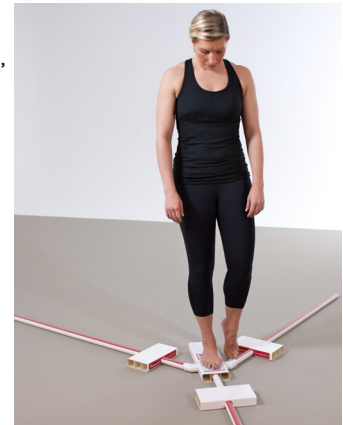


# Y Balance Test-Lower Quarter

## Purpose

The Lower Quarter Y Balance Test (YBT-LQ) is a dynamic test that requires stability, strength, flexibility, and proprioception of the lower quadrant of the body. This dynamic task requires the person to perform at his/her limit of stability.

It has been used to assess physical performance, identify chronic ankle and ACL instability, and identify athletes and military personnel at greater risk for lower extremity injury. Researchers have suggested including these tests in screening for activity participation. The YBT-LQ incorporates three movement directions (anterior, posteromedial and posterolateral). The goal of this test is to maintain single-leg stance on one leg while reaching as far as possible with the contralateral leg.



Starting Position

## Description

After giving the testing procedure instructions, have the client perform six practice trials in each of the three directions prior to formal testing. Start by having the client stand with the foot on the center foot plate, with the most distal aspect of the toes just behind the red starting line. While maintaining a single-limb stance, have the client reach with the free limb in one of three directions (anterior, posteromedial or posterolateral), and then return to the starting position.

Once ready to complete the formal testing, have the participant start with the right foot on the center of the foot plate and perform three attempts while reaching in one of the three directions. Then the participant will place the left foot on the center foot plate and repeat with the opposite limb. Alternating stance legs between trials will ensure adequate rest for accurate results.



Figure 1 Anterior Reach



Figure 2 Posterior Lateral Reach



Figure 3 Posterior Medial Reach

The maximal reach distance is measured by reading the tape measure at the edge of the reach indicator, at the point where the most distal part of the foot reached in half centimeters (e.g. 68.5, 69.0, 69.5 cm). Three trials in each direction for each foot will be collected and the maximal reach in each direction will be included for analysis. If there are failed attempts, perform a maximum of six trials in a single direction. If the participant has more than four failed attempts, a zero should be recorded for that trial.

# Reach Directions And Testing Order

The leg that is being measured is the stance leg. This simply represents the pattern and does not imply the functional ability of a body part or side. Reach is named in terms of directional relationship to the stance leg.

Once you are ready to complete the formal testing, have the client start with the right foot on the center of the foot plate and perform three attempts while reaching anteriorly. The best of the three reach attempts is recorded as the score for the right anterior reach. Then the participant will place the left foot on the center foot plate and repeat with the opposite limb. Alternating stance legs between trials will ensure adequate rest for accurate results.

The specific testing order is—

1. Right anterior reach (3 trials)
2. Left anterior reach (3 trials)
3. Right posteromedial reach (3 trials)
4. Left posteromedial reach (3 trials)
5. Right posterolateral reach (3 trials)
6. Left posterolateral reach (3 trials)

Three trials in each direction for each foot will be collected and the maximal reach in each direction will be included for analysis.

## Test Faults

Any of the following test faults invalidate a reach attempt:

- kicking push box
- not returning to starting position under control
- touching down during reach
- foot on top of stance plate

## Practice Trials

After you give the testing procedure instructions, have the client perform six practice trials in each of the three directions prior to formal testing. The Y Balance Test is a novel movement for most and it takes multiple trials for the client's learning effect to maximize.

In order to ensure that the maximal learning has taken place, once the testing starts the person should repeat the reaches at least 3 times or until a maximal reach is obtained. The reaches should be continued until at least two consecutive reaches are equal to or less than the greatest reach.

