THE
CrossFit JOURNAL

Analyzing the Handstand Position

Identifying and correcting range-of-motion, stability and technique issues will pay dividends when athletes are upside down.

By Zachary Long and Jennifer Iskat July 2015

Hai Tran

CrossFit demands that its athletes have the capacity to perform a wide range of movements and skills. Many exercises commonly used in CrossFit are also frequently used by athletes participating in other sports. However, the handstand—fundamental to gymnastics—is a rarely employed training tool in other sports but an essential part of CrossFit.

Anderson Vieira

"Being upside down exposes the athlete to, what is for many, a brand new world." —Greg Glassman, "Handstands"

The handstand requires considerable amounts of both joint mobility and stability if it is to be performed with optimal technique. Of CrossFit's 10 fitness domains, the handstand (and its progressions) requires six: strength, flexibility, coordination, balance, agility and accuracy (3,4). Some degree of stamina is also required for lengthy holds, and Event 4 in the recent CrossFit Games regionals added an element of speed as athletes walked 250 feet on their hands for time.

The basic handstand distinguishes itself from other skills because it provides an unconventional way of strengthening the shoulder complex. The typical athlete strengthens the shoulder and other joints of the body in the upright position. When standing and walking, the hip is the focus and must have sufficient strength to support body weight and provide stability.

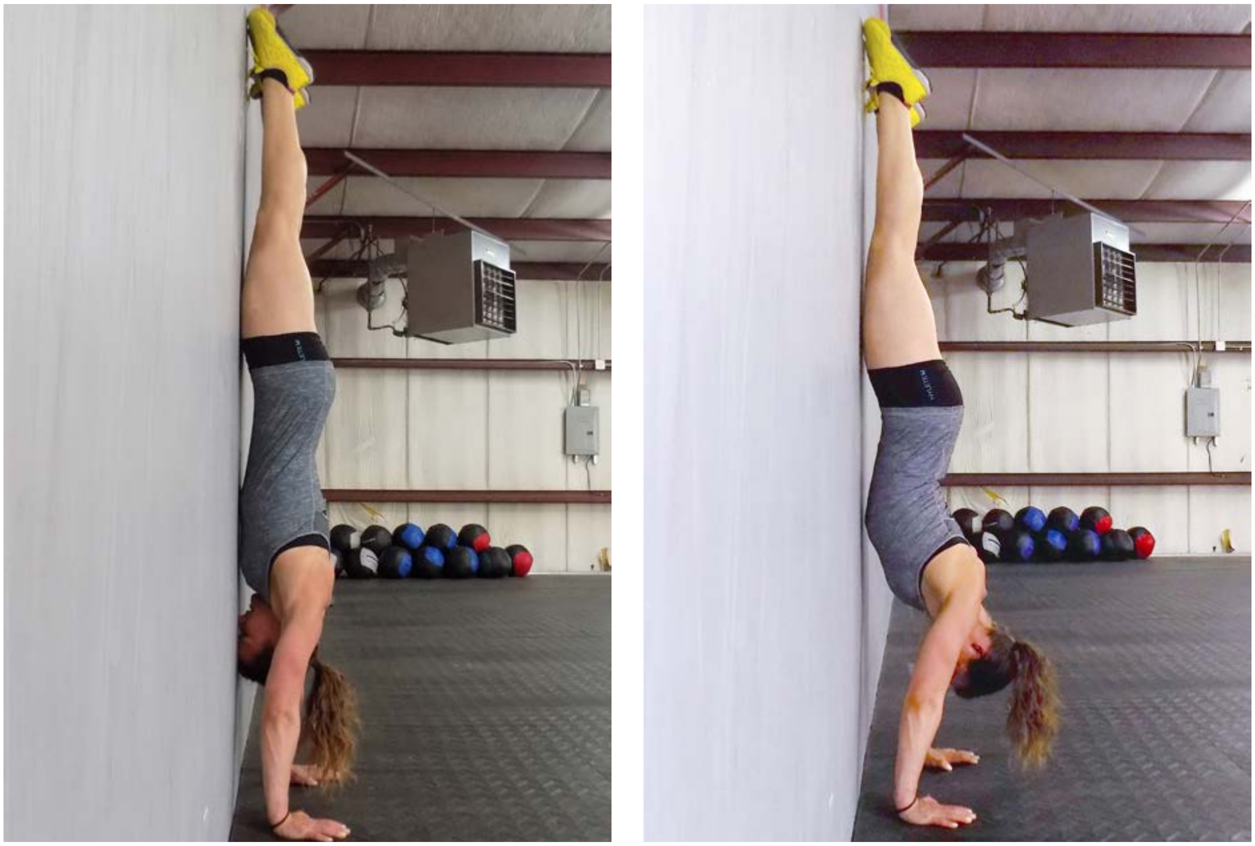
The handstand, however, reverses the conventional approach. The shoulder becomes the main joint providing stability to the body. This inverted position helps develop "shoulders strong as hips," increasing shoulder strength in ways other skills or weight-training exercises cannot (4). Because of the inverted position, increased demands are placed on the wrists, elbows and shoulders, as these three joints become the body's weight-bearing joints. An analysis of the joints and muscles involved in a handstand can help identify limitations that must be addressed to perfect this skill and improve athleticism.

