start with the ball on a high diagonal furthest away from the rebounder and throw the ball with a chopping motion. The movement should finish with the hands just outside the furthest foot. You will start off with 70% of your weight on the inside leg and shift to 70% on the outside leg. In the power chase you will be using an explosive tempo.

Variations:

- Cable
- Medicine ball

B. EXPLOSIVE REVERSE WOOD CHOP

The explosive reverse wood chop is performed in a similar manner as the wood chop, but from the lower position to the upper position, working the extensor/rotation pattern. Be sure to extend the thoracic spine. If you are using a medicine ball you can let go of the ball and toss it to a partner. Remember, do not sacrifice your form.

Variations:

- Cable
- Medicine ball
C. POWER BALL/TORNADO BALL EXERCISES

These exercises use a Power Ball or Tornado Ball, which is a medicine ball on a rope. These exercises are very demanding on the core musculature. Always start off with a warm-up set. If you are new to these types of exercises, start off with a lighter ball, such as one weighing 1 kg. Progress up to the larger 2 or 3 kg. balls.

Variations:

• Kneeling chop
• Supine position
  - Sagittal plane chop
  - Lateral chop
  - V chop
  - Multi-directional chop

• Against wall
  - Sagittal plane chop
  - Lateral chop
  - V chop
  - Multi-directional chop
Swiss Ball Arch to Bridge to Pike

Place your feet on the Swiss ball in a push-up position with the shoulders, hips and ankles in the same horizontal plane. Allow the body to sag in the middle until full spinal extension is reached. To return to the bridge position, draw the umbilicus inward and actively tilt the pelvis posteriorly, as you assume a bridge position with perfect spinal alignment. After holding the bridge position for a few seconds, flex your hips and go up into a pike position.

Variations:

- Alternate legs
- 2 Swiss balls

Prone Ball Roll

Place your sternum on the apex of the Swiss ball and wrap your arms round the ball. The high performance version of this exercise is performed from the toes rather than from the knees. Start off with a warm-up set by slowly rolling from side to side and holding your end position. As you warm into the exercise, challenge your balance barrier further on each side. This can be done by lifting one foot off the ground that will allow you to roll farther to each side. If you want a real challenge, you can hop from foot to foot as you rotate on the ball. Remember to always keep good form and don’t let your back arch!
Swiss Ball Drop and Recover

Start off in a supine position. Roll across the ball and let one side drop down, so that your forearm touches the ground. Explode upward raising your arm straight up. This is an explosive exercise; so as soon as you feel your speed drop off, stop the exercise and rest.

Variations:

• Hold onto a light dumbbell for extra resistance
• Combine the rotation with a push by going up onto your elbow

Swiss Ball Inverted Bar Pull

Hold onto a bar, secured in a rack, and place your feet on a Swiss ball. Pull up explosively and lower yourself slowly.

Variations:

• Alternate legs
• Single arm with a push
Swiss Ball Frog Kick

Start off in a prone position with each foot on a Swiss ball and the hands under the shoulders. The back and head should be in neutral alignment. Activate the deep abdominal wall and draw the legs under the body. Keep the hips as low as possible and hold your spine in neutral for as long as you can. The back may flex slightly as the legs are drawn fully in. Next kick the legs out in a semicircle, like you would when doing the breast stroke in swimming. The legs should go to a wide V-position while the spine should remain in neutral. Close the legs and repeat.

Variations:

- One leg at a time
- Both legs together
- Single leg, 1 ball

Swiss Ball Squat

This advanced exercise should only be done once you are very confident kneeling and standing on a Swiss ball. To start, you may want to hold onto a stable object, such as a doorway, while performing a squat on the ball.
Explosive Oblique Toss – Push Pass Combo

Stand in an upright position with your knees slightly bent. Make sure not to round your back as you catch or throw the medicine ball. Pass the ball to just in front of your partner. When catching the ball, absorb the weight and toss it back to your partner. After five oblique tosses, switch to the chest pass for five reps. Then change to the other side and do five more oblique tosses.

Unhooked Sit-up Pass

Sit facing your partner with the bottom of your feet just touching. Begin lying down with a medicine ball behind your head. Explode up as you toss the ball to your partner. Keep your tongue on the roof of your mouth and do not let the legs rise off the ground.
Explosive Leg Toss

**NOTE:** As a prerequisite for this exercise, you must have normal lower abdominal strength and coordination. See the “Assessing Core Function” Sections on pages 50-90 of this correspondence course for details on these tests.

Lie supine on the ground and grab onto the back of your partner’s feet/ankles. As the partner pushes your feet towards the ground, make sure not to let your back rise up from the ground. To increase the difficulty, have your partner increase the force on the feet. To emphasize the obliques, have your partner(s) toss your legs to each side. If you have two partners for this exercise, make sure that they are using equal force.

**Variations:**

- No weight added
- Weighted
- Two partner oblique toss
- Increase speed

Jump Kick Pass

To warm up for this exercise, do a series of jumps and tuck jumps. Place a medicine ball between your feet. As you jump up, extend your feet outwards and toss the ball forward. You may bring the knees up and then extend, or you may complete the pass from a piked position.
**Weighted Swiss Ball Crunch**

The Weighted Swiss Ball Crunch is a very advanced exercise requiring significant core strength. Always use a spotter and complete a thorough warm-up when performing this exercise. Use dumbbells that equal the weight you are using to anchor your feet. Lie over a Swiss ball so that your sacrum and head comfortably touch the ball. Arch your back as you roll the weight onto your chest to keep the ball from shooting out behind you. Keep your tongue on the roof of your mouth and do not protrude your head forward. Curl up from the head, one vertebra at a time, until the rectus abdominis is fully contracted. Slowly reverse the curl, ending with the head and neck. To advance the exercise, have your partner load you eccentrically and then explode through the concentric contraction.

![Figure 110: Weighted Swiss Ball Crunch](image1)

**Swiss Ball Chop with Dumbbell**

Lie supine on a Swiss ball with the head and pelvis in contact with the ball. Place the tongue on the roof of the mouth behind the front teeth. Hold the dumbbell over your head and as you crunch up, bring the weight down to between your legs. Your head, neck and shoulder girdle should move as a unit.

For the cross chop, the weight should end at the outside of the leg you are rotating towards. The head and neck can rotate together with the torso during the cross chop. The exercise is completed when the oblique muscles are fully contracted, not necessarily when the elbow touches the opposite knee (as often taught). This exercise can be performed by alternating sides or by fatiguing one side and then the other.

![Figure 111: Swiss Ball Cross Crunch with Dumbbell](image2)
Swiss Ball – Medicine Ball Toss

This exercise will help condition the abdominal wall and the shoulders. Perform a crunch over the Swiss ball with a medicine ball held above your head. As you sit up, toss the ball to your partner or a rebounder. Your toss should be high enough that your partner can catch it, extend over the ball in a fluid motion and toss the ball back to you.

Figure 112: Swiss Ball – Medicine Ball Toss

Russian Twist Toss

From a sitting position on a Swiss ball, roll down so that your shoulders rest on the middle of the ball. Keep your pelvis up and your tongue on the roof of your mouth. Grasp your hands together and raise your arms so that they are perpendicular to your torso. Perform a warm-up set by slowly rotating your trunk to each side, gradually increasing the speed. Now you can incorporate a toss with a medicine ball. Let go of the ball when your arms are about parallel to the ground. Toss the ball to your partner so that they do not need to adjust their position too much as they catch it. Keep your hips up throughout the exercise.

Figure 113: Russian Twist Toss
Kneeling Swiss Ball – Medicine Ball Oblique Toss

If you are confident kneeling on a Swiss ball, try doing an oblique toss with a medicine ball. Use a light medicine ball to start with, as this is a fairly challenging exercise. You will notice that you will be constantly checking your balance, since tossing and catching the ball will continually change your center of gravity.

Squat Push Press

Once you have mastered squatting on a Swiss ball, try doing a squat push press while on the ball. Hold onto a medicine ball and as you rise up from the squat, press the ball over your head. Your arm and leg movement should be synchronized.
Soccer Toss

Stand facing your partner or a rebounder. Most of the force should be coming from your abdominals, not the arms. Draw the belly button inward and flex your trunk as you would when doing a crunch. As you contract the abdominals, toss the ball in an arc to your partner or the rebounder.

**Variations:**

- Parallel stance
- Split stance
- Balance or Wobble Board
- Swiss ball
Hanging Leg Raise

The hanging reverse crunch should only be attempted once the athlete has achieved 100% lower abdominal strength and can successfully perform a reverse crunch on a horizontal surface and an incline. Performed with proper technique, inertia from throwing the legs is eliminated and the abdominals are isolated. Performed with poor technique, this exercise is often harmful to the lower back.

The start position is with the legs flexed at the hip until the curve begins to come out of the low back (as determined by a spotter). This discourages contraction of the psoas through a poor length/tension relationship. Locking the hips in this position, rotate the pelvis backward like a wheel (which can only be done by using the lower abdominals) until the abdominals are fully contracted. For those with a flat back, this exercise can be performed with the legs in a full hang start position. This encourages psoas recruitment, which helps restore lumbar curvature. Coordination exercises must still be performed on a weekly basis to prevent loss of previously developed functional motor patterns.

Progressions:

- Isolation
- Pike with medicine ball
- Lift and rotate left then right, engaging obliques
Bi-Lateral Push

Line the cables up with your shoulders. Keep the trunk vertical as you perform the push. This requires the abdominals to be the key stabilizers of the trunk. The inner abdominal wall should activate prior to any extremity movement. The hip flexors and knee extensors of the trail leg are also being trained with this exercise. Switch your stance so that you are doing an even number of reps in each stance.

To destabilize this exercise, you can stand on a skateboard while performing the push.

Trunk Flexion/Rotation

Stand facing the cable column and set the cable up high. As you flex your trunk, rotate to one side. Your hands should end up outside of your foot.