## Measuring Lower Limb Length

Determine the client's limb length by measuring the distance from the Anterior Superior Iliac Spine (ASIS) to the most distal aspect of the medial malleolus. Have the individual lie supine on a table, without socks and shoes. Start with both knees bent, feet flat on the table as if standing. Ask the client to raise the hips off the table, and return to the resting position. Straighten the individual's knees to fully extended. Pull on the legs at the malleoli to ensure legs are fully extended. On the client's right limb, palpate the most inferior distal surface of the ASIS and align it with the "0" zero line of a cloth tape measure. While holding the tape on the ASIS, extend the tape to the inferior distal surface of the medial malleolus of the right ankle. Record the measurement to the nearest 0.5 cm.

# Verbal Instructions For the Lower Quarter Y Balance Test

The following is a script to use while administering the Lower Quarter Y Balance Test. For consistency throughout all testing, this script should be used during each test.

Please let me know if there is any pain while performing any portion of the test.

Please remove your shoes while performing the test.

Place your \_\_\_\_\_ foot on the center of the foot plate with your toes just behind the starting line.

While maintaining the foot on the platform, push the reach indicator in the red target area as far as possible with the opposite leg.

The reach foot must maintain contact with the reach indicator on the target area while it is motion (i.e. cannot kick the reach indicator).

Do not use the reach indicator for stance support (i.e. place foot on top of reach indicator).

Return the reach foot to the starting position under control (i.e. return the reach foot to the floor behind the angle, next to the stance platform).

Do you understand the instructions?

The participant will perform each movement three times before alternating the supporting foot in the same direction. Once completed in the same direction for both feet, continue with the next direction.

Thus, because the Y Balance Test Lower Quarter is predictive of injury and can identify the motor control changes that occur after injury, it is imperative that it is included as part of the return to play criteria for athletes and discharge criteria for all patients.

Researchers have found that limb length is a small, but significant factor in how far someone reaches on the Y Balance Test. Therefore, limb length needs to be measured (from most inferior aspect of the anterior superior iliac spine to the inferior distal surface of the medial malleolus of the right ankle to the nearest 0.5 cm).<sup>14</sup>

Researchers have also found that there is a learning effect with the test which is why 6 practice trials are first performed and then 3 trials in each of the 3 directions for each foot (for a total of 9 trials on each limb). In the Y Balance Test research, the greatest reach (not the average reach) is used for analysis.

## References

1. Shaffer SW, Teyhen DS, Lorenson CL, et al. Y balance test: a reliability study involving multiple raters. *Military medicine*. 2013;178(11):1264-1270.
2. Plisky PJ, Gorman PP, Butler RJ, Kiesel KB, Underwood FB, Elkins B. The reliability of an instrumented device for measuring components of the star excursion balance test. *N Am J Sports Phys Ther*. 2009;4(2):92-99.
3. Faigenbaum AD, Myer GD, Fernandez IP, et al. Feasibility and reliability of dynamic postural control measures in children in first through fifth grades. *International journal of sports physical therapy*. 2014;9(2):140-148.
4. Plisky PJ, Rauh MJ, Kaminski TW, Underwood FB. Star Excursion Balance Test as a predictor of lower extremity injury in high school basketball players. *J Orthop Sports Phys Ther*. 2006;36(12):911-919.
5. Butler RJ, Lehr ME, Fink ML, Kiesel KB, Plisky PJ. Dynamic balance performance and noncontact lower extremity injury in college football players: an initial study. *Sports Health*. 2013;5(5):417-422.
6. Smith CA, Chimera NJ, Warren M. Association of y balance test reach asymmetry and injury in division I athletes. *Medicine and science in sports and exercise*. 2015;47(1):136-141.
7. Lehr ME, Plisky PJ, Butler RJ, Fink ML, Kiesel KB, Underwood FB. Field-expedient screening and injury risk algorithm categories as predictors of noncontact lower extremity injury. *Scand J Med Sci Sports*. 2013;23(4):e225-232.
8. Garrison JC, Arnold A, Macko MJ, Conway JE. Baseball players diagnosed with ulnar collateral ligament tears demonstrate decreased balance compared to healthy controls. *J Orthop Sports Phys Ther*. 2013;43(10):752-758.
9. Hannon J, Garrison JC, Conway J. Lower extremity balance is improved at time of return to throwing in baseball players after an ulnar collateral ligament reconstruction when compared to pre-operative measurements. *International journal of sports physical therapy*. 2014;9(3):356-364.
10. Mayer SW, Queen RM, Taylor D, et al. Functional Testing Differences in Anterior Cruciate Ligament Reconstruction Patients Released Versus Not Released to Return to Sport. *Am J Sports Med*. 2015;43(7):1648-1655.
11. Boyle MJ, Butler RJ, Queen RM. Functional Movement Competency and Dynamic Balance After Anterior Cruciate Ligament Reconstruction in Adolescent Patients. *J Pediatr Orthop*. 2016;36(1):36-41.
12. Sun L, Lin DE, Fan J, Gill TJ. Editorial: Functional testing in the assessment of return to sports after anterior cruciate ligament reconstruction. *Ann Transl Med*. 2015;3(16):225.
13. Garrison JC, Bothwell JM, Wolf G, Aryal S, Thigpen CA. Y Balance Test Anterior Reach Symmetry at Three Months Is Related to Single Leg Functional Performance at Time of Return to Sports Following Anterior Cruciate Ligament Reconstruction. *International journal of sports physical therapy*. 2015;10(5):602-611.
14. Gribble PA, Hertel J, Plisky P. Using the Star Excursion Balance Test to assess dynamic postural-control deficits and outcomes in lower extremity injury: a literature and systematic review. *Journal of athletic training*. 2012;47(3):339-357.

