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KEEP BACK PAIN AWAY – ISOMETRIC EXERCISES CAN "PREHAB" THE TRUNK

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Jennifer Novak

The first part of this article presents a medical/exercise science prospective of low back pain and prevention strategy. The second part is a prehab prevention conditioning program. We encourage the baseball/softball-strength and conditioning coach to provide this information to their sports medicine professional to create discussion and strengthen their working relationship. ***- Ken Kontor, Publisher.***

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LOWER BACK PAIN (lbp) in the athlete is more common than one might think. Depending on the sport and positions within sports, current estimates of lbp at some point among athletes ranges from 18-65%, much higher than incidences of pain in either the thoracic (6% average) or cervical (4% average) ranges (Trompeter, Felt, & Platen, 2017). Over the course of an athlete's lifetime, one study proposed prevalence of lbp (at some point in an athlete's career) as much as 94%, with males reporting a higher incidence than females (Trompeter et.al., 2017)! In adult athletes, pain may typically be attributed to either muscular or ligamentous strain or a lumbar disc issue, or what's known as non-specific low back pain (Trompeter et.al., 2017). Youth athletes may be more prone to back pain due to a spondylolisthesis, or anterior slippage of one vertebra over another – either by congenital defect or acquired.

However, it is the muscular system that comprises the **ACTIVE** restraints and allowances to proper motion, and therefore, supports and guards the more passive structures like the ligaments, bones, and discs of the lower back region. While the use of resistance training to improve muscular strength and support of the spine has been well-documented, here may be a point where training intensity and volume, combined with the repetitive motions of certain sports and/or sport positions, may place one at risk for developing this ubiquitous condition. Knowing this, current research would also suggest that improving muscular function through on-demand contractile capability, with mobility throughout the sports ranges of motion and muscular stamina would be of utmost importance in the prevention of low back pain that would hinder performance.

ISOMETRIC EXERCISE has a rich history with athletes in terms of improving strength, hypertrophy, and power from the likes of Charles Atlas and Arnold Swarzenegger (bodybuilders), Bruce Lee (martial artist), and Alexander Zass (strongman). Lately, isometric exercise is trending as a safe and versatile means to promote preventative strength (Ryu, Park, Park, & Park, 2015), stamina (Ryu, et.al., 2015), firing rate (Del Balso & Cafarelli, 2006), and tendon stiffness (Blackburn & Norcross, 2014), among

other benefits, depending on targeted design and strategic application.

THE SAFETY and **VERSATILITY** of isometric exercise provides endless combinations of exercise design because the joints remain stable during the contractions and the exercise can be adapted to numerous joint angles/positions. Changes to variables like intensity, volume, duration and/or velocity of contraction, direction of force, involving single or multiple joints, executing them unilaterally or bilaterally, changing the work:rest ratio, and more, can provide nearly endless manipulations to reach preventative and performance goals. While they're not intended to REPLACE dynamic exercise, isometrics can go a long way in improving **MUSCULAR RESPONSIVENESS** at both central (brain) and peripheral (neuromuscular junction) locations (Mafiuletti & Martin, 2001; Del Balso & Cafarelli, 2015).

ISOMETRICS = PVMC

For the purposes of this article, we will rename the targeted isometrics **POSITIONAL, VOLITIONAL MOTOR CONTROL** exercises, or **PVMCs**. Why? Because one of the first reasons for using an isometric is to improve motor control by stimulating multiple brain areas concerned with the planning, coordination, and execution of both training and sport movement. Passive interventions in which we engage to change tightness in a muscle or muscle group will only stimulate one brain area, the somatosensory cortex within the parietal lobe (contralateral to the side we address). PVMC exercises create a bridge that takes the somatosensory input and with active participation of the athlete, reaches the other parts of the brain within the timeframe that stretch reflexes, joint mechanoreceptors, and proprioceptors are going to provide different input to the same area, but will also reach places like the following to assimilate and utilize the new information to assist in motor control and learning. For single joint, unilateral PVMCs, these important brain areas are stimulated:

1. MOTOR OUTPUT (contralateral primary motor cortex)
2. COMPLEX MOVEMENT PLANNING (SMA)
3. PLANNING/EXECUTION (Putamen)
4. REWARD (Pallidum)
5. MOTOR TONE (Cingulate cortex)
6. MOVEMENT COORDINATION/EXECUTION (ipsilateral cerebellum) and
7. PROCESSING SENSORY INPUT (Ipsilateral parietal lobe/somatosensory cortex)

By changing to a multi-joint PVMC, you'll also be adding
1. COMPLEX MOVEMENT AND MULTI-JOINT COORDINATION (premotor cortex) and
2. BODY MAPPING/COMPLEX SPATIAL AWARENESS (somatosensory association cortex)

To the motor control and task learning list. This broad range of CNS stimulation and utilization is why **PVMC** exercises inserted into a training program may be of great importance to overall performance.