Variations:

- Parallel stance
- Split stance
- Single leg
NOTES
PART VII - PUTTING IT ALL TOGETHER

1. Strength of the upper and lower abdominal must be assessed.
2. Coordination must be assessed.
3. Follow this training order for best results:
   a. The lower abdominal should always be trained first. These exercises require maximal coordination and synergistic support of the upper abdominal.
   b. The obliques should be trained next. These exercises also require maximal coordination and the synergistic support of the upper abdominal.
   c. The upper abdominal should be trained last. These exercises involve simple movement patterns and the upper abdominals is generally the strongest group in the abdominal region.

The abdominal are a striated, skeletal muscle group. They are under voluntary control and behave just like any other muscles you work in the gym. Therefore, they require the same work-rest ratio as any other muscle group of this type. Training all regions of the abdominal daily will most likely lead to strains, poor performance and adaptive shortening from repeated micro trauma. Adaptive shortening of the abdominal can also disturb the normal respiratory excursion of the ribs, increase the workload on the accessory respiratory muscles and encourage poor posture. A daily maintenance program can be implemented only after the desired level of strength is achieved.

An effective abdominal training program always begins with re-establishing coordination (motor control). This is particularly important in the muscles performing lower abdominal functions. Coordination exercises are best performed at low intensity and higher volumes (12-30 reps per set). Neuromuscular exercises may be performed daily, providing the client doesn’t develop post exercise muscle soreness. Post exercise muscle soreness is an indication of protein breakdown in the muscle and indicates the need for more rest between exercise sessions. If multiple abdominal muscle groups are to be strengthened in one session, the progression should always be from lower to oblique and finally upper. In general, it is best to only condition one specific region of the abdominal wall per training session. This helps maintain quality and allows greater focus on any given area, which results in greater overall strength development. Careful observation of volume and intensity of movement patterns that heavily utilize the abdominal should also be considered when determining the training dosage of abdominal exercises. For example, a landscaper who swings a pick ax several hours a day is more likely to overtrain the abdominal with an added abdominal program than a firefighter on the same program.

A beginner should start with one set to fatigue. When you can complete an abdominal workout with minimal or no soreness the following day you can add a second set. The same principle should be used to add a third set. The intermediate and advanced-level exerciser may work the strength exercises to functional failure (fatigue, not form loss). Because of the abdominal musculature’s importance to posture and stabilization of the trunk, failure means stopping just before your form breaks. Because the abdominal are multi-functional, always use a variety of exercises.
References


33. ibid

34. ibid


37. Sazanov, V.P. “Mechanical loads & prevention of injury to the spinal column during execution of strength exercises by girls participating in rowing,” Soviet Sports Review. 06/00/88: 23 No 2: 56-59. Escondido CA. Michael Yessis, Ph.D.

38. ibid


41. Kendall, F.P. & Kendall-McCreary, E. Muscles, Testing and Function. 00/00/83 Williams & Wilkins. 2005

42. Schafer, R.C. Clinical Biomechanics - Musculoskeletal Actions and Reactions. 12, 00/00/87: 481-569. Williams & Wilkins.


47. Whired, R. Athletic Ability and the Anatomy of Motion. 00/00/87: Wolfe Medical Publications.


For additional works cited, see references at end of Inner and Outer Unit Chapters (p. 237 - 238).
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APPENDIX:
Inner Unit and Outer Unit
THE INNER UNIT
(Adapted from an article first published on www.PTontheNet.com)

How many ways can you do a crunch? If you have been reading the muscle tabloids for the past 20 years, you could probably come up with well over 100. Today we have classes devoted to nothing but TRASHING people’s abdominals, complete with every variation of crunch, jack knife, side bend and leg raise known to man. Are these classes or exercises really improving the way you look or function? Are they reducing your chances of back pain?

In 1992, I began investigating the correlation between the type and volume of abdominal exercises my clients performed, with their postural alignment, pain complaints and overall appearance. To ensure objective observations of postural alignment and responses to specific exercises, I designed and patented calibrated instruments to measure structural misalignment.

In the first year of recording information, such as forward head posture, first rib angle, pelvic tilt and overall postural alignment, it became evident that those performing high volume sit-up/crunch exercise programs were not showing promising results (Figure 1)! Not only were those attending “Ab Blast” classes and/or performing high repetition/high volume abdominal routines having a harder time recovering from back pain, they were also having slower or nonexistent improvement in their postural alignment.

**Poor Posture and Abdominal Training**
Those regularly performing crunch and sit-up type exercises frequently demonstrate forward head posture (A). Note that when head carriage is normal, the dotted line through the cheekbone should fall in the same vertical plane as the sternum and pubic symphysis. As the rectus abdominis becomes chronically shortened, it pulls the chest downward, increasing first rib angle (B). This is commonly associated with shoulder dysfunction and impingement of the nerves feeding the arm as they exit the cervical spine. As the hip flexors strengthen and shorten (from chronic exposure to the sit-ups, leg extension and leg lowering exercises commonly used in abdominal workouts) the lower abdominal and hamstring muscles are lengthened, frequently demonstrating positional weakness (C). The postural changes demonstrated here are common among today’s athletes and can be corrected through improved control and strengthening of the inner unit musculature.
When studying clients who performed high volume abdominal routines, it became evident that there was a common link. About 98% of those with back pain had weak lower abdominal and transversus abdominis muscles, while those with no current or history of back pain were frequently able to activate the transversus abdominis and scored better on lower abdominal strength and coordination tests. Frequently, to alleviate back pain, I had to suggest that clients stay completely away from any form of sit-up or crunch type exercises. When this advice was adhered to and exercises for the lower abdominal and transversus abdominis were practiced regularly, back pain not only decreased or was completely alleviated, but posture routinely improved.

During this time, a popular view expressed by some “experts” in the health and fitness industries has been that there is no such thing as lower abdominal muscles. Others have suggested that the best treatment for back pain is to exercise on machines that isolated the low back muscles. My clinical observations led me to believe that both theories were wrong.

In 1987, Clinical Anatomy of the Lumbar Spine by Nikolai Bogduk and Lance Twomey was published. This book is important because Bogduk was the first to make sound clinical observations concerning how the abdominal and back muscles work together as a functional unit. This occurs via the connection of the transversus abdominis and internal oblique to the envelope of connective tissue (thoraco-lumbar fascia) surrounding the back muscles (Figure 2). In 1999, Australian researchers Richardson, Jull, Hodges and Hides began making significant headway into the understanding of how the deep abdominal wall works in concert with other muscles, creating what they would later call THE INNER UNIT.

The Inner Unit became a term describing the functional synergy between the transversus abdominis and posterior fibers of the internal obliques, pelvic floor muscles, multifidus and lumbar portions of the longissimus and iliocostalis, as well as the diaphragm (Figure 3). Research showed that the inner unit was under separate neurological control from the other muscles of the core. This explained why exercises targeting muscles such as the rectus abdominis, external obliques and psoas were very ineffective at stabilizing the spine and reducing chronic back pain. These are the muscles exercised with traditional abdominal conditioning programs used in gyms and athletic programs worldwide.
Exercising the big muscles (*prime movers*), was not providing the correct strengthening for essential small muscles, such as the multifidus, transversus abdominis and pelvic floor. When working properly, these muscles provide the necessary increases in joint stiffness and stability to the spine, pelvis and rib cage to provide a stable platform for the big muscles. In a sense, as the big muscles (*outer unit*) become stronger and tighter, the delicate balance between the Inner and Outer Units becomes disrupted. This concept is easier to understand using the pirate ship model (Figure 4).

![Figure 4: A Pirate’s View of the Inner and Outer Units](image)

Although the large guy wires (*outer unit*) support the mast of the pirate ship, its functionality is completely dependent upon the support provided by the small guy wires. These small guy wires represent the multifidus and inner unit muscles in this analogy.
The mast of the pirate ship is made of vertebra which are held together (stiffened) by the small guy wires running from vertebra to vertebra, just like the multifidus (a member of the inner unit) do in the human spinal column. Although the big guy wires (representing the outer unit) are essential to holding up the mast of the pirate ship (our spine), they could never perform this function effectively should the small segmental stabilizers (inner unit) fail. By viewing the pirate ship’s large guy wires, it becomes easy to see how developing too much tension from the over-use of exercises such as the crunch, could disrupt the posture of the mast, or spinal column, in the case of a human.

To better apply the concept of the pirate ship, let’s examine how the Inner and Outer Units work in a common situation such as picking dumbbells up from the floor in the gym (Figure 5). Almost in synchrony with the thought, “Pick up the weights from the floor,” the brain activates the inner unit, contracting the multifidus and drawing in the transversus abdominis. This tightens the thoracolumbar fascia in a weight belt-like fashion (Figure 3). As this is happening there is simultaneous activation of the diaphragm above and the pelvic floor below. This works to encapsulate the internal organs as they are compressed by the transversus abdominis. This process creates both stiffness of the trunk and stabilizes the joints of the pelvis, spine and rib cage, allowing effective force transfer from the leg musculature, trunk and large prime movers of the back and arms to the dumbbells.

![Figure 5](image)

**Figure 5**  
Functional Use of the Inner and Outer Units

Such functional tasks as picking up dumbbells off the gym floor require synergistic function of the inner and outer units. Failure of the inner unit for any reason predisposes the spine to forces that frequently cannot be effectively stabilized and dissipated, resulting in spinal injury and/or sacroiliac joint injury.

When the Inner Unit is functioning correctly, joint injury is infrequent, even under extreme loads such as pushing a car, tackling an opponent in football or lifting large weights in the gym. When it is not functioning correctly, activation of large prime movers will be no different than a large wind hitting the sail of the pirate ship in the presence of loose guy wires running from vertebra to vertebra in the mast. **Any system is only as strong as its weakest link!**
INNER UNIT CONDITIONING TIPS

The first, and most important step toward reducing back pain and/or improving posture, which in turn generally improves aesthetics, is to stop all crunch and/or sit-up type exercises until you become proficient at activating your Inner Unit! Because Inner Unit dysfunction is extremely common in today’s working and exercising population, it is safe to assume that everyone needs to start with beginning exercises, even the most elite athletes.

