APPENDIX A: PHYSICAL PERFORMANCE ASSESSMENTS

1. Functional Movement Screen (FMS)
2. Selective Functional Movement Assessment (SFMA)
3. Lower Quarter Y-Balance Test (LQ-YBT)
4. Upper Quarter Y-Balance Test (UQ-YBT)
5. Hop Testing
6. 300 Yard Shuttle Run
7. Carry Test
8. Closed Kinetic Chain Dorsiflexion Range of Motion (CKC-DF)
FUNCTIONAL MOVEMENT SCREEN (Appendix A1)

1.0 GOAL/PURPOSE
This Manual Operating Procedure (MOP) describes the steps to execute the Functional Movement Screen (FMS)

2.0 EQUIPMENT:
2.1 FMS Test Kit includes:
   2.1.1 FMS Board (2x6)
   2.1.2 Dowel Rod (marked in inches)
   2.1.3 Dowels/Tubing for hurdle step (marked in inches)
   2.1.4 Tape measure (in centimeters)
2.2 Electronic testing device

3.0 GENERAL INSTRUCTIONS:
3.1 Dress Attire
   3.1.1 All study participants must wear shorts and t-shirt
   3.1.2 The test is performed with shoes and socks on (regular exercise shoes)

3.2 Trials and Scoring:
   3.2.1 All movements should be performed slow and controlled
   3.2.2 Participant has 3 attempts to perform each test movement properly
   3.2.3 If the repetition is not performed perfectly; repeat the movement
   3.2.4 Score the best of the 3 repetitions; when in doubt – score low
   3.2.5 There are 7 FMS tests; five of the 7 FMS tests are done bilaterally to assess asymmetry (annotated with an *):
      3.2.5.1 Deep Squat
      3.2.5.2 Hurdle Step*
      3.2.5.3 In-line Lunge*
      3.2.5.4 Shoulder Mobility*
      3.2.5.5 Active Straight Leg Raise* (ASLR)
      3.2.5.6 Trunk Stability Push-Up
      3.2.5.7 Rotary Stability*
   3.2.6 There are 3 clearing tests to assess for pain and the need for medical referral:
      3.2.6.1 Shoulder Impingement Clearing Test (done with Shoulder Mobility)
      3.2.6.2 Prone Press-Up Clearing Test (done with Trunk Stability Push-Up)
      3.2.6.3 Posterior Rocking Clearing Test (done with Rotary Stability)
   3.2.7 Pain:
      3.2.7.1 Tell the participant to let you know if they have any pain; but do not specifically ask if the event was painful after each repetition unless visual signs of pain exist.
      3.2.7.2 However, ask about pain for each clearing test.

(INSTRUCTIONS FOR EACH TEST START ON NEXT PAGE)
FUNCTIONAL MOVEMENT SCREEN  (Appendix A1)

4.0 DEEP SQUAT (Fig.1)

4.1 Instructions:

4.1.1 Should be performed slowly and controlled; (up to 3 times)
4.1.2 Participant assumes the starting position by placing his/her feet approximately shoulder width apart with feet aligned in the sagittal plane (no toe-out; all toes pointing forward). Shoulder width is instep aligned with the axilla bilaterally using the dowel rod.
4.1.3 The participant then adjusts their hands on the dowel to assume a 90-degree angle of the elbows with the dowel overhead.
4.1.4 Next, the dowel is pressed overhead with the shoulders flexed and abducted, and the elbows extended.
4.1.5 Participant then moves into the squat position, keeping both heels on the floor, head and chest facing forward and dowel maximally pressed overhead.
4.1.6 Score the deep squat based on the criteria describe below; if the participant does not meet the criteria the tester will ask the participant to perform the test with the FMS board under the heels.
4.1.7 If you are asked to perform the deep squat with the FMS board under the heels; the instructions are the same. Score based on the best of 3 trials.
4.1.8 Test does not need to be performed 3 times if all criteria are met by participant on first or second trial

4.2 Visual Observation:

4.2.1 Observe from front and side
4.2.2 No toe-out
4.2.3 Make sure the participant’s torso is parallel with tibia or toward vertical.
4.2.4 Femur is below horizontal
4.2.5 Knees are aligned over feet (no valgus or varus collapse)
4.2.6 Dowel aligned over feet
4.2.7 Heels Remain on the floor (or board if necessary)

4.3 Verbal Cues:

4.3.1 “Hold the dowel with both hands and rest the dowel on top of your head so that both your shoulders and elbows maintain a 90 degree angle. Now, press the dowel overhead and hold it there.”
4.3.2 “Place your feet in a comfortable position, approximately shoulder width apart. Point your toes forward and keep them pointing forward.”
4.3.3 “While maintaining a straight back, dowel overhead, head and eyes straight forward, and your heels on the floor, slowly lower yourself into a deep squat as low are you can go(Score participant).
4.3.4 “Return to the starting position.”