Handstand Analysis

To best analyze handstand positioning, we suggest a wall-facing handstand with hands shoulder width apart. This allows for the easiest visual analysis of joint positions. Positioning the hands at shoulder width challenges shoulder mobility more than a wider stance would. The hands should be flat on the ground and pointed away from the wall with the fingers splayed. This position challenges wrist extension and provides a slightly larger base of support with the fingers spread. The athlete should strive to keep the chest, front of the thigh and top of the foot against the wall.

If positioning is lost with breathing, the athlete is likely holding the breath as a means of creating false stabilization.

Analysis of the handstand should begin at the wrist and then move upward. From the side, the coach or partner should examine wrist extension by looking to see if the forearm is perpendicular to the ground. At the elbow, the coach or partner shoulder look for full extension. Moving to the shoulder, the joint should be fully "opened up," with the humerus nearly vertical. The lumbar spine should be in a neutral position without excessive arching, and the hips should be fully extended. The athlete should be able to complete several breath cycles without losing this positioning. If positioning is lost with breathing, the athlete is likely holding the breath as a means of creating false stabilization.



Courtesy of Zachary Long

A handstand performed with proper form (left) versus a handstand performed with limited shoulder flexion, excessive lordosis and unopened hips

If an athlete's form deviates from that described above, the coach or partner should provide verbal and/or tactile cueing to improve positioning. This feedback will allow the coach to see if the faulty positioning is due to an athlete's limited knowledge of correct positioning or the athlete's having a mobility or stability deficit preventing proper positioning, which would warrant further investigation.

Joint-Specific Testing

Due to the inverted position of the body, the wrist has a much more significant role in the handstand than it does in any other CrossFit movement. Without sufficient range of motion in the wrist, an athlete will have to compensate elsewhere in the kinetic chain, leading to poor positioning of the shoulders, lumbar spine or hips. This would be similar in nature to the effects of poor ankle range of motion leading to improper mechanics in the knees, hips, torso or shoulders during an overhead squat.

If range of motion at the wrist is limited, specific testing can provide insight as to whether the deficit is caused more by joint stiffness or muscular inflexibility. To test, we start with the palm and fingers flat on a box with the elbow extended (see Page 4). The athlete then moves the wrist into maximum extension and observes the angle of the forearm relative to the box. Next, wrist extension in retested with the fingers off the end of the box while keeping the palm flat. Optimal mobility in both positions should have the forearm approximately vertical. If the second position has greater mobility, wrist extension is more likely limited by flexibility of the wrist-flexor muscles. If range of motion is limited in both positions or the athlete feels a pinch in the wrist joint during testing, wrist extension is more likely limited by the wrist joint itself. Corrective exercises for these limitations will be discussed later.