To begin conditioning the transversus abdominis, use the Four-Point Transversus Abdominis Trainer (Figure 6). For conditioning of the multifidus and related stabilizer and postural muscles, the Horse Stance exercises may be used (Figure 7). These exercises are only a small sample of the number of Inner Unit exercises available, but, when done correctly, they are sufficient to make a noticeable difference in the way your body functions.

Four-Point Transversus Abdominis Trainer

• Assume the start position as shown in Figure 6.

• With the spine in neutral alignment, take a deep breath in and allow your belly to drop toward the floor.

• Exhale and draw your navel in toward your spine as far as you can. Once the air is completely expelled, hold the navel toward your spine for ten seconds, or as long as you comfortably can without taking a breath (not longer than ten seconds). Throughout the breathing pattern, keep your spine motionless.

• This process should be repeated ten times to complete a set.

• Rest one minute after completing one set. As you are able to, build up to completing three sets of the exercise.
Horse Stance Vertical

• Place your wrists directly below the shoulders and your knees directly below their respective hip joints.

• The legs are parallel and the elbows should remain turned back toward the thighs with the fingers directed forward.

• Place a dowel rod along your spine and hold perfect spinal alignment. The rod should be parallel to the floor. The space between your lower back and the rod should be about the thickness of your hand.

• Draw the navel inward toward the spine just enough to create a space between your belt and your stomach.

• It is advisable to find a spotter who can assist you with feedback about your body position. If you are not training with a spotter, it is highly recommended that you train in front of a mirror, to make sure you stay in correct position throughout the exercise. When you are checking your body position in the mirror, do not move your head, just look up with your eyes.

• The Horse Stance Vertical is initiated by lifting one hand off the floor just enough to slide a sheet of paper between the hand and the floor or mat. The opposite knee is then elevated off the floor to the same height. Keep the dowel rod level at all times. Hold this position for ten seconds. After ten seconds, alternate hands and knees, again lifting them only enough to slide a sheet of paper between the extremity and the mat.

• The target number of repetitions is ten reps per side, with a ten second hold in each position. When you are able to complete the exercise for three sets with a one minute rest between sets, you are ready to add the Horse Stance Horizontal to your program. Perform one set of the Horse Stance Vertical as a warm-up for the Horse Stance Horizontal.
Horse Stance Horizontal

• The start position is identical for all Horse Stance exercises.

• Raise one arm to a point 45° off the midline of the body and hold it in the same horizontal plane as the back. (Figures 8A & B). Always keep the thumbs pointed upward to increase lower trapezius activation.

• Elevate the leg opposite the arm you have raised (left arm / right leg and vice versa) to the point at which your leg is in the same horizontal plane as your torso. As you elevate the leg, do not tilt your pelvis forward; you will know if this happens if the space between the stick and your lower back increases. Hold the leg out straight, activating the muscles of the buttocks.

• At no point during the exercise should your shoulder girdle or pelvis lose their horizontal relationship with the floor. It is quite common for the shoulder to drop on the elevated arm side and for the hip to raise on the side of the extended leg. Either of these faults constitutes poor form!

• The arm and opposite leg are now held in this position for ten seconds before switching sides. Repeat ten times per side, providing you can maintain perfect form. Again, watch yourself in the mirror intermittently or have a spotter check your form. It is critical that you only perform as many repetitions as possible with perfect form! Failure to follow these instructions will result in futile attempts at conditioning and no improvement. Lack of attention to detail is exactly why many exercise programs fail!
Horse Stance Alphabet

• From the same start position described for the Horse Stance Horizontal (Figure 8A), place the dowel rod along the spine as seen in Figure 9.

• With the arm 45° to the side and the thumb up, use the extended leg to draw letters of the alphabet. Start with small letters of 4-6 inches high and progress to larger letters as you are able to stabilize your core and keep the dowel rod in place.

• When performing the exercise, it is important to make sure the following checkpoints are met:

  - The head and neck should stay in line with the spine. The head should not drop down nor look up at any time.

  - Elbow of support arm should point directly backward, not to the side.

  - The arm that is up should maintain an angle of 45° off the midline of the body at all times.

  - The shoulders and hips should remain parallel with the floor at all times.

  - There should be no significant movement of the low back. The movement of the leg needed to draw the letters of the alphabet should come from the hip.

  - The lower leg should move as a unit with the thigh. It is not good technique to just use the lower part of the leg.

  - Draw the navel toward the spine throughout, but do not disrupt respiration by over-recruiting the transversus abdominis.

• Perform as many repetitions as possible with perfect form before switching sides. This is indicated in your Reps column as Max (Table 1). When you can perform the alphabet on either side with perfect form, add a 1 lb. weight to each wrist and a 3 lb. weight to each ankle.
To get the most from the inner unit exercises shown here it is suggested that the exercises be done 3-4 times per week as an individual workout (Table 1). To get best results from these exercises while continuing with a traditional gym program, I suggest you stop all crunch and sit-up exercises and replace them with the exercises demonstrated here. Always perform an Inner Unit exercise as the last exercise of your training session, i.e. perform one exercise after each workout. Alternate through the exercises, selecting either the Four-Point Transversus Abdominis Trainer or a variation of the Horse Stance exercises after each training session. **It is very important not to fatigue the stabilizer system before attempting traditional free weight exercises or injury is likely!**

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Rest</th>
<th>Reps</th>
<th>Tempo</th>
<th>Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four-Point Transversus Abdominis Trainer</td>
<td>1:00</td>
<td>10</td>
<td>10/10</td>
<td>1-3</td>
</tr>
<tr>
<td>Horse Stance Vertical/Horizontal</td>
<td>1:00</td>
<td>10 each arm/leg</td>
<td>10/10</td>
<td>1-3</td>
</tr>
<tr>
<td>Horse Stance Alphabet</td>
<td>1:00</td>
<td>Max</td>
<td>Slow</td>
<td>1-3</td>
</tr>
</tbody>
</table>

*Table 1. Individual Workout*

If you are implementing the stabilizer exercises into a machine-based program, you may intersperse the exercise among the machine exercises. Because of the inherent stability provided by machines, it is unlikely that you will become injured. As your stabilizer system improves, I suggest progressively replacing machine exercises with free weight exercises, as machine-based programs do nothing to enhance functional strength and stability. Should you begin adding free weight exercises to a machine-based program, you must always perform your stabilizer training after completion of all free weight exercises.

Inner unit training provides essential joint stiffness and the stability needed to provide the large prime movers of the body with a working foundation. When Outer Unit or prime mover exercises are executed in absence of a functional Inner Unit, poor posture, unwanted aesthetic changes and musculoskeletal injury are inevitable. For optimal health and performance, the Inner Unit must not only be functional, but must be maintained with technically correct exercise protocol.
THE OUTER UNIT
(Adapted from an article first published on www.PTontheNet.com)

Functional Anatomy of the Outer Unit

The Outer Unit consists primarily of phasic muscles (Table 2), although there are many muscles, such as the oblique abdominals, quadratus lumborum, hamstrings and adductors, which serve a dual role, acting in a tonic role as stabilizers and a phasic role as prime movers. To be technically correct, we may say that Outer Unit functions are predominantly phasic functions (geared toward movement).

<table>
<thead>
<tr>
<th>Function</th>
<th>Tonic</th>
<th>Phasic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posture/Stability</td>
<td>Movement/Gross Stability*</td>
<td></td>
</tr>
<tr>
<td>a-2 motoneuron</td>
<td>a-1 motoneuron</td>
<td></td>
</tr>
<tr>
<td>Late</td>
<td>Early</td>
<td></td>
</tr>
<tr>
<td>Shortening</td>
<td>Weakening/Lengthening**</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Properties of Tonic and Phasic Muscles

* Phasic muscles are commonly recognized as those muscles primarily responsible for movement, although as presented in this article, many Outer Unit muscles serve to provide both movement and gross stability.

** Clinical experience shows that muscles prone to weakening are commonly lengthened in relation to their optimal resting length and the relative length of their antagonists.

Modified from: Stretching and Strengthening Exercises, Thieme, 1991

Superficial to the musculature of the Inner Unit are the Outer Unit systems, sometimes referred to as slings. The Deep Longitudinal System (DLS) is composed of the erector muscles of the spine and their investing fascia.¹ ² The spinal erectors communicate with the biceps femoris through the sacrotuberous ligament of the pelvis, and to the lower extremity via the peroneus longus muscle (Figure 10).

---
¹² - Scientific Core Conditioning
380 S. Melrose Dr, Ste 415
Vista CA 92081, USA
Ph: 760.477.2620 or 800.552.8789
Fax: 760.477.2630
www.chekinstitute.com
educate@chekinstitute.com
Here the actions of the DLS can be seen in a boy running the bases during a baseball game. As the right leg goes through swing phase, there is posterior rotation of the right ilium relative to the sacrum (A), assisting in what is termed form closure or passive closure of the sacroiliac (SI) joint. In preparation for heel strike in the late swing phase of gait, the biceps femoris works to control both hip flexion and knee extension. The action of the biceps femoris is transferred upward through the sacrotuberous ligament (B), assisting in force closure of the SI joint. There is a dual action in the lower leg with the contraction of the biceps femoris causing tension through the peroneus longus (C), which in conjunction with the anterior tibialis, stabilize the foot and ankle, creating a working platform the body can move across. When the foot strikes the ground, kinetic energy will be captured in the thoracolumbar fascia (D) for use in the propulsive phase. Kinetic energy will be dissipated through the paraspinal system and should be nullified before reaching the occiput.\textsuperscript{1, 2, 4, 6}

Figure 10
The Deep Longitudinal System
The Posterior System (PS), or sling, consists primarily of the latissimus dorsi and the contralateral gluteus maximus (Figure 11).1, 2, 4

The Anterior Oblique System (AS) consists of a working relationship between the oblique abdominal muscles, the contralateral adductor musculature and the intervening anterior abdominal fascia (Figure 12).1

Figure 11 - The Posterior Oblique System

In the propulsive phase of gait, there is a phasic contraction of the gluteus maximus, which occurs in concert with that of the contralateral latissimus dorsi as it extends the arm as a means of counter rotation. This timed contraction produces tension in the thoracolumbar fascia that will assist in stabilizing the sacroiliac joint of the stance leg. Vleeming quotes Margaria, who states that the posterior oblique system may act like a smart spring, storing and releasing energy in the thoracolumbar fascia mechanism (A). This would reduce the metabolic cost of walking.4

Figure 12 - The Anterior Oblique System

The adductors work in concert with the internal oblique and opposite external oblique abdominal muscles to both stabilize the body on top of the stance leg and to rotate the pelvis forward. This relationship positions the pelvis and hip optimally for the succeeding heel-strike.
The Lateral System (LS) (Figure 13) consists of a working relationship between the gluteus medius, gluteus minimus and ipsilateral adductors.\textsuperscript{1,3} Porterfield and DeRosa indicate a working relationship between the gluteus medius and adductors of one leg with the opposite quadratus lumborum.\textsuperscript{3} The author’s clinical experience strongly suggests that the oblique musculature is synergistic with the quadratus lumborum during lateral sling functions such as those seen in Figure 13.