4.4 Reason for the deep squat to be repeated:

4.4.1 If the participant has pain with the deep squat with feet flat on the floor; score the performance and select “yes” for pain. The participant will not be asked to complete the test with the board under their heels.
4.4.2 If the participant is unable to perform squat with feet flat on the floor, the software will ask you to repeat with the FMS board underneath heels
4.4.3 If loss of balance on all 3 repetitions; score “no” for all questions.

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FUNCTIONAL MOVEMENT SCREEN  (Appendix A1)

4.5 Clearing Test:  None
4.6 Scoring:
   4.6.1 Record the participants best squat
   4.6.2 Try not to interpret the score while testing.
   4.6.3 If you have a question on how to score, make sure to view the participant from
         the side during the next repetition.
   4.6.4 Answer the following questions Yes/ No:
         • *Femur below horizontal*
         • *Upper torso is parallel with tibia or toward vertical*
         • *Dowel aligned over feet*
         • *Knees are aligned over the feet (no valgus or varus collapse)*
         • *Heels remain on the ground/board*
         • *Pain during test*
   4.6.5 If you have a doubt, then “no” should be the answer
   4.6.6 If the first 5 criteria are not scored with a “yes”, you will be prompted to have the
         participant repeat the test with the FMS board underneath their heels.
   4.6.7 If the participant has pain (yes), then you will proceed to the next test and you
         will not assess the deep squat with the heels on the FMS board.

5.0 HURDLE STEP: (Fig.2)
5.1 Instructions:
   5.1.1 Should be performed slowly and controlled; each leg can be repeated as many as 3 times.
   5.1.2 Participant assumes the starting position by placing the feet together and aligning the toes
         touching the base of the hurdle.
   5.1.3 Then adjust the hurdle to the height of the participants’ most medial, proximal
         aspect of the tibial tuberosity.
   5.1.4 Position the dowel across the participants shoulders below the neck.
   5.1.5 The participant is then asked to step over the hurdle and touch their heel to the
         floor while maintaining the stance leg in an extended position with head/eyes
         forward.
   5.1.6 The hurdle leg is then returned to the starting position (the hurdle step should
         be performed slowly and controlled).
   5.1.7 Bilateral testing should be performed with the right lower extremity first (up to
         3 trials) followed by the left lower extremity (up to 3 trials)
   5.1.8 Test does not need to be performed 3 times if all criteria are met by participant on
         first or second trial.
5.2 Visual Observation:
   5.2.1 Hips, knees and ankles remain aligned in the sagittal plane
   5.2.2 Minimal to no movement is noted in lumbar spine (standing tall) with head/eyes
         pointing forward
   5.2.3 Dowel and hurdle remain parallel
   5.2.4 Make sure the toes of stance foot keep in contact with the hurdle during and after
         each repetition
FUNCTIONAL MOVEMENT SCREEN  

(Appendix A1)

5.2.5 Maintain proper alignment with the cord
5.2.6 Movement for trial should only occur within the hurdle uprights

5.3 Verbal Cues:
5.3.1 “Place the dowel across your shoulders. Now, stand comfortably with your feet together and your toes against the base of the hurdle.”
5.3.2 “Do not lock your knee during the test, but keep your stance leg generally straight.”
5.3.3 “While maintaining an upright posture, keeping your head and eyes straight forward, step over the hurdle with your _____leg without touching the string.”
5.3.4 “Touch the floor with your heel and return to the starting position.”

5.4 Reason for the attempt at the hurdle step to be repeated:
5.4.1 Dowel and hurdle not parallel
5.4.2 Improper alignment of hips, knees and ankles
5.4.3 Movement of lumbar spine
5.4.4 Contact with hurdle
5.4.5 Contact from the calf during heel placement is ok
5.4.6 Loss of balance

5.5 Clearing Test: None

5.6 Scoring:
5.6.1 Score the leg that is stepping over the hurdle
5.6.2 Answer the following questions Yes/No for each leg:
   • Hurdle remains upright, no loss of balance by subject (able to complete test)
   • Foot clears cord (does not touch; calf touching allowable)
   • Hips, knees, and ankles remain aligned in the sagittal plane
   • Minimal to no movement is noted in the lumbar spine
   • Dowel and hurdle remain parallel
   • Pain during test
5.6.3 Only record the participant’s best trial
5.6.4 When in doubt score low

6.0 INLINE LUNGE: (Fig.3)

6.1 Instructions:
6.1.1 Should be performed slowly and controlled; each leg can be repeated as many as 3 times.
6.1.2 Participant assumes the starting position by first placing the toes of the back leg behind the red line of the FMS board.
6.1.3 Place the dowel behind the back, touching the head, thoracic spine and sacrum.
6.1.4 The hand opposite to the front foot should be the hand grasping the dowel at the cervical spine.
6.1.5 The other hand grasps the dowel at the lumbar spine.
6.1.6 The participant then steps out on the board placing the heel of the opposite foot at the indicated mark on the board (the distance between toes to heel is the participant’s tibial tuberosity height (most medial, proximal aspect of the tibial tuberosity used)).