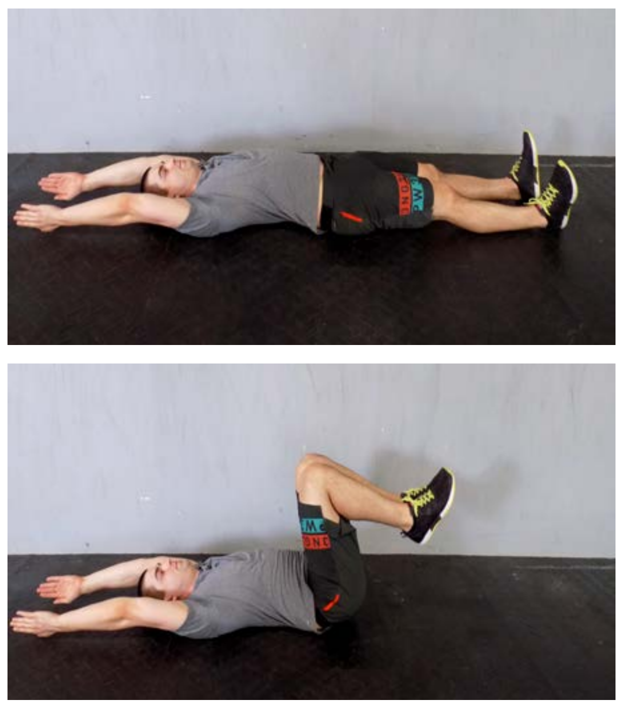
To test flexibility of the pectoralis major, have the athlete stand completely upright with the elbow bent to 90 degrees and raised to shoulder height, the fingers pointing upward and the palm facing away. The forearm should rest against a stable vertical structure such as a squat-rack upright. Have the athlete stretch the arm back while watching him from the side. If he has good flexibility of the pecs, the forearm can be stretched to a point behind the shoulder joint. If the athlete is unable to reach this point, pec flexibility should be addressed. It is important to note that this test should not be administered to individuals with instability of the shoulder.

To test lat flexibility, examine an athlete's overhead shoulder motion first when he's lying on his back with legs flat on the ground and then with hips flexed to 90 degrees. The athlete raises the hands as far overhead as possible with the arms staying parallel (no deviation to the sides) and leading with the thumbs. If overhead motion is decreased with the hips flexed, lat tightness is present (1). Be sure to also watch the athlete's lumbar spine during the test, as excessive arching of the back when the legs are flat will alter the test. If overhead position is unchanged and less than full range of motion is seen in both positions, flexibility limitations may be present in the teres major or minor, subscapularis, rhomboids, thoracic spine or gleno-humeral joint capsule. Flexibility testing for other structures such as the teres muscles, rhomboids and levator scapulae can be very difficult and is best addressed using test-treat-retest principles, to be discussed below.

The thoracic spine and shoulder complex are closely related in their function. Often, limitations in overhead mobility are associated with decreased thoracic mobility. The lumbar-locked internal-rotation test allows for assessment of thoracic-spine rotation and extension (see Page 5). To perform, have the athlete sit on his heels with one arm flat on the ground in front of his or her knees and the other behind the back. The athlete then rotates toward the back arm without shifting weight to either side. The raised shoulder should create an angle of 50 degrees or more relative to the ground (1). Decreased rotation to one side would indicate thoracic-rotation restriction to that direction, and decreased motion to both sides would indicate a thoracic-extension limitation.

Many athletes who cannot maintain a neutral spine during the handstand do so as a compensation for limitations elsewhere. Therefore, assessing and treating dysfunctions in the shoulder and wrist should be performed prior to addressing those in the lumbar spine (2).

Assess wrist extension with the fingers flat on a box (top) versus off the end of a box to help identify whether range-of-motion deficits are caused by muscular or joint issues.



Courtesy of Zachary Long

Flexibility of the latissimus dorsi muscle is assessed by evaluating shoulder range of motion in the supine position with the hips extended (top) and flexed.

The lumbar-locked internal-rotation test can be used to analyze thoracic rotation and extension.

Courtesy of Zachary Long

A resistance band can be used to measure the point at which an athlete can no longer maintain a flat back while lowering the legs.