![Figure 13 - The Lateral System](image)

As she raises her leg in step class, the body must be stabilized atop the left leg. Contraction of the left gluteus medius and adductors stabilize the pelvis in concert with activation of the contralateral quadratus lumborum, which works to elevate the pelvis enough to ensure adequate freeway space for the swinging leg. Should the lateral system fatigue and the exerciser continue to follow the instructor, she will be forced to progressively rely on passive supports such as ligaments and disks in the pelvis and spine. Such lateral system dysfunction is a common source of injury in the back and legs.

THE OUTER UNIT SYSTEMS IN ACTION

THE DEEP LONGITUDINAL AND POSTERIOR SYSTEMS

To better understand how the Deep Longitudinal System (DLS) and Posterior System (PS) function, we will explore their actions in what is one of our most primal movement patterns, gait (walking). While walking, there is a consistent low level activation of the Inner Unit muscles to provide the necessary joint stiffness to protect the joints and support the actions of the larger Outer Unit muscles.\textsuperscript{5} Recruitment of the inner unit muscles will fluctuate in intensity as needed to maintain adequate joint stiffness and support, as the inertial forces of limb movement, kinetic forces and intradiscal pressures increase.

As we walk, we swing one leg and the opposite arm forward in what is termed counter rotation. Just prior to foot strike, the hamstrings become active.\textsuperscript{6} The DLS, uses the thoracolumbar fascia and paraspinal muscle system to transmit kinetic energy above the pelvis, while using the biceps femoris as a communicating link between the pelvis and lower extremity. For example, Vleeming shows that the biceps femoris communicates with the peroneus longus at the fibular head, transmitting approximately 18\% of the contraction force of the biceps femoris through the fascial system into the peroneus longus.\textsuperscript{4}
Interestingly, the anterior tibialis, like the peroneus longus, attaches to the plantar side of the proximal head of the first metatarsal. This relationship is significant since there is recruitment of the biceps femoris and the anterior tibialis just prior to heel strike in conjunction with the peroneal muscles, which act as dynamic stabilizers of the lower leg and foot. Dorsiflexion of the foot and activation of the biceps femoris just prior to heel strike, therefore, serves to “wind up” the thoracolumbar fascia mechanism as a means of stabilizing the lower extremity and storing kinetic energy that will be released during the propulsive phase of gait.

As you can see by observing Figure 11, just prior to heel strike the gluteus maximus reaches maximum stretch as the latissimus dorsi is being stretched by the forward swing of the opposite arm. Heel strike signifies transition into the propulsive phase of gait, at which time the gluteus maximus contraction is superimposed upon that of the hamstrings. Activation of the gluteus maximus occurs in concert with activation of the contralateral latissimus dorsi, which is now extending the arm in concert with the propelling leg. The synergistic contraction of the gluteus maximus and latissimus dorsi creates tension in the thoracolumbar fascia, which will be released in a pulse of energy that will assist the muscles of locomotion, reducing the metabolic cost of gait.

**THE ANTERIOR OBLIQUE SYSTEM**

The concept of the Anterior Oblique System (AS - Figure 12) appears to have become popular recently. A review of the literature shows that spiral concept of muscle-joint action was understood as integral to human movement and corrective exercise by Robert W. Lovett, M.D. and by anatomist Raymond A. Dart in the early 1900’s. To clarify the point that movement originates in the spine (core), Gracovetsky describes torque generation by an S-shaped spinal column. He exemplifies the point that the legs are not responsible for gait, but merely instruments of expression, by showing that a man with no legs can walk. In both these examples of what Gracovetsky calls the spinal engine, it is evident that the kinetic and potential energies of the oblique abdominal musculature, in concert with other core muscles, are primarily responsible for creating the torque that drives the spinal engine; the oblique abdominals being best situated to create rotary torque.

The oblique abdominals, like the adductors, serve to provide stability and mobility in gait. When looking at the EMG recordings of the oblique abdominals during gait (Basmajian) and superimposing them upon the cycle of adductor activity in gait demonstrated by Inman, it is clear that both sets of muscles contribute to stability at the initiation of the stance phase of gait, as well as to rotate the pelvis and pull the leg through during the swing phase of gait. As the speed of walking progresses to running, activation of the anterior oblique system becomes more prominent.

The AS is important, particularly in sprinting, when the limbs and torso must be accelerated. The demands on the AS are great in multi-directional sports such as tennis, soccer, football, basketball and hockey. In such sporting environments the AS must not only contribute to accelerating the body, but also to changing direction and decelerating it.
One need not see an EMG study to appreciate the strong contribution of the AS, just ask anyone that has experienced an abdominal strain! Accelerating, decelerating and changing directions are all activities that result in immediate pain in the presence of both abdominal and groin strains or tears.

AS functions can be appreciated when running in sand. Because sand gives away during the initiation of the stance and propulsive phases of gait, the impulse timing of ground reaction forces is disrupted. This results in poor use of the thoracolumbar fascia, or what Margaria calls the smart spring system.4 The result is that you must muscle your way through the sand. Many athletes having performed sand sprints, will note abdominal fatigue in the following day or two after the sand sprints. This is due to the increased activation of the AS to compensate for the lost kinetic, potential and muscular energy, which is usually stored and released in part by the thoracolumbar fascia system. Gracovetsky states that wearing soft soled sporting shoes, as athletes often do today, can easily disrupt the body’s timing mechanism. This could very well result in increased work and/or injury.2

During explosive activities, such as swinging a sledge hammer (Figure 14), the AS serves critical function, stabilizing as in gait, yet assisting in propelling the hammer. Trunk flexion and rotation, as a closed chain movement atop of the lead leg, is generated by the adductors as they assist in trunk flexion and internal rotation of the pelvis and assisted by gravity. Activation of the adductors occurs in concert with activation of the ipsilateral (stance leg side) internal oblique and contralateral (throwing arm side) external oblique, pulling the trunk in the necessary direction to propel the shoulder/arm complex. The forces of the shoulder/arm unit summate with those of the legs and trunk below to produce a powerful hammer swing. Here one can clearly see the phasic functions of the AS at work.
THE LATERAL SYSTEM

Porterfield and De Rosa suggest that functional anatomy dictates that the lateral system provides essential frontal plane stability.3 While walking, the Lateral System (LS) will be active at heel strike (initiation of stance phase), providing frontal plane stability. This is accomplished by a force-couple action between the gluteus medius and minimus, pulling the iliac crest toward the stable femur while the opposite quadratus lumborum and oblique abdominal musculature assist by elevating the ilium. This action is necessary to help create the freeway space needed to swing the leg in gait, particularly when you consider the terrain we ambulated across during developmental years.

During functional activities, such as participating in Step class (Figure 13) or simply walking up stairs (Figure 15), the LS plays a critical role, stabilizing the spine in the frontal plane. Stability in the frontal plane is very important to the longevity of the lumbar spine because frontal plane motions of the lumbar and thoracic spine are mechanically coupled with transverse plane motions; excessive amounts of either will quickly aggravate spinal joints. Many people are injured carrying heavy suitcases, which overload the lateral system, resulting in muscle, ligament and/or joint injury.

The LS provides stability that not only protects the working spinal and hip joints, but is a necessary contributor to overall stability of the pelvis and trunk. Should the trunk become unstable, the diminished stability will compromise one’s ability to generate the forces necessary to move the swing leg quickly, as required by many work and sports environments. Attempts to move the swing leg, or generate force with the stance leg during gait and other functional activities, can easily disrupt the sacroiliac joints and pubic symphysis and cause kinetic dysfunction in joints throughout the entire kinetic chain.

A classic example of distal expression of LS dysfunction was illustrated by Sahrmann.13 She described a lateral shift of an athlete's center of gravity over the subtalar joint while going through the stance phase of gait (Trendelenburg’s Sign) resulting in an inversion ankle sprain. Since attending her course in 1992, I have found gluteus medius weakness and contralateral low back pain due to quadratus lumborum overload, common among athletes exhibiting recurring ankle sprain.

Figure 15
Functional Use of the Lateral System

Activation of the lateral system provides necessary support during such activities as walking up stairs. Many people are injured carrying heavy suitcases, which overload the lateral system, resulting in muscle, ligament and/or joint injury.
THE OUTER UNIT AS A STABILIZING SYSTEM

Although the outer unit is thought of as a phasic system (a system for moving the body) by most, it does provide crucial stabilizer functions. We must remember that the muscles of the Inner Unit are relatively small, with less potential to generate force than the large Outer Unit muscles.