Referring back to safety and versatility, the ranges of the aforementioned variables will be confined to promote prehabilitative benefits, which is designed to make one **LESS VULNERABLE** to low back injuries common to sport by promoting core stiffness (Lee & McGill, 2015) and muscle activation (Mafiuletti & Martin, 2001; Del Balso & Cafarelli, 2015). The exercises are for the most part universal in ability and effect, but of course, let pain be your guide and modify any of the exercises to pain-free range of motion or force tolerance levels.

THE FOLLOWING EXERCISES can be executed as part of the strength training regimen, but may most comfortably fit into a mobility session, or as part of a warm-up. Remember, these particular intensities and volumes listed are designed to be **PREVENTATIVE**, protecting the core from potential episodes of lbp.

EXERCISES 1 AND 2 (ANCHORING ANTERIOR AND POSTERIOR CHAIN)

- Foundational multi-joint core exercises
- Research backing up the benefits
- Completed before any or each training session, time permitting, or at least twice per week
- PVMC exercises offer both acute and chronic effects, so completed regularly, during any season, can be a good thing

EXERCISES 3A, 3B (Trunk Rotation Power)

- 3A is designed to emphasize ipsilateral trunk rotators
- 3B is designed to emphasize contralateral trunk rotators
- Both are used in batting and pitching motions
- Changes to height of cable used as indicated by height of athlete

EXERCISE 4 (Unilaterally-based trunk flexion stamina)

- To be used if movement analysis reveals gait-related trunk asymmetries or one side of anterior core less responsive or active than the other
- Place within warm-up or corrective
- Cueing to use trunk/core as opposed to extremities important

EXERCISE 5 (Unilaterally-based spinal muscle activator)

- To be used as warm-up or corrective
- Used if movement assessment or postural observation reveals asymmetries in spinal muscle activity
- The athlete self-reports as he/she raises the ball toward the forehead when he/she feels the erector spinae engage to support the load, then hold there for the PVMC

EXERCISE 6 (IMTP)

- To be used after any form of passive intervention changing joint ROM
- NOT a max lift – about 50% effort
- Enough to give every joint above and below area of passive intervention opportunity to provide new sensory input to the CNS for utilizing before loading in training

1. ANCHORING THE ANTERIOR CHAIN

EQUIPMENT:

- Mat
- Training partner
- Possibly small ball or yoga block (see below)

WHY:

This exercise was used as part of a study in a Korean University to find better ways of engaging the **TRANSVERSUS ABDOMINIS** muscle, a lower abdominal muscle that is key in supporting the lumbo-pelvic complex and stabilizing the lumbar spine.

HOW TO EXECUTE:

- Lie supine, arms by the sides of the body, dorsiflexing the feet.
- Have a partner hold onto your feet, and with the chin tucked, lift upwards into a small core lift (up to the shoulder blades), reaching fingertips toward your partner and breathing, drawing the navel up and in toward the spine.
- Simultaneously pull the feet into further dorsiflexion (toes toward nose), until you feel the abdominal muscles below the navel engaging. Hold for 10 seconds, rest for 10 seconds, and repeat 4-5 times.

TRAINING TIP:

If your athlete is **QUAD DOMINANT**, they may not initially be able to feel lower abdominals engaging in this exercise. Have them squeeze a lacrosse ball, or small side of a yoga block, between their thighs to take some of the effort away from rectus femoris, and they should start to feel the transversus engaging.

BONUS PREVENTION FOR COMMON BASEBALL/SOFTBALL INJURY: HAMSTRING STRAINS

This **PVMC** has been shown to not only improve activation of the **TRANSVERSUS ABDOMINIS** muscle – a key muscle for providing support to the lumbar spine – but can also improve performance of the **ACTIVE STRAIGHT LEG RAISE**, used frequently to assess hamstring mobility. Wan et.al. (2017) found that hamstring mobility is correlated with incidence of hamstring strain. Hamstring strains can take an athlete out of play for 3-6 weeks depending on severity, therefore, creating a stable and strong core may also help attenuate the aberrant level of demand placed on the hamstring.