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6.1.7 The participant is then asked to lower the back knee enough to touch the board behind the heel of the front foot.

6.1.8 The participant then returns to the starting position.

6.1.9 The lunge is performed up to three times bilaterally in a slow, controlled fashion with the right leg tested first, then the left leg.

6.1.10 Test does not need to be performed 3 times if all criteria are met by participant on first or second trial

6.2 Visual Observations:

6.2.1 The front leg identifies the leg being scored.

6.2.2 Dowel remains vertical and in contact with the head, thoracic spine and sacrum.

6.2.3 Feet start and end in sagittal plane: toes pointed forward throughout the motion.

6.2.4 The front heel remains in contact with the board and back heel touches board when returning to starting position.

6.2.5 No torso movement noted

6.2.6 Knee touches board behind heel of front foot (not off to the side)

6.2.7 Watch for loss of balance

6.2.8 Remain close to participant in case he/she has a loss of balance.

6.3 Verbal Cues:

6.3.1 “Hold the dowel with both hands and position it along your spine with your left hand against the back of your neck and your right hand against your low back.”

6.3.2 “Step onto the FMS board with your left foot along the back edge and place your right foot with the heel just past (length of the tibia) the black line (or mark). Point your toes forward and keep them pointing forward.”

6.3.3 “While maintaining an upright posture, descend into a lunge, touching your left knee along the black line (or mark) behind your right heel. Maintain contact with the dowel against your head, thoracic spine and sacrum.”

6.3.4 “Return to the starting position, making sure to place the left heel flat on the board.”

6.3.5 Repeat this test for the left leg

6.4 Reason for the inline lunge to be repeated:

6.4.1 Loss of contact with dowel

6.4.2 Dowel not in vertical position

6.4.3 Failure to keep dowel and feet in sagittal plane

6.4.4 Movement in torso

6.4.5 Knee does not touch behind heel of front foot

6.4.6 Loss of balance

6.5 Scoring:

6.5.1 Score the front leg (right leg, then left leg)

6.5.2 Answer the following questions Yes/No for each leg:

- Stays on board, completes movement (No loss of balance)
- Dowel and feet remain in sagittal plane
- Knee touches behind heel
- Dowel contacts maintained
- Dowel remains vertical
- No torso movement noted
- Pain during test

6.5.3 Only record the participant’s best trial

6.5.4 When in doubt score low

7.0 SHOULDER MOBILITY: (Fig.4)
FUNCTIONAL MOVEMENT SCREEN

(Appendix A1)

7.1 Instructions:

7.1.1 Should be performed slowly and controlled; each direction can be repeated as many as 3 times.

7.1.2 Have participant stand facing away from the tester with feet together.

7.1.3 Determine the participant’s right hand length to the nearest half cm by measuring from the distal wrist crease to the tip of the third digit.

7.1.4 Participant forms fists with the thumbs inside the fingers with arms at 90 degrees of shoulder abduction.

7.1.5 Participant is then asked to assume a maximally adducted, extended and internally rotated position with one shoulder and a maximally abducted flexed and externally rotated position with the other.

7.1.6 The thumbs should remain inside the hands and the final position should be achieved in one smooth movement with no “walking” of the hands on the back.

7.1.7 Measure the distance between the two closest bony prominences to the nearest half cm.

7.1.8 Repeat the measurement with the position of the arms switched.

7.1.9 Test does not need to be performed 3 times if all criteria are met by participant on first or second trial.

7.2 Visual Observations:

7.2.1 The flexed (overhead) shoulder identifies the side being scored.

7.2.2 Measure the distance between the two closest points of the hands. The computer system will determine the score based on the hand measurement.

7.2.3 Make sure participant does not try to “walk” the hands toward each other.

7.3 Verbal Cues:

7.3.1 “Stand with your feet together”

7.3.2 “Make a fist with both hands by tucking your thumbs into the fist and bring your arms out to the side.”

7.3.3 “In a single motion, place your right (left) fist over your head on to your back and your left (right) behind your back, attempting to touch the fists”

7.3.4 “Do not move your hands closer after their initial placement.”

7.3.5 “Hold them right there while I measure.” (Measure the distance between the two closest points of the hands.)

7.3.6 “Once completed, a clearing test will be done for each side.”