The Inner Unit muscles are concerned with providing joint stiffness and segmental stability. They work for extended periods of time at low levels of maximal contraction. The Outer Unit muscles, while well oriented for moving the body, are also important to stability. These often serve to protect the Inner Unit muscles, spinal ligaments and joints from damaging overload. For example, consider this common scenario:

The coach instructs two football players to engage in an oblique medicine ball toss drill. One player is much bigger and stronger than the other, as the second player finds out by attempting to catch the 8 kg. (17.5 lbs.) medicine ball traveling at him at over 60 kph (40mph)! The smaller player does not have the strength in his Outer Unit to decelerate the ball, and is forced into end-range trunk flexion and rotation; therefore traumatizing his lower lumbar disks, ligaments and intrinsic spinal muscles (multifidus, rotatores, intertransversarii and interspinales).

Regardless of how well-conditioned the Inner Unit of the smaller player may have been, a lack of strength in his Outer Unit relative to his partner or the demands of the task at hand, resulted in Inner Unit overload and injury! With careful scrutiny of most activities in the work or sports environment, you will find that good eccentric strength in the Outer Unit systems is critical to protecting the Inner Unit from damage. Protection of the Inner Unit through proper conditioning of the Outer Unit is a worthy goal when one considers that optimal proprioception is dependant upon the health of the Inner Unit muscles and the joints they protect!

A MODERN APPROACH TO EXERCISING THE OUTER UNIT

Now that we have taken a detailed look at the anatomy and function of the Outer Unit, it should be clear that modern exercise technology has taken us a long way from conditioning the Outer Unit systems the way they were designed to work! For example, would any of the following exercises condition the Outer Unit systems in such a way that they could carry over to most functional work or sport activities?

- Crunch on floor
- Crunch machines of all types
- Sit-up
- Hanging leg raises of all types
- Bench press
- Leg press
- Seated row machines
There are hundreds of exercises that do little to enhance function. Many of you will no doubt recognize the above exercises as traditional bodybuilding exercises. What has happened? Only a few years back in the days of Bill Pearl, bodybuilders were building beautiful physiques with functional exercises like squats, lunges, barbell rows, cable rows, deadlifts and the like. Today, we are overrun by the machine era, the era of the aesthetic—an emotional hook so carefully used by the machine manufacturers to convince you that you will look better using their machines.

Our bodies were not designed to exercise on machines, they were designed to function in the wild. We are designed for three-dimensional freedom, not two dimensional guided, unrealistic exercise that encourages muscle imbalance between those muscles used to stabilize and those used in a phasic manner for any given movement. The motor programs developed on machines are of little use to the body for anything other than pushing or pulling the levers of that machine during that exercise. This limits functional carryover to those that operate cranes, excavators, bulldozers, and buses for a living; almost the only people that must apply force to levers in a seated, supported, two-dimensional environment.

**OUT WITH THE NEW AND IN WITH THE OLD!**

Using your new understanding of the Outer Unit systems, carefully analyze such functional pushing and pulling exercises as the single arm standing cable row (Figure 16) and standing single arm cable push (Figure 17). You will see all Outer Unit systems being conditioned simultaneously, just as they are used in most of our work and sport environments.

*Figure 16 - Standing Cable Row*  
Although the Standing Cable Row exercise conditions the anterior and lateral systems, it is an excellent form of conditioning for the posterior oblique system. As you can see, pulling on the cable with a split stance provides an excellent opportunity for the latissimus dorsi and contralateral gluteus maximus to work together in accordance with functional anatomy.

*Figure 17 - Standing Cable Push*  
As the exerciser pushes the handle of the cable machine forward there is a concerted effort by the anterior oblique system to produce the necessary leg and trunk stabilization and motion to support the smaller shoulder and arm musculature.
Medicine ball exercise, like free weight training, was much more popular in the 40s, 50s, 60s, and 70s than it is today. Great athletes of those decades used exercises such as the oblique medicine ball toss and push-pass, not to mention almost 100 other variations of medicine ball exercises.16, 17

The Swiss ball can be used to effectively condition the Outer Unit systems in three-dimensional movement while providing unloading opportunities for those recovering from injury. For example, analyze the Supine Lateral Ball Roll (Figure 18) and see if you can determine which Outer Unit systems are being used and categorize them in the order of demand during this exercise. This will be a great start toward a better understanding of functional exercise.

The Outer Unit consists of four systems: the deep longitudinal; posterior oblique; anterior oblique; and lateral. These systems are dependent upon the Inner Unit for the joint stiffness and stability necessary to create an effective force generation platform. Failure of the Inner Unit to work in the presence of Outer Unit demand often results in muscle imbalance, joint injury and poor performance. The Outer Unit can not be effectively conditioned in patterns of movement that carryover to function when using modern bodybuilding machines. Effective conditioning of the Outer Unit should include exercises that require integrated function of the Inner and Outer Units, using movement patterns common to any given client’s work or sport environment.
REFERENCES

The Inner Unit


The Outer Unit


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1. Which region of the abdominals is generally strongest in most individuals?

   A. The lower abdominal muscles  
   B. The transversus abdominis  
   C. The oblique muscles  
   D. The upper abdominal musculature  

2. A positive (as used by the medical community) Forward Flexion Activation Test would be_______.

   A. The umbilicus drawn inward toward the spine & The umbilicus moving out away from the spine  
   B. The umbilicus moving out away from the spine & No change in the distance between the umbilicus and the spine  
   C. The umbilicus draws inward  
   D. The umbilicus drawn inward toward the spine & No change in the distance between the umbilicus and the spine  

3. During the Lower Abdominal Strength Test, if the low back rises when the legs form a 15° angle to the floor, this indicates a strength grade of_______.

   A. 100%  
   B. 50%  
   C. 75%  
   D. 90%  

4. The Wall Standing Test for determining lumbar curvature is positive (as used by the medical community) when the thickest part of the client’s hand_______.

   A. Just fits between the wall and the lumbar spine (at belt level) & Passes right through to the other side  
   B. Just fits between the wall and the lumbar spine (at belt level)  
   C. Passes right through to the other side; Gets stuck prematurely, allowing only the finger tips between the wall and lumbar spine  
   D. Passes right through to the other side & Fits “just right” when the client makes a fist
5. When performing the Squat Test with little or no weight, you can determine whether or not the stabilizer mechanism is weak if the_____ is activated.

A. TVA
B. Rectus abdominis
C. Piriformis
D. Internal obliques

6. When performing the Lower Abdominal Coordination Test, if your client’s spine begins to arch before the feet touch the floor, this indicates that______.

A. The lower abs cannot stabilize the lumbar spine against the pull of the iliopsoas and rectus femoris
B. The TVA cannot coordinate with the lower abs to stabilize the pelvis
C. The lower abs cannot stabilize the lumbar spine against the pull of the iliopsoas and rectus abdominis
D. There is little coordination between the multifidus, erector spinae and quadratus lumborum

7. With posterior rotation of the pelvis, what trunk muscles are the prime movers?

A. The serratus anterior and deltoids
B. The transversus abdominis and erector spinae
C. The sternalis and longisimus
D. The anterior fibers of the external oblique and the rectus abdominis

8. During the Cervical Flexion Activation Test, which muscle(s) will you see activated if the tester overpowers the cranium causing the head to posteriorly rotate?

A. Supra and infrahyoid muscles
B. Sternocleidomastoid
C. Anterior & Posterior Scalenes
D. Platysma

9. How much of their respiratory volume do chest breathers get?

A. 1/3 of normal or ideal volume
B. 2/3 of normal or ideal volume
C. Full volume
D. None of the above
10. **During the Forward Flexion Activation Test, why are the fingers placed above and below the spinous process of L3?**

   A. To feel the supraspinous ligament tightening and correlate the tightening with the activation of the TVA
   B. To determine if there is multifidus activation with concomitant firing of the TVA
   C. To evaluate the amount of space created between the vertebrae during flexion movements
   D. To help the client feel more comfortable as they bend forward to pick up the object

11. **What muscles are postural antagonists to the sternocleidomastoid (SCM)?**

   A. Suboccipitals
   B. Cervical neck flexors
   C. Scalenes
   D. Masseter

12. **When administering the Lower Abdominal Coordination Test, the psoas muscle will be dominant if the lower abdominal musculature cannot stabilize the pelvis.**

   A. True
   B. False

13. **TVA activation can be assessed with a Blood Pressure cuff placed under the lumbar spine.**

   A. True
   B. False

14. **Core deficiencies increase an individual's risk for lower extremity injuries.**

   A. True
   B. False
15. Janda’s Upper Abdominal Strength Test is more accurate than the Kendall Sit-up Test because______.

A. It decreases the use of the rectus abdominis & It increases the feedback to the tester through palpation of the TVA
B. It decreases the use of the rectus abdominis & It increases the feedback to the tester through palpation of the feet
C. It decreases the ability of the client to cheat & It increases the feedback to the tester through palpation of the feet
D. It decreases the ability of the client to cheat & It increases the feedback to the tester through palpation of the TVA

16. What test would you use first to assess the strength of the Transversus Abdominis?

A. Have the client perform the forward ball roll with a string around their waist. The client must pull the umbilicus in so that the string goes slack or two fingers can fit underneath the string.
B. Have the client lie supine with a Blood Pressure cuff under the umbilicus and inflate it to 70mmhg. The client must then draw the umbilicus in and reduce the pressure in the cuff.
C. Have the client perform the 4-point kneeling tummy vacuum with a string around the waist. The client must pull the umbilicus in so that the string goes slack or two fingers can fit underneath the string.
D. Have the client lie prone with a Blood Pressure cuff under the umbilicus and inflate it to 40mmhg. The client must then draw the umbilicus in and reduce pressure in the cuff.

17. Which exercise should you or your client start off with when learning how to activate the TVA?

A. Lower abdominal exercises
B. Forward ball roll
C. Four point kneeling tummy vacuum
D. Swiss ball crunch

18. A safe and effective way to double the range of motion of the crunch exercise and maintain extension in the thoracic spine is to______.