2. SECURING THE POSTERIOR CHAIN, STABILIZING THE SI JOINT

EQUIPMENT:

- Glute-ham apparatus or
- Secure, low-positioned bar or
- Trainers hands for supporting lower legs

WHY:

By combining the lateral hamstrings with gluteus maximus activation on the same side, and multifidus on the opposite side, a sturdy force vector is achieved for anchoring the sacrum between the ilia (hip bones) on both sides, thereby preventing any aberrant shear forces on the L5-S1 junction (between the lower back and sacrum).

HOW TO EXECUTE:

- Can be done either on a glute-ham apparatus or on the floor (shown).
- The athlete's thighs are slightly externally rotated to bias for the lateral hamstring group, also known as biceps femoris.
- Lower legs hooked under the rollers on the glute-ham machine or other stable bar with enough room to create about 130 degrees of knee flexion (or can be done manually with a partner cupping the heels or ankles)
- Draw the weight of the navel off the floor (or stabilize on glute-ham), and lift into a small amount of extension through the spine, arms reaching toward the feet to encourage scapular stability
- Breathe through the exercise, holding 10 seconds, resting 10 seconds, and repeating 4-5 times.

TRAINING TIP:

If using and glute-ham apparatus and the athlete feels discomfort in lower back or SI area, move them to the floor or a table to provide a greater base of support

3. TRUNK ROTATION (3A, 3B)

As a bonus for **BASEBALL** and **SOFTBALL HITTERS**, these **PVMC** exercises have been shown in research at high intensities to improve BATTING VELOCITY (Higuchi, et.al., 2013).

EQUIPMENT:

- Adjustable cable machine with handle or
- Resistance band with stable place to anchor

WHY:

Many athletes have some level of trunk rotation involved in sport movement, particularly in baseball/softball. Providing a **PVMC** exercise that includes trunk rotation can help prime that movement pump. Oblique strains seem to be no stranger to baseball and softball athletes, and training regimens are emphasizing resilience in this important movement pattern.

HOW TO EXECUTE:

3A

- The athlete is holds a cable (with about 30 lbs resistance loaded on it) close to the body at waist height, palm supinated
- Utilize trunk rotation to push the resistance away from the machine
- Keep pelvis neutral
- Hold 10 sec, rest 10 sec, repeat 4-5 times

3B

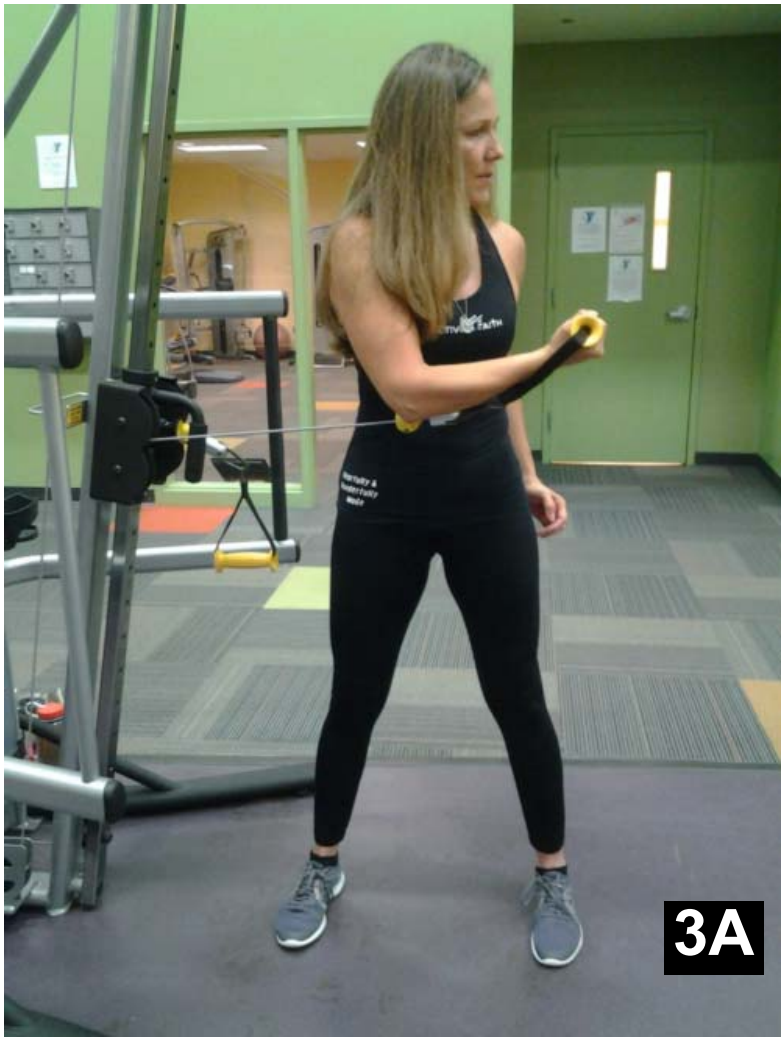
- The athlete holds a cable (with same load as 3A, above) close to the body, this time at chest height, palm pronated
- Adjust the height of the cable accordingly (chest level)
- Utilize trunk rotation to pull the resistance with the opposite side of the core
- Keep pelvis neutral
- Hold 10 sec, rest 10 sec, repeat 4-5 times