7.4 Reason for the shoulder mobility attempt to be repeated:

7.4.1 Fists are not within one or one-and-a-half hand lengths

7.4.2 Walking of the hands

7.4.3 Fists open

7.5 Clearing Test: (Fig.5)

7.5.1 Have the participant place the right hand on the left shoulder by reaching across the chest.

7.5.2 Instruct the participant to raise the elbow as high as possible.

7.5.3 Record any pain felt by participant.

7.5.4 Repeat for the left arm.

7.6 Scoring:

7.6.1 Score the arm that is above the head (score right arm first, then left arm), insert measurement with either a “0” or a “5” to the right of the decimal place (to the nearest half cm)
FUNCTIONAL MOVEMENT SCREEN  
(Appendix A1)

7.6.2 Answer the following questions Yes/No for each arm:
   • Pain during test
   • Pain with clearing exam

7.6.3 Only record the participant’s best trial

7.6.4 When in doubt score low

8.0 ACTIVE STRAIGHT-LEG RAISE: (Fig.6)

8.1 Instructions:
8.1.1 Should be performed slowly & controlled; each leg can be repeated as many as 3 times.
8.1.2 Participant assumes the starting position by lying supine with the arms at the participant’s side with palms up and head flat on the floor.
8.1.3 The FMS board is placed under both knees.
8.1.4 Tester identifies mid-point between ASIS and midpoint of the patella and places dowel at that position, perpendicular to the ground.
8.1.5 Participant is then instructed to lift the test leg with a dorsiflexed-neutral ankle and extended knee.
8.1.6 During the test the opposite knee should remain in contact with the board and the leg cannot externally rotate. The test leg should remain straight, the toes should remain pointed upward, and the head should remain flat on the floor.
8.1.7 The tested leg should be straight without any bend in the knee.
8.1.8 Test does not need to be performed 3 times if the participant is able to raise the leg far enough that the malleoli resides between the mid-thigh and ASIS.
8.1.9 Test does not need to be performed 3 times if all criteria are met by participant on first or second trial

8.2 Visual Observations:
8.2.1 The flexed hip identifies the side being scored. (right leg tested first, then the left leg)
8.2.2 Make sure the leg on the floor does not externally rotate at the hip.
8.2.3 Both knees remain extended
8.2.4 Ensure the knee of the extended hip remains touching the board.
8.2.5 If the dowel resides at exactly the mid-point, score low.

8.3 Verbal Cues:
8.3.1 “Lay on your back with the back of your knees against the board, arms at your side, palms facing up, and toes pointing up.”
8.3.2 “With your legs remaining straight and toes pointing toward the ceiling/sky, raise your right (left) leg as high as possible, without any movement occurring in the opposite leg.”
8.3.3 “Will repeat with opposite side.”

8.4 Reason for the active straight-leg raise to be repeated:
8.4.1 Vertical line of malleolus resides below mid-thigh
8.4.2 Non-moving limb does not remain in neutral position (contact with board and no external rotation)

8.5 Clearing Tests: None

8.6 Scoring:
8.6.1 Score the leg that is being lifted (flexed)
8.6.2 Answer the following questions Yes/No for each leg:
   • Malleolus resides between mid-thigh and ASIS
   • Malleolus resides between mid-thigh and joint line (mid-patella)
FUNCTIONAL MOVEMENT SCREEN  (Appendix A1)

- Malleolus resides below joint line (mid-patella)
- Pain during test

8.6.3 Only record the participant’s best trial
8.6.4 When in doubt score low

9.0 TRUNK STABILITY PUSH UP: (Fig.7)

9.1 Instructions:
9.1.1 Should be performed slowly and controlled and as many as 3 times
9.1.2 Participant is prone with hands overhead
9.1.3 Hands are then brought to align with axilla (shoulder-width apart) and thumbs aligned with the forehead (males) or with the chin (females).
9.1.4 The feet are dorsiflexed and the participant is in a push-up position on the ground.
9.1.5 Instruct the participant to perform a push-up while maintaining a rigid torso with no lag in the spine.
9.1.6 If the participant is unable to perform the push-up or maintain a rigid torso, instruct the participant to now move the thumbs in line with the chin (males) or with the clavicles (females).
9.1.7 Have the participant attempt the movement again, with emphasis on maintaining a rigid torso
9.1.8 Test does not need to be performed 3 times if all criteria are met by participant on first or second trial

9.2 Visual Observations:
9.2.1 Men will perform the push-up test with their hands even with their forehead. Women will perform the push-up test with their hands even with their chin.
9.2.2 The body lifts as a unit with no lag in the spine.
9.2.3 Ensure the hands do not move from the starting position during the push-up.
9.2.4 Ensure the chest and stomach come off the floor at the same time.
9.2.5 If unable to perform push-up in current position, have the participant move their hand placement. Men will have hands even with chin and women will have hands even with clavicle.

9.3 Verbal Cues:
9.3.1 “Lie on your stomach as if you are about to do a push-up.”
9.3.2 “Place your hands shoulder-width apart and line your thumbs up with your forehead (chin).”
9.3.3 “Keeping your body as one solid unit, perform a push-up.”
9.3.4 If unable to perform in this position, men will lower hands to chin and women will move their hands to shoulder level.

9.4 Reason for the trunk stability pushup to be repeated:
9.4.1 Unable to perform test for men with hands at forehead and women at chin
9.4.2 Unable to perform test for men with hands at chin and women at clavicle
9.4.3 Body is not lifted as a unit (sag in trunk).