A. Use a Medicine ball
B. Use a back extension machine
C. Use a crunch machine
D. Use a Swiss ball
19. The “stabilization threshold” is defined as_______.

A. The ability to use the rectus abdominis as a stabilizer during movement
B. The ability to stabilize one's spine against intrinsic and extrinsic forces
C. The point where the TVA begins to assist the rectus abdominis in stabilization
D. The ability to stabilize one's spine against centrifugal forces

20. Why is it important to test lower abdominal strength and coordination?

A. To determine where to start your clients' training & To determine if proper muscle strength is present in the lower abs
B. To ensure the body can activate the psoas prior to the lower abs & To determine if proper muscle strength is present in the lower abs
C. To assess the degree of muscle imbalance & To determine where to start your clients' training
D. To assess the degree of muscle imbalance & To ensure the body can activate the psoas prior to the lower abs

21. Why is it important to have the tongue in the physiological rest position?

A. It allows the sternocleidomastoid muscles to aid in flexion.
B. It allows the supra and infrahyoid muscles to aid in flexion.
C. The stress placed on the levator scapulae is decreased.
D. It increases the activation of the deep cervical flexors.

22. Why is it important to keep the spine in neutral during the four point kneeling tummy vacuum?

A. To reduce the load placed on the spine
B. To activate the rectus abdominis as a stabilizer
C. To increase hip/back disassociation
D. To decrease sensory motor awareness

23. Why is it important to breathe through pursed lips, while lifting a weight through the sticking point of any lift?

A. To charge the thoracic cavity & To exhale all the air from your lungs
B. To exhale all the air from your lungs
C. To charge the thoracic cavity & To avoid the valsalva maneuver
D. To avoid the valsalva maneuver & To exhale all the air from your lungs
24. What is a negative effect of supporting one’s head during crunches?

A. The neck is allowed to relax for optimal abdominal function.
B. Flexor chain is not strengthened in a functional pattern.
C. The abdominals are forced to contract maximally.
D. The sternocleidomastoid becomes a synergistic muscle.

25. Assume you are performing the Oblique Muscle Balance Test and your client is lying over a Swiss ball on his right side. When the client side flexes, he rotates to his right. What type of imbalance does this indicate?

A. Imbalance between the right internal oblique and left external oblique
B. Imbalance between the left internal oblique and left external oblique
C. Imbalance between the right internal oblique and right external oblique
D. Imbalance between the right external oblique and left internal oblique

26. Which actions indicate a negative finding (as used by the medical community) for the Forward Flexion Activation Test?

A. There is no movement at the umbilicus level.
B. Umbilicus pushes out & There is no movement at the umbilicus level.
C. Umbilicus pushes out & The umbilicus draws inward.
D. The umbilicus draws inward.

27. When should the Lower Abdominal Strength Test not be performed and instead be replaced by the Lower Abdominal Coordination Test?

A. Your client is a professional athlete.
B. Your client tested positive on the strength test.
C. Your client has tight psoas muscles.
D. Your client has low-back pain.

28. Which of the following are typical ways a client can cheat during the Blood Pressure TVA Strength Test?

A. Using the hip extensors, Rolling to the side & Coming up on the toes
B. Using the hip flexors, Rolling to the side & Coming up on the toes
C. All of the above
D. None of the above
29. Why is it important to test both the eccentric and concentric movements during the Lower Abdominal Strength and Coordination Tests?

A. You cannot test the eccentric movement.
B. Lower abs must be able to work both eccentrically and concentrically.
C. Lower abs must be able to activate the psoas during the eccentric phase.
D. You cannot test the concentric movement.

30. During the TVA Strength Test, what constitutes normal TVA strength?

A. Pulling the umbilicus off the cuff 10mmHg
B. Having the string around your waist go slack
C. Fitting two fingers under the string around your waist
D. Pulling L3 off the cuff 10 mmHg

31. The sooner a client reaches the “stabilization threshold” the better they are able to stabilize.

A. True
B. False

32. When the umbilicus pushes out during the Forward Flexion Activation Test, this indicates that ________.

A. The external obliques are acting as stabilizers
B. The rectus abdominis is not firing
C. The TVA is not firing
D. The TVA is activated

33. The abdominal muscles are ________.

A. Striated skeletal muscles
B. Smooth cardiac muscle
C. Tonic postural muscles
D. None of the above

34. Strength development of the abdominal muscles can be done daily because the abdominal musculature repairs itself faster than any other muscle in the body.

A. True
B. False
35. At what level should a Blood Pressure cuff be placed when performing any of the lower abdominal exercises?

A. L3 & Belly Button level  
B. L4 & Belly Button level  
C. L5 & Belly Button level  
D. T12 & Belly button level

36. When doing lower abdominal #4, use of the psoas will cause_______.

A. The knees to raise  
B. The back to flatten  
C. The knees to move toward the head  
D. The umbilicus to deviate to one side

37. Fully flexing the hips has what kind of effect on the psoas?

A. Facilitating  
B. Stimulating  
C. Inhibitory/weakening  
D. None of the above

38. A full contraction of the abdominal musculature during the crunch exercise performed from the floor will flex the torso to approximately_______.

A. 45 degrees  
B. 30 degrees  
C. 37 degrees  
D. 80 degrees

39. When performing the reverse crunch, the concentric movement cycle of the abdominal muscles involved is completed when_______.

A. The rectus abdominis is fully contracted  
B. The knees are over the head  
C. The stomach begins to cramp  
D. Pressure is felt at the base of the neck
40. Which of the following muscles are part of the Inner Unit?

A. TVA & Rectus abdominis
B. Rectus abdominis & External obliques
C. TVA & Pelvic floor muscles
D. Rectus abdominis & Pelvic floor muscles

41. When walking up stairs, the Lateral System stabilizes the spine in which plane?

A. Sagittal
B. Frontal
C. Transverse
D. Horizontal

42. Exercises for the internal and external oblique musculature commonly require a rotary component of trunk motion. This has been shown to increase the likelihood of _______.

NOTE: This is most common in the standing and/or seated positions, with the likelihood of injury increasing in proportion to the load on the spine.

A. Indigestion
B. Vertigo and dizziness
C. Muscle tearing
D. Tearing of the annular rings of a vertebral disc

43. Pulling hard on the neck while doing abdominal crunch exercises or sit-ups can_______.

A. Strain the extensor muscles and sprain the joints of the neck
B. Be associated with pain between the shoulder blades and in the arm region
C. Be a source of headaches
D. All of the above

44. The end of the concentric phase of the cross-crunch exercise is when_______.

A. The elbow touches the opposite knee
B. The elbow passes the opposite knee
C. The external oblique muscle being worked is fully contracted
D. The spine makes two or more popping sounds
45. If you are sore when you begin your next abdominal workout and you feel you cannot complete your required number of reps and or sets, you should_______.

A. Complete half of your usual number of reps  
B. Sit in the Jacuzzi before working out  
C. Take an extra day off  
D. Tell your doctor right away

46. When setting up an abdominal program for yourself or someone else, it is not advisable to recommend an exact number of repetitions because_______.

A. It may be too many for their level of ability  
B. It may be too few for their level of ability  
C. Each individual will fatigue at the number of repetitions compatible to his/her current level of ability  
D. All of the above

47. What is the main fault with the Ab Roller device?

A. The neck is allowed to relax for optimal abdominal function.  
B. The flexor chain is not strengthened in a functional pattern.  
C. The abdominals are forced to contract maximally.  
D. The SCM becomes a synergistic muscle.

48. Which exercise(s) must a client master before attempting hanging leg raises?

A. Pull-ups  
B. Lower abdominal # 1-4  
C. Decline bench reverse crunch  
D. Forward ball roll

49. What technique modification is most likely to eliminate pulling on the head during safe and effective crunch and sit-up type exercises?

A. Lacing your fingers behind your neck  
B. Placing your finger tips behind your ears  
C. Placing your tongue on the roof of your mouth  
D. Placing your tongue behind your lower teeth
50. At what point in a workout do you recommend performing abdominal exercises?
   A. Beginning
   B. During the warm-up
   C. End
   D. It doesn’t matter

51. If you were developing an abdominal conditioning class or segment of a class, what region of the abdominal wall would you exercise first, second and last?
   A. Obliques, upper abdominals, lower abdominals
   B. Upper abdominals, lower abdominals, obliques
   C. Upper abdominals, obliques, lower abdominals
   D. Lower abdominals, obliques, upper abdominals

52. What are common postural changes in people who regularly perform crunch or sit-up type exercises without properly balancing these flexion exercises with extension exercises?
   A. Forward head posture & Steeper first rib angle
   B. Forward head posture, Steeper first rib angle & Scoliosis
   C. Forward head posture, Steeper first rib angle & Kyphosis
   D. Steeper first rib angle, Scoliosis & Kyphosis

53. Traditional abdominal exercises that target the rectus abdominis, external obliques and psoas are effective in improving back stabilization.
   A. True
   B. False

54. Phasic muscles react to faulty loading by becoming_______ and_______.
   A. Short, weak
   B. Long, weak
   C. Long, tight
   D. Short, tight

55. The Anterior Oblique System is comprised of a working relationship between_______ and_______.
   A. Obliques, contralateral adductors
   B. Glute medius & minimus, ipsilateral adductors
   C. Obliques, ipsilateral abductors
   D. Rectus abdominis, contralateral adductors
56. A Trendelenburg Sign is best defined as_______.
   A. An inward curve of the lumbar spine, causing a lateral shift in the pelvis during the swing phase of gait
   B. A leg length discrepancy that occurs from birth causing a severe limp
   C. A dysfunctional abdominal wall causing a shearing force in the sacroiliac joint
   D. A center of gravity shift over the subtalar joint, while going through the stance phase of gait

57. What muscles make up the lateral system?
   A. Gluteus medius & minimus, erector spinae, obliques
   B. Gluteus maximus, quadratus lumborum, TVA
   C. Gluteus medius & minimus, quadratus lumborum, obliques
   D. Rectus abdominis, gluteus maximus, adductors

58. What role does the Posterior Oblique System play in the propulsion phase of gait?
   A. Stabilizes the body on top of the stance leg
   B. Stabilizes the knee during the swing phase
   C. Assists in the swing phase of the moving leg
   D. Stabilizes the sacroiliac joint of the stance leg

59. The main function of the Outer Unit is to provide joint stiffness.
   A. True
   B. False

60. Which of the following exercises are effective for training Inner Unit muscles?
   A. Swiss Ball crunch & Dumbbell side flexion
   B. Dumbbell side flexion & Seated posture training
   C. Lower abdominal #1 & Swiss Ball crunch
   D. Lower abdominal #1 & Seated posture training

61. The best exercise to train the Anterior Oblique System is the_______.
   A. Forward ball roll
   B. Superman
   C. Woodchop
   D. Cable side flexion
62. Acceleration, deceleration and multi-directional changes put demands on primarily which system?