TRAINING TIP:

This can be executed sitting as well if needed but keeping the hips parallel with the cable will help emphasize trunk rotation. Hold the end comfortable range of trunk rotation with a neutral hip. If the athlete is ready, these can be used with graded amount of trunk rotation, starting small and increasing as the athlete is able to keep the pelvis neutral and there is no pain.

BONUS FOR BASEBALL/SOFTBALL ATHLETES: BATTING VELOCITY

This particular **PVMC** exercise was adapted from a Japanese study that found these two isometrics, executed at maximal force for 5 seconds, resting 5 seconds, and repeating 5 times against a stable cable with handle provided chronic effects better than weighted bats for improving bat velocity (Higuchi et.al., 2013). It might be worth pursuing as an adjunct to other training methods if swing velocity improvements is part of the needs analysis.



4. UNILATERALLY-BASED TRUNK STIFFNESS WITH FLEXION

EQUIPMENT:

- Medicine ball (10 lb. ball shown here)

WHY:

This **PVMC** is shown biasing for the right side of the obliques and rectus abdominis muscles. If it's discovered that your athlete has one side stronger than the other, this can be used only for that side, or done on both sides alternating.

HOW TO EXECUTE:

- Using a modified V-sit, with heels on the ground
- Hold 10 lb medicine ball in one hand, palm facing upward
- Hugging the ball close to the body, as the athlete leans back with a neutral pelvis and trunk, the right side of that trunk will be forced to engage to keep the athlete "centered"
- Breathing through it, hold 10 seconds, rest 10, repeat 4-5 times.

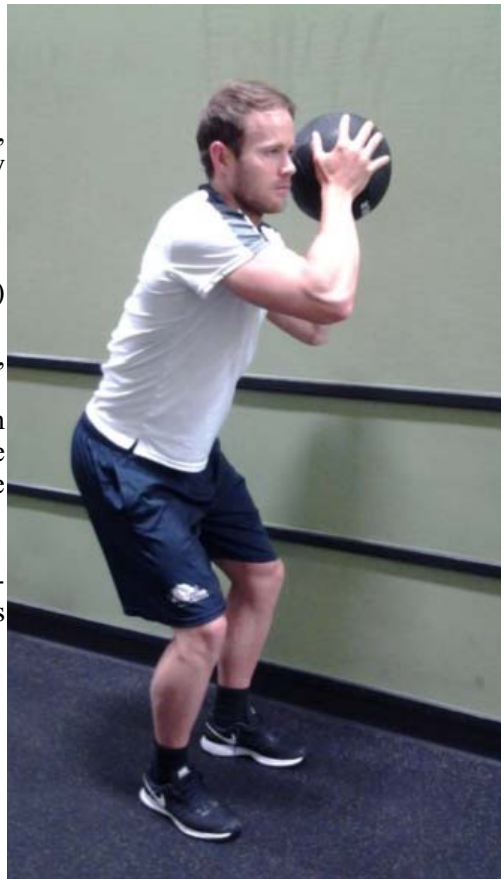
TRAINING TIP:

Pelvic and trunk alignment should be closely monitored, and if the athlete looks "shaky", have them lift the chest up into a higher V to eliminate the shake.

5. UNILATERALLY-BASED ERECTOR SPINAE ACTIVATION

EQUIPMENT:

- Medicine Ball (10 lb. shown here)



WHY:

If movement or postural analyses reveal unequal activation of the spinal muscles, this **PVMC** can unilaterally stimulate activity in the erector spinae group; it is also easily modifiable to current levels of force tolerance.