9.5 Clearing Exam: (Fig.8)
9.5.1 Have the participant stay prone and place his or her hands at mid-chest level.
9.5.2 Keeping the legs and hips on the ground, have the participant extend the arms to attain a “cobra stretch” position.
9.5.3 Record any pain felt by the participant.

Fig.7: Trunk Stability Push Up
Fig.8: Extension Clearing Test

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FUNCTIONAL MOVEMENT SCREEN  
(Appendix A1)

9.6  Scoring:

9.6.1 Score the push up as one entire movement

9.6.2 Answer the following questions

- Gender (male(female))
- Ability to perform movement with thumbs at forehead (chin)
- Ability to perform movement with thumbs at chin (clavicle)
- Failure to perform movement with thumbs at chin (clavicle)
- Pain during test
- Pain with clearing exam

9.6.3 Only record the participant’s best trial

9.6.4 When in doubt score low

10.0  ROTARY STABILITY: (Fig.9)

10.1  Instructions:

10.1.1 Should be performed slowly and controlled; each side can be repeated as many as 3 times.

10.1.2 Participant is in a quadruped position over the FMS board with knees underneath hips, hands directly underneath shoulders and ankles dorsiflexed.

10.1.3 The thumbs, knees and feet of the weight bearing limbs will remain in contact with the sides of the board throughout the test.

10.1.4 Instruct the participant to simultaneously extend the right leg and right arm (unilateral repetition) in a slow and controlled manner so that they are at least six inches off the ground.

10.1.5 From the extended position, have the participant touch the right knee to the right elbow in line with the FMS board (without rotating at hips or shoulders).

10.1.6 After touching the right knee to the right elbow, without touching down, have the participant extend the right leg and arm again then return to the starting position.

10.1.7 If after 3 attempts the participant is unable to perform the movement, have them perform the test extending the right arm and the left leg (diagonal repetition). The side scored will correspond to the arm being extended.

10.1.8 Repeat the test on the other side.

10.1.9 Test does not need to be performed 3 times if all criteria are met by participant on first or second trial

10.2  Visual Observations:

10.2.1 The upper limb that is being lifted indicates the tested side.

10.2.2 The unilateral limbs must remain over the board for successful movement

10.2.3 No rotation at hips or shoulders allowed when attempting unilateral limb rotary stability

10.2.4 The diagonal knee and elbow must meet over the board for the diagonal repetition to be scored as successful

10.2.5 Ensure spine is flat while hips and shoulders are at 90 degrees at the start.

10.3  Verbal Cues:

10.3.1 “Get on your hands and knees with your knees under your hips, hands under your shoulders and toes pulled up towards your shins. Your feet, knees and thumbs should be touching the board.”

10.3.2 “Without touching down at any time during the movement, extend your right arm and leg at the same time, touch the right knee to the right elbow over the board, extend out again, then return to the starting position.”

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https://clinicaltrials.gov/ct2/show/NCT02776930
FUNCTIONAL MOVEMENT SCREEN (Appendix A1)

10.3.3 If unable to perform a unilateral repetition – “Perform the movement again, this time using your right arm and left leg.”

10.3.4 While utilizing opposite arm and leg, touch the opposite elbow with the knee.

10.4 Reason for the rotary stability attempt to be repeated:

10.4.1 Unable to perform test on unilateral side

10.4.2 Unable to perform test on contralateral side

10.5 Clearing Exam: (Fig.10)

10.5.1 Have the participant assume a quadruped position on the hands and knees.

10.5.2 Instruct the participant to extend the arms as far as possible on the ground in front of them.

10.5.3 Instruct the participant to sit back on the heels while maintaining arms extended out in front.

10.5.4 Record any pain felt by the participant.

10.6 Scoring:

10.6.1 Score as one entire movement

10.6.2 Answer the following questions Yes/No for each leg:

- Unilateral repetition
- Diagonal repetition
- Failure with diagonal repetition
- Pain during test
- Pain with clearing exam

10.6.3 Only record the participant’s best trial

10.6.4 When in doubt score low

11.0 DEFINITIONS

11.1 Quadruped position: On hands and knees

11.2 Prone: lying on stomach
SELECTIVE FUNCTIONAL MOVEMENT ASSESSMENT (SFMA)
(Appendix A2)

1. **GOAL/PURPOSE**
   This Manual Operating Procedure (MOP) describes the steps to administer the SFMA

2. **EQUIPMENT:**
   2.1. Bubble goniometer
   2.2. Tape measure (in centimeters)