For those requiring evaluation specific to midline stabilization, we suggest two tests. First, the trunk-stabilization push-up has been previously discussed in the April 2015 CrossFit Journal article "The Hip and Athletic Performance." A more objective test can also be employed. Attach a resistance band to a squat rack or other stable surface. Apply tension to the band before having the athlete lie supine with the band running under and perpendicular to the lumbar spine. Begin with both legs vertical and the knees extended. The athlete then lowers both legs together while keeping the low back flat on the ground. The weight of the legs challenges the abdominal muscles' ability to resist lumbar extension. If the athlete loses neutral positioning of the spine, the resistance band will slide under the back. An athlete with great midline stabilization can lower the legs to just above the ground and back to upright without loss of core positioning. Lowering 45-80 degrees would indicate good but non-optimal control. Anything less than 45 degrees should be addressed quickly for both positioning during the handstand and midline stability in all CrossFit exercises.

Evaluation of hip-extension flexibility with the Thomas test was discussed "The Hip and Athletic Performance." This test is used to analyze flexibility of the rectus femoris and iliopsoas muscles—the primary muscles that flex the hip. To perform the Thomas test, have the athlete sit on the edge of a box or table and lie back while holding both knees against his or her chest. Then, passively lower one of the legs down. Examine the amount of hip extension as well as how much knee flexion is apparent at the bottom position. If the knee is not bent to 90 degrees, rectus femoris tightness is present. If the hip does not reach full extension, iliopsoas flexibility is the likely limitation. If the Thomas test is negative for inflexibility, cue the athlete to activate the glutes during the handstand to extend the hips.

Corrective Exercises

After testing to determine if wrist range of motion is limited by joint stiffness or muscular flexibility, an athlete can begin corrective exercises to target specific deficits. If wrist extension is limited by muscular tightness, the athlete can perform soft-tissue work by working a lacrosse ball or foam roller over the anterior forearm (the palm side). Stretching should follow soft-tissue work.

One very effective wrist-stretching exercise is performed when kneeling on hands and knees with palms down on the ground and fingers straight forward. The athlete will rock forward, moving the wrist into extension as far as his flexibility will allow. Tension or stretching should be felt in the inside of the forearm, indicating the wrist flexors are being stretched. Adequate flexibility is achieved when the athlete can hold the shoulders directly over the wrist or directly over the fingers for increased flexibility.

If wrist range of motion is more limited by joint stiffness, resistance bands can be used to perform mobilization of the joint. The athlete should position a resistance band around the wrist joint as close as possible to the crease in the hand, and the hand should be placed flat on a box or table. The other end of the resistance band can be attached to a rig or other anchor. The athlete should then move far enough away from the anchor to create tension. Most often, the band is used to provide a glide in the direction of the fingers as shown in the photo below, but a lateral glide in either direction can be employed as well. The athlete can then rock back and forth over the wrist.

If lat flexibility is found to be a limiting factor in shoulder range of motion, a combination of soft-tissue mobilization and stretching can be employed. An effective soft-tissue mobilization of the lats involves lying on the side with a foam roller placed directly along the lats. The athlete can then roll up and down and side to side.

Many stretches can be used for the lats, but we prefer having the athlete hold a band, ring or rig at about chest height. The athlete will bend at the waist and shift body weight backward, moving the hand overhead. A slight twist of the lower back/hips away from the extended arm will increase the intensity of the lat stretch.

As with the lats, a combination of myofascial release and stretching is great for improving flexibility of the pectorals. Following foam rolling or work with a tool such as a lacrosse ball, have the athlete stretch the pectorals in the same position described earlier for testing of pectoral flexibility.

The teres minor, rhomboids and levator scapulae are other muscles that commonly cause some limitation in the shoulders. As mentioned previously, these muscles can be identified through a process of elimination (test, treat, retest). An efficient way to target these muscles in soft-tissue work is by using a foam roller or a lacrosse ball to roll around the scapula at the superior and inferior angles, as well as between the spine and the scapula.

One other way to address soft-tissue restriction of the rhomboids is with an across-body stretch. The affected arm should reach across the front of the body at shoulder height while the other hand applies pressure at the elbow to pull the arm further across the body.

To target the thoracic spine, the athlete should assume a position on hands and knees and place one hand behind the head. He should keep the arm on the ground straight

Courtesy of Zachary Long

Utilizing bands to glide the joint can help athletes reduce joint stiffness and increase range of motion.

Repeatedly performing this movement can improve thoracic rotation as well as extension.

while rotating the chest toward the elevated arm. The rotated position should be held for three to five seconds before returning to the start position and performing several additional reps. Improving rotation bilaterally will improve extension as well.

