THORACIC MOBILITY

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Whether you are throwing a ball, swinging a club, or evading a grappling opponent on the mat, impeded trunk rotation and thoracic and pelvic dissociation—separation in opposite directions—may biomechanically be a contributing factor of performance deficits and injury. The loss of required thoracic spine ranges of motion for sport movements can be problematic for the elite athlete, as well as the weekend warrior. No matter what level of competition, athletes are required to access the transverse plane to produce power and excel in most sport or physical activities. Limitations in mobility can occur for different reasons including bony impingement, soft tissue hypertonicity or adaptive shortening, motor control deficits, a reduced tolerance for physiological stress (fitness), or even pain and the fear of pain. In this article, the first three listed will be the focus because restrictions in thoracic mobility may require compensatory extremity movement beyond physiologically acceptable ranges, which can lead to injury.

The purpose of this article is to explore biomechanical causes for restriction as well as provide easily applicable techniques to restore mobility. Strategies for restoring thoracic mobility in the transverse (rotational) plane should first consider the sagittal and frontal planes where flexion/extension and abduction/adduction occur, respectively. If the spine is restricted to a chronic pattern of extension with the ribs in external rotation (Figure 1), the vertebral architecture does not allow for transverse plane movement. The architecture of the posterior elements of the spine make contact as the spine is extended, thus suggesting limitations in subsequent

FIGURE 1. INHALATION/EXTENSION

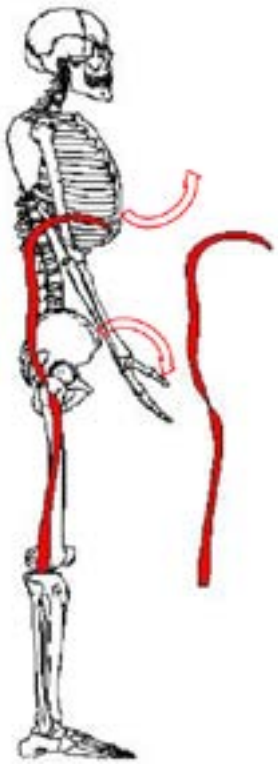

FIGURE 2. EXHALATION/FLEXION

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frontal and/or transverse plane movements (1,4,5). Thus, it is important to ensure thoracic rotation does not occur with excessive concomitant extension. By promoting an exhalation bias (Figure 2), the athlete can better access the frontal and transverse plane ranges of motion. For lack of a better term, this can be called a "neutral spine" position. A "neutral spine" position can be considered a transition zone where the spine is neither extended nor flexed with a normal curvature to the lumbar and thoracic spines—mid-range lordosis and kyphosis, respectively.

This is not meant to imply that extension is deleterious to sports performance. In fact, extensor strength is needed to perform most strength and power movements. However, appreciation of vertebral column and rib cage anatomy as well as biomechanics suggests that hyperextension is not favorable to thoracic mobility (1,4,5). For example, the posterior articular facets when first predisposed to spinal extension are in greater contact with each other and may contribute to limiting spinal mobility for rotation and sidebending. Therefore, it is important to restore sagittal plane mechanics by flexing the spine out of hyperextension—towards a "neutral spine"—to access the proper joint positions and in turn, joint actions, in the frontal and transverse planes. Faulty joint position leads to faulty joint action.

The concept of a "neutral spine" should first be cultivated under low duress to establish motor control before incorporating substantial load or speed. Deliberate breathing that emphasizes exhalation can help to favorably position the spine and rib cage reflexively by promoting rib retraction, depression, and internal rotation (2,3,4). These movements flex the spine out of extension and more toward "neutral" in individuals who gravitate towards hyperextension (Figure 2). Additionally, it is important for athletes to be able to dissociate their pelvis from their rib cage in order to create torque for power output. The dissociation required for rotational power is built into the exercises below in order to help train for the positional demands needed for sport performance. In the following exercises, breathing is the driver to improving mobility by changing the position of the rib cage. Purposeful muscle activation is needed to make these areas of the thorax more receptive to airflow and to allow the breath cycle to influence motor control away from hyperextension. Beyond utilizing these techniques to improve mobility, the athlete must train these new ranges and display strength and power capabilities. The following techniques originated and have been modified with permission by the Postural Restoration Institute® © 2016 www.posturalrestoration.com.