A. Posterior oblique system  
B. Anterior oblique system  
C. Deep longitudinal system  
D. Lateral system

63. The Superman exercise targets the muscles of primarily which system?

A. Deep longitudinal system  
B. Posterior system  
C. Anterior oblique system  
D. Lateral system

64. There are_______muscular layers in the abdominal wall.

A. 2  
B. 3  
C. 4  
D. 5

65. The most superficial abdominal muscles are the_______and the_______.

A. Rectus abdominis, external obliques  
B. Internal obliques, external obliques  
C. Transversus abdominis, rectus abdominis  
D. External obliques, transversus abdominis

66. The rectus abdominis can flex the trunk and_______.

A. Posteriorly rotate the pelvis  
B. Assist in rotation of the trunk  
C. Assist in extension of the spine  
D. Interdigitate with the latissimus dorsi

67. The_______is the largest muscle in the abdominal region.

A. External oblique  
B. Internal oblique  
C. Transversus abdominis  
D. Rectus abdominis
68. Left rotation of the trunk with the lower body anchored, such as throwing a ball with the right arm, is accomplished by the synergistic function of the______.

A. Right internal & left external obliques
B. Left internal & right external obliques
C. Left side of the rectus abdominis & right external obliques
D. All of the above

69. The psoas muscles are______.

A. Powerful flexors of the trunk when the feet are anchored
B. Powerful flexors of the hip with the trunk anchored
C. Commonly overworked during abdominal exercises
D. All of the above

70. The quadratus lumborum is the______ and is______.

A. Deepest muscle of the low back & Seldom injured
B. Strongest muscle in the low back & Seldom injured
C. Deepest muscle of the low back & Frequently aggravated in low back conditions
D. Strongest muscle in the low back & Frequently aggravated in low back conditions

71. Side sit-ups may aggravate any pre-existing condition in the quadratus lumborum.

A. True
B. False

72. Poor tongue positioning during abdominal exercises may lead to strain of the deep cervical flexors and/or over development of the sternocleidomastoid muscles.

A. True
B. False

73. A common result of shortened cervical flexors is______.

A. An increased cervical curvature
B. A decreased cervical curvature
C. Increased energy levels
D. None of the above
74. When assessing posture from the side, what point is used as the primary reference?

A. Ear
B. Ribcage
C. Hip
D. Ankle

75. Anterior pelvic tilt causes 

A. Increased lumbar curvature
B. Decreased lumbar curvature
C. Strengthening of the rectus abdominis
D. None of the above

76. Improper strength and conditioning techniques for the abdominal musculature can cause 

A. Low back pain
B. Postural degeneration
C. Neck pain
D. All of the above

77. A long term postural change associated with increased postural curvatures is 

A. Dowagers hump
B. Protrusion of the abdomen
C. Forward displacement of the head
D. All of the above

78. A loss of agility, spinal mobility and a decreased sense of balance may be associated with 

A. Increased spinal curvatures
B. Low intensity training
C. Too much exercise
D. All of the above

79. Which of the following are short term (hours to weeks) implications of poor training technique with abdominal exercise?

A. Neck pain & Forward head posture
B. Neck pain & Back pain
C. Neck pain & Kyphosis
D. Forward head posture & Kyphosis
80. Which of the following are long term (months) implications of abdominal training with poor technique?
   A. Neck pain & Back pain  
   B. Forward head posture & Kyphosis  
   C. Neck pain & Kyphosis  
   D. Back pain & Forward head posture

81. Aside from respiration, what is the main function of the transversus abdominis?
   A. Trunk flexion  
   B. Contralateral rotation  
   C. Spine stabilization  
   D. Ipsilateral rotation

82. The external oblique is a contralateral rotator_______.
   A. When the pelvis is fixed  
   B. When the trunk is fixed  
   C. During the catch phase of the freestyle stroke  
   D. During a flutter kick in the pool

83. When performing trunk flexion exercises against gravity, it is best to_______ to protect the neck.
   A. Place the tongue behind the lower teeth.  
   B. Place the hands behind the head.  
   C. Lace the fingers behind the neck.  
   D. Place the tongue on the roof of the mouth.

84. At 90% of lumbar flexion, the body switches from_______ support to_______ support.
   A. Ligamentous, muscular  
   B. Inner unit, outer unit  
   C. Muscular, ligamentous  
   D. Outer unit, inner unit

85. What force-couple relationship is involved in supporting the sacroiliac joints?
   A. Abdominals and hamstrings  
   B. Gluteals and abdominals  
   C. Gluteals and hamstrings  
   D. Psoas and hamstrings
86. Sacroiliac joint pain is often the result of______.

A. Weak erector spinae musculature
B. Sheering of the lumbar spine
C. Tight psoas muscles
D. A dysfunctional abdominal wall

87. What is the long term effect on the abdominal wall from wearing a weight belt?

A. Sensory motor amnesia
B. Overdeveloped erector spinae
C. Increase TVA activation
D. Stronger inner unit muscles

88. The external oblique is an ipsilateral rotator when______.

A. The pelvis is fixed
B. The trunk is fixed
C. Throwing a ball
D. Rowing

89. The intra-abdominal pressure mechanism alleviates between______ and______ of the load in the lumbar spine at the L4 and L5 levels.

A. 10%, 20%
B. 22%, 36%
C. 12%, 26%
D. 12%, 36%

90. Which back muscle may be a flexor of the spine?

A. Multifidus
B. Erector spinae
C. Quadratus lumborum
D. Latisimus Dorsi

91. The Fitter™ helps to develop______.

A. Balance & Coordination
B. Joint stability
C. Strength
D. All of the above
92. **Most Fitter™ exercises are performed**______.
   A. In the sagittal plane
   B. In the transverse plane
   C. In the frontal plane
   D. In all planes simultaneously

93. **Surfing uses primarily which reflex?**
   A. Righting
   B. Tilting
   C. Labyrinthine
   D. Knee Jerk

94. **What modification could be made to a Swiss ball exercise to make it one that trains righting reflexes?**
   A. Get underneath the ball.
   B. Fixate the ball so it cannot roll around.
   C. Hold a weight while kneeling on the ball.
   D. Hold your breath while balancing on the ball.

95. **When should a client discontinue performing a high-performance core exercise?**
   A. Prior to form breaking down
   B. When speed slows down
   C. After 8-12 seconds
   D. At exercise failure

96. **Chop pattern exercises**______.
   A. Have a high level of carryover to work and sport environments & Are the most effective exercises for lower abdominal development
   B. Combine flexion and extension with rotation & Have a high level of carryover to work and sport environments
   C. Should only be performed using a high cable pulley
   D. Combine flexion and extension with rotation & Should only be performed using a high cable pulley
97. All of the following variables increase core demand except_______.

A. Speed
B. Clothing
C. Surface change
D. Heat

98. What abilities does Paul recommend you or your client possess prior to attempting the exercises in High Performance Core Conditioning?

A. Core strength
B. Swiss ball strength
C. Upper body strength
D. Lower body strength

99. Which exercises are predominantly transverse plane exercises?

A. Tornado ball wall chop & Jump kick pass
B. Wood chop & Weighted Swiss ball crunch
C. Tornado ball wall chop & Wood chop
D. Weighted Swiss ball crunch & Jump kick pass

100. _______ plane dominant exercises are ideal for training a swimmer.

A. Sagittal
B. Transverse
C. Frontal
D. Horizontal

101. Sit-ups are the ideal abdominal exercise to train baseball pitchers.

A. True
B. False

102. What sport would sit-ups be well suited for?

A. Golf
B. Gymnastics
C. Rowing
D. Football
103. Kneeling on a Swiss ball is an example of ______ reflexes.

A. Balancing  
B. Tasking  
C. Righting  
D. Tilting

104. Training on a Swiss ball primarily trains the righting reflexes.

A. True  
B. False

105. Which of the following increases core demand for a firefighter?

A. Weight of clothing  
B. Use of tools  
C. Impaired vision  
D. All of the above

106. The difference between skill and ability is that skill is something you are born with and ability is something you develop.

A. True  
B. False

107. What must someone be able to do in order to perform the reverse wood chop properly?

A. Increase thoracic curvature  
B. Increase shoulder flexibility  
C. Increase lumbar curvature  
D. Reverse thoracic curvature

108. According to the DVD, what weight distribution shift is recommended during the explosive wood chop exercise?

A. 70% inside leg to 70% outside leg  
B. 30% inside leg to 30% outside leg  
C. 50% inside leg to 50% outside leg  
D. 40% inside leg to 40% outside leg
109. The prone ball roll works in which plane(s)?

A. Transverse & Sagittal
B. Sagittal & Frontal
C. Transverse & Frontal
D. Transverse only

110. While performing the integrated hanging leg raise, what does an excess lumbar lordosis indicate prior to hip flexion?

A. Weak rectus abdominis musculature
B. Weak erector spinae musculature
C. Eccentric overload of the lower abdominals
D. Concentric overload of the lower abdominals

111. What sport would the drop and recover be best for?

A. Marathon
B. Swimming
C. Rugby
D. Cycling

112. What muscles aid in flexion when the tongue is placed on the roof of the mouth during exercises where the head is being pulled posteriorly against gravity?