# Y Balance Test Upper Quarter

## Purpose

The Upper Quarter Y Balance Test (YBT-UQ) is a dynamic test where upper quarter mobility and stability are both maximally challenged. Stability of the stance arm, shoulder girdle and trunk is challenged at the same time that mobility of the reach arm, shoulder girdle and trunk is challenged. During each reach component, scapular stability, mobility, thoracic rotation and core stability are combined as you encourage the client to reach as far as possible without losing balance. By reaching as far as possible outside of a narrow base of support, the client is required to use balance, proprioception, strength and full motion.

This test is designed to test an individual's trunk and upper extremity while in a pushup position. The goal of the test is to maintain a pushup position while on the center platform of the YBT device and push the reach indicator with one hand as far medially and diagonally across the body in the inferolateral and superolateral directions.



Starting Position

## Description

Once you have given the client testing instructions, have the client perform two practice trials of all three reach directions sequentially on each arm prior to formal testing. The test will be completed with shoes off.

Start by having the participant place the right thumb just behind and parallel to the red line in a pushup position with feet shoulder-width apart and hands directly under the shoulders. The participant will push the reach indicator with the left hand in the red target area to the left as far as possible. While maintaining the same position, have the client push the inferolateral box as far as possible, and finally, push the superolateral box as far as possible without setting the reach hand down. Read the reach distances while the client rests, and then repeat the test two more times with the right hand on the stance plate. The client will then complete three trials in the same manner with the opposite limb. Unlike the lower quarter YBT, all three reach directions are performed sequentially, one right after another without setting the reach hand down between reach directions. When rested, the client will return to the starting position to perform the next trial.



Medial Reach



Inferolateral Reach



Superolateral Reach

Once ready to complete the formal testing, have the participant start with the right hand on the center plate and perform all three trials while reaching in the three directions in the specific testing order. Measure the maximal reach distance by reading the tape measure at the edge of the reach indicator, at the point where the most distal part of the hand reached in half centimeters (e.g. 68.5, 69.0, 69.5 cm). Three trials in each direction for each arm will be collected and the maximal reach in each direction will be included for analysis. If there are failed attempts, a maximum of six trials will be performed for any stance arm in a single direction. If the participant has more than four failed attempts, record a zero for that trial.

# What Do We Look For On The YBT-UQ?

There should not be a greater than four centimeter right and left reach distance difference in the medial, inferolateral and superolateral reach directions. Also, the composite score—the sum of three reach directions is divided by three times limb length, then multiplied by 100—should not be less than the cut points that are specific for the age, gender and sport of the individual. This can be obtained by using the Move2Perform software available at [www.move2perform.com](http://www.move2perform.com).