3. **GENERAL INSTRUCTIONS:**
   3.1. Dress Attire
      3.1.1. All study participants must wear PT clothes; no sweat pants/ tops
      3.1.2. The test is performed with *shoes and socks off.*
   3.2. Trials and Scoring:
      3.2.1. No warm up is allowed to evaluate raw, unaltered movement
      3.2.2. All movements should be performed slow and controlled
      3.2.3. Each test should be performed one time.
      3.2.4. Be picky; if unsure, score dysfunctional.
      3.2.5. Demonstrate what you want performed allows for faster evaluation times.
      3.2.6. There are 10 SFMA tests; five of the 10 SFMA tests are done bilaterally to assess asymmetry (annotated with an *):
         3.2.6.1. Active Cervical Flexion
         3.2.6.2. Active Cervical Extension
         3.2.6.3. Cervical Rotation*
         3.2.6.4. Upper Extremity Pattern 1 (Medial Rotation and Extension (MRE))*
         3.2.6.5. Upper Extremity Pattern 2 (Lateral Rotation and Flexion (LRF))*
         3.2.6.6. Multi-Segmental Flexion
         3.2.6.7. Multi-Segmental Extension
         3.2.6.8. Multi-Segmental Rotation*
         3.2.6.9. Single Leg Stance*
         3.2.6.10. Overhead Deep Squat
   3.2.7. Movement is placed into one of the following categories:
      3.2.7.1. Functional and non-painful (FN)
      3.2.7.2. Functional and painful (FP)
      3.2.7.3. Dysfunctional and painful (DP)
      3.2.7.4. Dysfunctional and non-painful (DN)
   3.2.8. Pain:
      3.2.8.1. At the beginning of testing, tell the participant to let you know if they have any pain with any of the movements; but do not specifically ask if the event was painful after each test unless visual signs of pain exist.

MP3-RD
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4. ACTIVE CERVICAL FLEXION (Fig.1)
   4.1. Instructions:
      4.1.1. Should be performed slowly and controlled
      4.1.2. Participant assumes the starting position by standing erect with feet
together and toes pointing forward.
      4.1.3. The participant tries to touch the chin to the sternum, keeping the trunk
erect during movement
      4.1.3.1. The participant should be able to touch the sternum without pain
      4.1.4. Make sure the participant’s mouth remains closed throughout
movement.
      4.1.5. Observe participant from the front and side.
      4.1.6. Do not coach the movement; simply repeat the instructions if
needed.

   4.2. Verbal Cues:
      4.2.1. “Stand tall with your feet together.”
      4.2.2. “Try to touch your chin to your sternum while keeping your mouth closed.”

   4.3. Scoring:
      4.3.1. Try not to interpret the score while testing.
      4.3.2. Answer the following criteria Yes/ No:
            Unable to touch chin to sternum
            Excessive effort and/or lack of motor control
            Pain during test
      4.3.3. If you have a doubt, the test should be scored “dysfunctional”

5. ACTIVE CERVICAL EXTENSION (Fig.2)
   5.1. Instructions:
      5.1.1. Should be performed slowly and controlled
      5.1.2. Participant assumes the starting position by standing erect with feet
together and toes pointing forward.
      5.1.3. The participant looks up, aiming the face parallel with the ceiling (do not
keep patient in this position for long)
      5.1.3.1. Participant should be able to get within 10 degrees of parallel without
pain
      5.1.4. Make sure the participant’s mouth remains closed throughout movement.
      5.1.5. Observe participant from the front and side.
      5.1.6. Do not coach the movement; simply repeat the instructions if
needed.

   5.2. Verbal Cues:
      5.2.1. “Stand tall with your feet together”
      5.2.2. “Look up toward the ceiling as far as you can.”

   5.3. Scoring:
      5.3.1. Try not to interpret the score while testing
      5.3.2. Answer the following criteria Yes/ No:
            Not within 10 degrees of parallel
            Excessive effort and/or lack of motor control
            Pain during test
      5.3.3. When in doubt score “dysfunctional”

6. CERVICAL ROTATION (Fig.3)
   6.1. Instructions:
      6.1.1. Should be performed slowly and controlled to both sides.
6.1.2. Participant assumes the starting position by standing erect with feet together and toes pointing forward.
6.1.3. The participant rotates the head as far as possible to the right and then to the left.
6.1.4. Check to ensure the participant’s mid-chin or nose is over or past mid-clavicle.
6.1.4.1. Normal range is nose in line with mid-clavicle bilaterally without pain
6.1.5. Observe participant from the front and side.
6.1.6. Do not allow scapular elevation and protraction.
6.1.7. Do not allow participant to perform cervical side bending; participant should be performing isolated cervical rotation.
6.1.8. Do not coach the movement; simply repeat the instructions if needed.

6.2. Verbal Cues:
6.2.1. “Stand tall with your feet together”
6.2.2. “Look as far over your right shoulder as you can. Then look as far over your left shoulder as you can.”