A. Levator scapulae muscles
B. Supra & infrahyoid muscles
C. Sternocleidomastoid
D. Scalenes

113. Which exercise best trains the hip flexors for quick movement?

A. Swiss ball pike
B. Drop & recover
C. Hanging leg raise
D. Jump kick pass
114. When setting up for the Swiss ball crunch, which two parts of the body should be touching the ball?

A. Sacrum and head
B. L3 and head
C. Sacrum and shoulders
D. L3 and shoulders

115. While performing the weighted Swiss ball crunch, how much weight should be anchoring the feet to the floor?

A. Same weight as you are lifting
B. Half your body-weight
C. 20 pounds
D. 50 pounds

116. To isolate the lower abdominals when performing the hanging leg raise, you must_______.

A. Rotate the pelvis forward and flex the hips until the low back flattens.
B. Swing the legs up until the pelvis rotates posteriorly.
C. Rotate the pelvis backward and flex hips until the low back flattens.
D. Pull the knees into the chest.

117. How can the bilateral push be made into a transverse plane movement?

A. Use both arms
B. Alternate arms
C. Use a straight bar
D. Stand on one leg

Congratulations!
You have completed this course.
Answer Sheet for Scientific Core Conditioning Exam

This exam is designed to be taken online. If you are unable to take exam online, you will need to submit:
1. Answer Sheet - page 235   2. Grading Request - page 237

**Directions:** Circle the correct letter (A/B/C/D etc) for your answers to the multiple choice questions. There is only one correct answer for each question. You must apply what you have learned from the concepts and philosophies presented in this course in order to answer some of the questions.

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<td>86. A B C D</td>
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</table>

Mail, email or fax your completed Exam Answer Sheet, and payment to:

C.H.E.K Institute  
380 S. Melrose Dr, Ste 415  
Vista, CA 92081

Email: educate@chekinstitute.com  
Fax: 760.477.2630
Grading Request for Scientific Core Conditioning

Directions for taking this exam are on page 211-212. You can use the answer sheet to practice on before taking the exam online. If you need to send this Exam Answer Sheet into the C.H.E.K Institute to be graded, there is a US$30 fee. The normal turn around time for exams mailed or faxed to the C.H.E.K Institute is 2-3 weeks.

☐ Yes, please grade my exam for a US$30 fee with 2-3 weeks turn around time.
☐ Yes, please grade my exam for a US$50 fee with 2 business days turn around time.

Please send my certificate of completion by: ☐ mail to the address below ☐ fax to the fax number below
☐ e-mail to the e-mail address below

Name:__________________________________________________ Date:________________________
(as you would like it to appear on your certificate)

Billing Address:__________________________________________ Apt./Ste. __________
City:________________________ State:________________________ Zip Code:____________
Country:________________________ E-mail:____________________

Phone:________________________ Fax:______________________
Credit card type : ☐ Visa ☐ MasterCard ☐ Discover ☐ Amex

Amount to be charged: US$___________

Credit Card #: ________________________________ Exp. Date: __________ CID#: __________
Signature:__________________________________________
☐ I am paying by check: check enclosed for US$ ______________
☐ I am paying by PayPal: send payment to paypal@chekinstitute.com

☐ Providing this information constitutes your permission for C.H.E.K Institute and authorized distributors to contact you regarding related information via mail, e-mail, fax and phone. Please check this box if you do not wish to be contacted about future educational opportunities.

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C.H.E.K Institute
380 S. Melrose Dr, Ste 415
Vista, CA 92081

Email: educate@chekinstitute.com
Fax: 760.477.2630
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Request for Paper Certificate

☐ Please send me a paper certificate for a US$10 fee.
My course registration number (found on page 4) is: ____________________________

Name: ____________________________ Date: ____________________________
(as you would like it to appear on your certificate)

Billing Address: ____________________________ Apt./Ste. __________
City: __________ State: __________ Zip Code: __________
Country: __________ E-mail: ____________________________

Phone: ____________________________ Fax: ____________________________

Credit card type: ☐ Visa  ☐ MasterCard  ☐ Discover  ☐ Amex

Amount to be charged: US$ __________

Credit Card # ____________________________ Exp. Date: __________ CID#: __________

Signature: ____________________________

☐ I am paying by check; check enclosed for US$ __________

☐ I am paying by PayPal: send payment to paypal@chekinstitute.com

☐ My mailing address is the same as my billing address.

Mailing Address (if different): ____________________________ Apt./Ste. __________
City: __________ State: __________ Zip Code: __________
Country: __________

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380 S. Melrose Dr, Ste 415
Vista, CA 92081

Email: educate@chekinstitute.com
Fax: 760.477.2630
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Course Critique

Name: ___________________________ Date: _______________________

Occupation: _______________________________________________________________________

Where did you purchase this course? _______________________________________________________________________

(Please rate on scale of 1 to 5; 1 being the lowest and 5 being the highest – circle one)

<table>
<thead>
<tr>
<th>Quality of materials presented</th>
<th>1</th>
<th>2</th>
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<th>5</th>
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<tr>
<td>Information was academically accurate and educationally sound</td>
<td>1</td>
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<td>Requirements for course completion were explained well</td>
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<td>The post-completion test was a valuable tool for measuring the amount of knowledge gained</td>
<td>1</td>
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<td>The level of difficulty was appropriate for my profession</td>
<td>1</td>
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<td>The course provided useful information for my profession</td>
<td>1</td>
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<td>My expectations were met</td>
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</table>

What did you like most about this course?

How would you like to see this course improve for future participants?

Would you recommend this course to a friend or professional colleague? Y/N

Why or why not?

What other courses or topics would interest you in the future?

Do you know anyone who would be interested in receiving information on C.H.E.K Institute? If you do, please list their names, addresses and/or phone numbers on the back of this page. We would be delighted to send them a brochure on seminars, courses, books/articles, DVDs, inventions, etc.

Thank you for your participation.

☐ Providing this information constitutes your permission for C.H.E.K Institute and authorized distributors to contact you regarding related information via mail, e-mail, fax and phone. Please check this box if you do not wish to be contacted about future educational opportunities.
Request for Testimonials

We are always appreciative of testimonials from C.H.E.K students that we can use to show prospective students how the programs can benefit them. Please take a moment to help us to help you! You can also submit a testimonial online via the Customer Comments section of the C.H.E.K Institute website. We give small “thank-you” gifts for any testimonials that we use in our marketing. Thanks for taking the time to write something – the more great quotes that we have to let the world know about the program, the more successful we shall be!

Here are a few ideas to get you going:

• How has this C.H.E.K Institute correspondence course helped you in your profession?
• What specific skills or knowledge have you learned that have been particularly beneficial?
• Can you tell us about any particular success that you have achieved with a client?

I, _____________________________ (print name) authorize the C.H.E.K Institute and distributors of the C.H.E.K Institute’s products to use the following statement(s) for promotional purposes.

Signature: __________________________ Date: __________________________

My occupation: __________________________

My testimonial: __________________________

☐ Providing this information constitutes your permission for C.H.E.K Institute and authorized distributors to contact you regarding related information via mail, e-mail, fax and phone. Please check this box if you do not wish to be contacted about future educational opportunities.

Mail, email or fax your completed Testimonials Sheet to:

C.H.E.K Institute
380 S. Melrose Dr, Ste 415
Vista, CA 92081

Email: educate@chekinstitute.com
Fax: 760.477.2630
Paul Chek HHP is a prominent expert in the field of holistic health and corrective and high-performance exercise. For over twenty-six years, Paul's unique, holistic approach to clinical assessment, intervention, treatment rehabilitation and education has changed the lives of countless individuals worldwide. By treating the body as a whole system and finding the root cause of a problem, Paul has successfully coached clients toward complete resolution of their health and performance challenges, where traditional approaches have consistently failed.

Paul is the founder of the C.H.E.K (Corrective Holistic Exercise Kinesiology) Institute and the PPS Success Mastery Program based in San Diego, California. He developed the C.H.E.K Advanced Training Programs in 1995, which currently have over 6000 C.H.E.K Institute Trained Professionals worldwide.

For over twenty-six years, Paul’s unique, holistic approach to clinical intervention, treatment and education has changed the lives of countless individuals worldwide. As a walking, talking definition of success, Paul is above all an educator: teaching and applying his methods to benefit others. His programs are not only cutting-edge, students leave his courses and trainings with practical information that can be applied to achieve successful results right away.

Paul is a sought after presenter and has consulted for organizations such as the Chicago Bulls, Australia’s Canberra Raiders, New Zealand’s Canterbury Crusader’s and the US Air Force Academy. Paul was the keynote speaker for the NZ Musculoskeletal Conference in 1998 and was rated number one speaker by participants at the 1998 IHRSA conference.

From 1992 to present, Paul has produced over 50 DVDs and advanced level home study courses designed for the fitness and clinical professional, such as his Scientific Core Conditioning and Scientific Back Training series. He is a regular contributor to several publications and websites. His book, The Golf Biomechanics Manual and course are PGA approved, and has been adopted for use by professional golf schools, as well as featured on the Golf Channel in 2000.

Certifications: Holistic Health Practitioner (California), Certified Neuromuscular Therapist, Clinical Exercise Specialist (ACE), Massage Therapist (CAMTC)

Testimonials From Peers

“Paul Chek's courses will give you a greater understanding and appreciation of the role that core strength and stability play in the development of an athlete”

-Al Vermeil, Strength Coach, Chicago Bulls

“Paul’s workshops and videos are easily understood and provide excellent tips on proper biomechanics. These programs are a must for anyone in the rehabilitative or exercise fields.”

-Darryl Curl, D.D.S., D.C.

“Paul's approach reflects a unique synthesis of scientific principles and clinical experience that the practitioner can immediately apply.”

-Jay Smith, MD