## Reach Directions And Testing Order

The upper extremity that is being measured is the stance arm. This simply represents the pattern and does not imply the functional ability of a body part or side. Reach is named in terms of directional relationship to the stance arm.

Start by having the participant place the right thumb just behind and parallel to the red line in a pushup position with feet shoulder-width apart and hands directly under the shoulders. The participant will push the reach indicator with the left hand in the red target area to the left as far as possible. While maintaining the same position, have the client push the inferolateral box as far as possible, and finally, push the superolateral box as far as possible. Read the reach distances while the client rests, and then repeat the test two more times with the right hand on the stance plate. The client will then complete three trials in the same manner with the opposite limb. Unlike the lower quarter YBT, all three reach directions are performed sequentially, one right after another without a break.

The specific testing order follows—

1. Right medial reach; right inferolateral reach; right superolateral reach
2. Left medial reach; left inferolateral reach; left superolateral reach

## Reading The Measure

Measure the maximal reach distance by reading the tape measure at the edge of the reach indicator, at the point where the most distal part of the hand reached in half centimeters (e.g. 68.5, 69.0, 69.5 cm). Three trials in each direction for each arm will be collected and the maximal reach in each direction will be included for analysis. If there are failed attempts, a maximum of six trials will be performed for any stance arm in a single direction. If the participant has more than four failed attempts, record a zero for that trial.

## Test Faults

- Shoving push box
- Not returning to starting position under control
- Touching down with reach hand before all three reach directions are completed
- Hand on top of stance plate
- Not maintain both feet in contact with the floor

## Practice Trials

Once you have given the client the testing instructions, have the client perform two practice trials, two with each arm in each of the three directions prior to formal testing. The test will be completed with shoes off.

*Note: Only two practice trials are performed for the Upper Quarter Y Balance Test due to the high demand of the test and fatigue becoming factor a,*

# Measuring Upper Limb Length

First, determine the client's arm length in standing by measuring the distance from the Cervical 7 (C7) spinous process—most bony prominence at the base of the neck—to the distal tip of the third digit to the nearest half centimeter with the arm elevated to 90 degrees—out to side. If you are unable to determine the location of the C7 spinous process, have the participant flex and extend the neck; the C7 spinous process will remain prominent throughout. Only measure the right arm.

## Tips for Testing

- The test is performed with the shoes off.
- The arm that is being measured is the stance arm. This simply represents the pattern and does not imply the functional ability of a body part or side.
- Two practice trials for each arm in each direction should be performed prior to testing.
- Client must maintain unilateral stance on the platform.
- Client must maintain reach hand contact with the reach indicator on the target area while it is motion (i.e. cannot shove the reach indicator).
- Client cannot use the reach indicator for stance support (i.e. place hand on top of reach indicator).
- Client must keep both feet in starting position throughout the test.
- The three directions must follow this pattern: medial, inferolateral and superolateral directions.
- Client must return the reach hand to the starting position under control.
- Do not coach the movement; simply repeat the instructions if needed.
- The stance arm elbow may bend during the test.

# Verbal Instructions For The Upper Quarter Y Balance Test

The following is a script to use while administering the Upper Quarter Y Balance Test. For consistency throughout all testing this script should be used during each test. Equipment needed: Y Balance Test kit and cloth tape measure

## Instructions

Please let me know if there is any pain while performing any portion of the test.

Please remove your shoes while performing the test.

Place your \_\_\_\_\_ hand on the center of the stance plate with your thumb just behind and parallel to the red starting line with the other hand on top of the reach indicator.

While maintaining the \_\_\_\_\_ hand on the platform, push the reach indicator in the red target area as far as possible with the opposite hand out to the side, then under and across, and finally over and across without resting between directions.

The reach hand must maintain contact with the reach indicator on the target area while it is motion (i.e., cannot shove the reach indicator).

Do not use the reach indicator for stance support (i.e. don't place hand on top of reach indicator).

Return the reach hand to the starting position under control.

Repeat two more times and then use the opposite arm in the same three directions.

Do you understand the instructions?

Have the participant perform each movement three times before alternating the supporting arm in the same direction.