6.3. Scoring:
6.3.1. Try not to interpret the score while testing
6.3.2. Answer the following criteria Yes/No:
   - Nose not in line with mid-clavicle
   - Excessive effort or lack of motor control
   - Appreciable asymmetry
   - Pain during test

6.3.3. When in doubt score “dysfunctional”

7. UPPER EXTREMITIES (UE) PATTERN 1 (MRE) (Fig.4)

7.1. Instructions:
7.1.1. Should be performed slowly and controlled
7.1.2. Participant assumes the starting position by standing erect with feet together and toes pointing forward.
7.1.3. The participant reaches back with the right arm, trying to touch the inferior angle of the scapula.
7.1.4. Place a finger on the spot where the patient’s fingers touch the back, and compare that spot to the left arm’s test results.
7.1.5. Note the distance from the scapula if the motion is reduced.
7.1.6. Do not coach the movement; simply repeat the instructions if needed.

7.2. Verbal Cues:
7.2.1. “Stand tall with your feet together”
7.2.2. “Reach your right hand behind your back as far as you can. Then repeat the same thing with your left hand.”

7.3. Scoring:
7.3.1. Try not to interpret the score while testing.
7.3.2. Answer the following criteria Yes/No; score for both Right and Left:
   - Does not reach inferior angle of scapula
   - Excessive effort or lack of motor control
   - Appreciable asymmetry
   - Pain during test

Fig.3: Testing position for Cervical Rotation
Fig.4: Testing position for UE Pattern 1 (MRE)
SELECTIVE FUNCTIONAL MOVEMENT ASSESSMENT (SFMA)  
(Appendix A2)

7.3.3. When in doubt score “dysfunctional”

8. **UPPER EXTREMITY PATTERN 2 (LRF) (Fig.5)**

8.1. Instructions:

8.1.1. Should be performed slowly and controlled

8.1.2. Participant assumes the starting position by standing erect with feet together and toes pointing forward.

8.1.3. The participant reaches overhead with the right arm, trying to touch the spine of the left scapula.

8.1.4. Place a finger on the spot where the patient’s fingers touch the back, and compare that spot to the left arm’s test results.

8.1.5. Note the distance from the spine of the scapula if the motion is reduced.

8.1.6. Do not coach the movement; simply repeat the instructions if needed.

8.2. Verbal Cues:

8.2.1. “Stand tall with your feet together”

8.2.2. “Reach your right hand behind your head as far as you can. Then repeat the same thing with your left hand.”

8.3. Scoring:

8.3.1. Try not to interpret the score while testing

8.3.2. Answer the following criteria Yes/No; score for both Right and Left:

- Does not reach spine of scapula
- Excessive effort or lack of motor control
- Appreciable asymmetry
- Pain during test

8.3.3. When in doubt score “dysfunctional”

9. **MULTI-SEGMENTAL FLEXION (FORWARD BEND) (Fig.6)**

9.1. Instructions:

9.1.1. Should be performed slowly and controlled

9.1.2. Participant assumes the starting position by standing erect with feet together and toes pointing forward.

9.1.3. The participant bends forward at the hips while reaching the hands toward the toes, trying to touch the ends of the fingers to the tips of the toes without bending the knees.

9.1.4. Check sacral angle utilizing bubble goniometer

9.1.5. Do not coach the movement; simply repeat the instructions if needed.

9.2. Verbal Cues:

9.2.1. “Stand tall with your feet together”

9.2.2. “Bend over and try to touch your toes.”

9.3. Scoring:

9.3.1. Try not to interpret the score while testing

9.3.2. Answer the following criteria Yes/No:

- Cannot touch toes
- Sacral angle < 70 degrees
- Non-uniform spinal curve
- Lack of posterior weight shift (Thoracic-lumbar (T-L) junction should be over midfoot)
- Excessive effort and/or lack of motor control
- Pain during test

https://clinicaltrials.gov/ct2/show/NCT02776930
SELECTIVE FUNCTIONAL MOVEMENT ASSESSMENT (SFMA) (Appendix A2)

9.3.3. When in doubt score “dysfunctional”

10. MULTI-SEGMENTAL EXTENSION (BACKWARD BEND) (Fig.7)

10.1. Instructions:

10.1.1. Should be performed slowly and controlled
10.1.2. Participant assumes the starting position by standing erect with feet together and toes pointing forward.
10.1.3. Participant then raises the hands above the head with arms extended and elbows in line with the ears.
10.1.4. Have the patient bend backward as far as possible, making sure the hips go forward and the arms go back simultaneously.
10.1.5. Do not coach the movement; simply repeat the instructions if needed.

10.2. Verbal Cues:

10.2.1. “Stand tall with your feet together”
10.2.2. “Raise your arms up overhead and bend backwards as far as you can”

10.3. Scoring:

10.3.1. Try not to interpret the score while testing
10.3.2. Answer the following criteria Yes/No:
   - UE does not achieve or maintain 170 degrees
   - Anterior Superior Iliac Spine (ASIS) does not clear toes
   - Spine of scapula does not clear heels
   - Non-Uniform spinal curve
   - Excessive effort and/or lack of motor control
   - Pain during test

10.3.3. When in doubt score “dysfunctional”

11. MULTI-SEGMENTAL ROTATION (Fig.8)

11.1. Instructions:

11.1.1. Should be performed slowly and controlled
11.1.2. Participant assumes the starting position by standing erect with feet together and toes pointing forward and arms extended to the sides at about waist height.
11.1.3. Participant then rotates the entire body hips, shoulders and head as far as possible to the right while the foot position remains unchanged.
11.1.4. Have the patient return to the starting position, and rotate to the left.
11.1.5. Do not coach the movement; simply repeat the instructions if needed.