HOW TO EXECUTE:

- This version is biased for left side erector spinae activation
- Stand in "ready" stance and have them hold a 10 lb medicine ball (lighter if needed) in both hands, close to the chest
- Move the ball over the left pec major muscle, then have them begin lifting the ball, staying close to the body, up toward the nose/forehead
- When the athlete says he/she can feel the spinal muscles engaging to keep them from "falling" forward with gravity pressing on the mass of the ball, have them hold there
- 10 seconds hold, 10 seconds rest, repeat 4-5 times. As always, breathe through the exercise

TRAINING TIP:

Check pelvic to spinal alignment during this exercise, and maybe go back to exercises 1 and 2 if the athlete is unable to maintain a quality hip hinge with spine and hips aligned, or if they start laterally flexing toward the side of the ball.

6. GIVE EVERY JOINT A VOICE

EQUIPMENT:

- Squat rack
- Olympic bar
- Enough plates to hold bar stationary

WHY:

Whenever we stretch, or foam roll, or get a deep tissue massage, there's a need to get all the muscles and joints reintegrated into the idea of moving again. If a passive intervention is used to improve range of motion, the sensory reporting system, both in joint mechanics and muscular excitatory/inhibitory mechanisms, has changed, but only one area of the brain (the somatosensory cortex, mentioned earlier) is hearing this information (Mima, et.al., 1999). For this reason, I have a go-to exercise that most, if not all, of my athletes are given after any such passive intervention to help integrate new information into the motor planning fold.

By utilizing an isometric mid-thigh pull (at about 50% of what you feel you "could" do), the ankle, knee, hip, spine, and arm areas are given an opportunity to send new sensory information to the brain for assessing and eventually planning, coordinating, and executing movement using the new info. Earlier in this article, the number of brain areas stimulated with isometrics was listed, including the motor and premotor cortices, areas concerning balance and coordination, and areas concerned with body mapping and complex spatial awareness are also getting a workout (Yoon, et.al., 2014; Albein, et.al., 2013). The CNS needs this kind of input in a safe environment (motor control and learning calls that "constraints") to begin utilizing changes done peripherally via feedback and feedforward communication loops.

HOW TO EXECUTE:

- Feet shoulder's width apart, chest, toes, and knees pointed forward
- Hinge at the hip, gripping the bar at shoulder's width (both sides of this machine are loaded as heavy as possible) and pull as if finishing the concentric phase of a deadlift.
- Core engaged
- Use approximately 50% of a max effort
- Breathe through the exercise, holding for at least 15 seconds, resting the same amount, and repeating 3-5 times

TRAINING TIP:

Again, this is not designed to be a "max" effort, but working at about 50% effort, the IMTP can be used as a "reporting tool"

to allow every joint to report new positional and stretch/deformation information to the CNS for planning and coordinating movement with new joint mechanics and muscle function.

PUTTING IT ALL TOGETHER

By understanding force application and being aware of the form and force tolerance of the body in front of you, the **SAFETY** and **VERSATILITY** of **PVMC** exercises can be utilized to promote better motor control through

1. Active client engagement
2. Stimulation of multiple brain areas
3. Reinforcing muscle synergies
4. Improving muscular responsiveness and resilience

****IF YOU DO ACQUIRE LOW BACK PAIN, THE TOOLS ARE ALSO RIGHT HERE***

Find your athlete suffering a bout of low back pain? Of course, seek a medical professional to rule out any pathologies needing immediate attention, but the good news is that the first two **PVMCs** in this article (anchoring/securing the anterior and posterior chains) have been used in studies to reduce pain, increase muscle activation of key core muscles, and decrease what's called anticipatory postural adjustment delay (a delay in the reflexive muscular activity of deep spinal muscles in anticipation of extremity movement). The efforts aren't maximal either; the studies report that acutely, pain should be reduced and reflexive spinal activation should improve; motor control-related autonomous activation is improved centrally and peripherally within 3 weeks (Massé-Alarie, et.al., 2016). In fact, applying these two isometrics for 5 seconds work: 5 seconds rest, repeating 5 times 3x per week in addition to reduced training load can have quite positive outcomes. That's not a lot of time to dedicate to better low back function! O

More Information Please! Contact PEAK Symmetry Performance Strategies at **www.symmetryperformance.com** or Jennifer directly at **jennifer@symmetryperformance.com**

Net Link: References:

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