MODIFIED ALL FOUR BELLY LIFT BEAR (FIGURES 3 – 4)

1. Place the hands below the shoulders and the knees below the hips
2. Reach the back towards the ceiling, but do not allow the pectoral muscles to get engaged
3. Keep the shoulders away from the ears when leaning forward
4. Raise the knees two inches from the floor while keeping in this position
5. Maintain this position for 3 – 5 breaths
6. Repeat two more times

FIGURE 3. MODIFIED ALL FOUR BELLY LIFT BEAR – START

FIGURE 4. MODIFIED ALL FOUR BELLY LIFT BEAR – FINISH

90 – 90 SUPPORTED ALTERNATING CROSSOVER WITH INTERNAL OBLIQUE AND TRANSVERSUS ABDOMINIS (FIGURE 5)

1. Pull the heels down to reach the knees towards the ceiling
2. Feel the hamstrings as the low back lowers toward the ground
3. Lift the right foot up while straightening the right knee
4. Reach the left hand towards the ceiling
5. Maintain this position while blowing up a balloon, pausing for 3 – 5 s during each exhale
6. Switch sides and repeat two more times

SIDE LYING TRUNK LIFT WITH HIP SHIFT (FIGURE 6)

1. Lie on the side with the knees and hips bent at 90 degrees
2. Drive the elbow and forearm into the floor to round out the upper back
3. Push the knees into the floor to lift the hips in the air and round the lower back
4. Shift the top knee in front of the bottom knee
5. Reach the free hand to the ceiling and turn the head to watch it
6. Hold this position for 3 – 5 breaths
7. Switch sides and repeat two more times

FIGURE 5. 90 – 90 SUPPORTED ALTERNATING CROSSOVER WITH INTERNAL OBLIQUE AND TRANSVERSUS ABDOMINIS

FIGURE 6. SIDE LYING TRUNK LIFT WITH HIP SHIFT

FIGURE 7. WALL-SUPPORTED HIP SHIFT WITH REACH

WALL-SUPPORTED HIP SHIFT WITH REACH (FIGURE 7)

1. Stand about 7 – 10 in. from a wall while holding a 4 – 6 in. ball between the knees
2. Reach the tailbone to the floor with a slight knee bend to press the lower back inon the wall
3. Only allow a little bit of pressure from the back to press into the wall
4. Shift one knee forward and reach toward the floor with the opposite hand while rounding the back
5. Hold this position for 3 – 5 breaths
6. Switch sides and repeat twice more

For each exercise, a general guideline to follow is about three sets of 3 – 5 breaths in each position. Breaths should focus on a forceful and elongated exhalation phase with a gentle subsequent inhalation—in through the nose and out through the mouth. Time-wise, a 2-s inhale followed by a 4 – 6-s exhale with a 4 – 6-s pause before the next inhalation is considered an appropriate breath. Clinical experience suggests performing these exercises twice per day in order to be sufficient enough to progress the exercises within 2 – 4 weeks, based on objective changes. Performing a mixture of these exercises before and after a performance training session as part of the movement preparation and dynamic warm-up is considered an appropriate strategy.

Though individuals respond differently to the interventions listed above, immediate objective changes in mobility typically occur. However, these changes should not be expected to last long-term without dedicated execution of these exercises on a regular basis and/or further progression to more advanced activities. The exercises listed are some lower-level options while over the subsequent weeks and months they would be replaced with higher level exercises that progress in intensity, coordination, and motor control demands as needed, which is much more individualized and beyond the scope of this article.

Coaches should consider the biomechanical concepts within this article to be an important piece of the performance training puzzle. Reducing excessive spinal extension patterning during training should be the goal to maintain optimal spinal mechanics for athletic endeavors. For example, hip hinging, squatting, pressing, and pulling movements in the gym should occur with a "neutral spine" position without hyperextension—under load—at all ranges of extremity movement. The focus should be on proximal stability to train the appendages for loaded mobility. Proper technique under load is key to making any changes in restriction last. Correcting a restriction will be fleeting in nature if the aforementioned biomechanics aren't carried over into training.

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