With athletes demonstrating poor core stabilization, corrective strategies are extremely important because a lack of midline stabilization will affect performance in a wide range of movements.

Another technique, this one focused on thoracic extension, utilizes a foam roller. The athlete should lie on his back with the foam roller running across the spine at the shoulder blades. The athlete should then raise his arms overhead repetitively to improve thoracic extension. The butt and feet should remain on the ground to ensure mobility is coming from the spine. The athlete can also perform a hold in this position while grasping a weight to increase extension. This movement can be performed with the foam roller positioned at various levels of the thoracic spine to target different segments.

The 90-degree wall stretch is a great tool for improving both shoulder and thoracic range of motion at the same time. During this stretch, the athlete should stand facing a wall with feet about 3 to 4 feet away (depending on height), and then place the hands on the wall at shoulder height. The athlete bends at the hips, stretching the shoulders into end-range flexion by moving the torso toward to the ground. More flexible athletes will be able to lower the chest more than inflexible athletes. This stretch is even more effective when a partner applies some overpressure through the thoracic spine to increase the stretch.

With athletes demonstrating poor core stabilization, corrective strategies are extremely important because a lack of midline stabilization will affect performance in a wide range of movements. An improvement in core stabilization will carry over to many CrossFit movements and produce improved results. The previously discussed test for lower-abdominal strength also makes a great exercise for improving midline stability. As explained above, the athlete should lie supine with hips flexed to 90 degrees and the lower extremities raised to the ceiling. The athlete should slowly lower the legs toward the floor while the lumbar spine maintains contact with the ground. The athlete should find the last point at which he can no longer maintain a "flat back" determined by contact with the floor, and he should hold this position for 10 to15 seconds.

Courtesy of Zachary Long

The 90-degree wall stretch hits any limitation in overhead mobility between the shoulders and the thoracic spine.

The hips are the final joint assessed in order to improve positioning for the handstand. The couch stretch is a great tool for addressing flexibility of the psoas and iliopsoas muscles, as well as the rectus femoris. The athlete should kneel on the floor facing away from the wall. One knee should be placed as close to the wall as possible with the knee flexed and the top of the foot against the wall. The other knee should be at placed at 90 degrees with the foot flat on the floor in front while the athlete tries to extend the trunk and maintain a neutral lumbar spine (see Page 8).

In order to target the rectus femoris more effectively, the athlete should strive to increase knee flexion and hip extension of the back leg by placing the front foot so as to create a more upright trunk. The end goal should be for the gluteals to meet the ankle against the wall, with the trunk erect while the abdominals and gluteal muscles remain engaged to assist in maintaining a neutral spine.

Courtesy of Zachary Long

The couch stretch is a great way to address hip inflexibility caused by either the rectus femoris or iliopsoas muscles.

In order to address the iliopsoas more than the rectus femoris, the athlete may decrease the amount of flexion at the knee joint by leaning forward while sustaining the neutral spine position (preventing trunk flexion or lumbar lordosis).

Conclusion

Addressing limitations discovered through this testing will help the CrossFit athlete develop better positioning in the handstand. In turn, this improved positioning will allow the athlete to more easily progress to advanced gymnastics movements such as handstand walking. Overall, these improvements will also translate into better performance in other exercises requiring shoulder and hip mobility as well as midline stabilization.

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About the Authors

Zach Long is a physical therapist and CrossFit Level 1 trainer at CrossFit Kaiju in Matthews, North Carolina. He attended the University of North Carolina at Chapel Hill, where he majored in exercise and sport science, and East Carolina University, where he earned his doctorate in physical therapy. Zach specializes in the prevention of and rehabilitation from sports-related injuries. He currently runs TheBarbellPhysio.com and works at Carolina Sports Clinic in Charlotte, North Carolina.

Jennifer Iskat is a physical therapist in Charlotte. She attended Liberty University, where she majored in kinesiology with a specialization in exercise science. She later went on to Lynchburg College to earn her doctorate of physical therapy. Jenn trains at CrossFit Kaiju and has previously competed in track and field and gymnastics, and she has completed two ultramarathons. She is regularly sought out by CrossFit athletes looking to optimize performance and rehab injuries.