11.2. Verbal Cues:

11.2.1. “Stand tall with your feet together and arms out at your sides.”
11.2.2. “Keeping your feet planted, rotate your entire body to the right”
11.2.3. “Come back to the center, then rotate your entire body to the left.”

11.3. Scoring:

11.3.1. Try not to interpret the score while testing
11.3.2. Answer the following criteria Yes/No; score for both the right and left:
   - Pelvis rotation < 50 degrees
   - Shoulder rotation < 50 degrees
   - Spine/pelvic deviation
   - Excessive knee flexion
   - Excessive effort and/or lack of motor control

https://clinicaltrials.gov/ct2/show/NCT02776930
SELECTIVE FUNCTIONAL MOVEMENT ASSESSMENT (SFMA)  
(Appendix A2)

Pain during test
11.3.3. When in doubt score “dysfunctional”

12. SINGLE LEG STANCE (Fig.9)

12.1. Instructions:
12.1.1. Should be performed slowly and controlled
12.1.2. Participant assumes the starting position by standing erect with feet together and toes pointing forward and arms extended toward the sides of the thighs.
12.1.3. Participant then lifts the right leg so the hip and knee are both at 90 degree angles.
12.1.4. The participant maintains this posture for at least 10 seconds.
12.1.5. Repeat the test on the left leg
12.1.6. Repeat with eyes closed for 10 seconds (on right leg then left leg).
12.1.7. The test is over when the patient loses posture, has to move from the original foot position, falls, or flails the arms.
12.1.8. Do not coach the movement; simply repeat the instructions if needed.
12.1.9. In order to call this pattern FN, the participant being tested must be able to clear both assessments: 10 seconds eyes open and 10 seconds eyes closed bilaterally.

12.2. Verbal Cues:
12.2.1. “Stand tall with your feet together and arms out at your sides.”
12.2.2. “Raise your right leg up to 90 degree angle and hold.”
12.2.3. “Try to balance for up to 10 seconds.”
12.2.4. “Repeat with your left leg, trying to balance for up to 10 seconds.”
12.2.5. “Repeat with your right leg again, but this time with your eyes closed for up to 10 seconds.”
12.2.6. “Finally, repeat with your left leg with your eyes closed for up to 10 seconds.”

12.3. Scoring:
12.3.1. Try not to interpret the score while testing
12.3.2. Answer the following criteria Yes/No; score for both the right and left:
   - Eyes open <10 seconds
   - Eyes closed <10 seconds
   - Loss of height
   - Excessive effort and/or lack of motor control
   - Appreciable asymmetry
   - Pain during test

12.3.3. When in doubt score “dysfunctional”

13. OVERHEAD DEEP SQUAT (Fig.10)

13.1. Instructions:
13.1.1. Should be performed slowly and controlled
13.1.2. Participant assumes the starting position by placing his/her feet approximately shoulder width apart with feet aligned in the sagittal plane (no toe-out; all toes pointing forward) Shoulder width is instep aligned with the axilla bilaterally using a dowel rod.

Fig.9: Testing position for Single Leg Stance

Fig.10: Testing position for Overhead Deep Squat
13.1.3. The feet should be in the sagittal plane, with no external out turn of the toes.
13.1.4. The participant obtains a 90-90 position with shoulders and elbows and then extends hands overhead with the shoulder flexed and abducted and the elbows fully extended.
13.1.5. The participant slowly descends as deeply as possible into a squat position.
13.1.6. The squat position should be assumed with the heels on the floor, head and chest facing forward and the arms maximally pressed overhead. Knees should be aligned over the feet with no valgus or varus collapse.
13.1.7. Do not coach the movement; simply repeat the instructions if needed.
13.1.8. Observe from the front and side.
13.1.9. The hand width should not increase as the individual descends to the squat position.

13.2. Verbal Cues:
13.2.1. “Stand with your feet shoulder-width apart and toes pointed forward.”
13.2.2. “Place your arms overhead and squat down as far as you can.”

13.3. Scoring:
13.3.1. Try not to interpret the score while testing.
13.3.2. Answer the following criteria Yes/No; score for both the right and left:
   - Loss of UE start position
   - Tibia and torso are not parallel or better
   - Thighs do not break parallel
   - Loss of sagittal plane alignment (R and/or L)
   - Excessive effort, weight shift and/or lack of motor control
   - Pain during test
13.3.3. When in doubt score “dysfunctional”
LOWER QUARTER Y-BALANCE (Appendix A3)

1.0 GOAL/PURPOSE
This Manual Operating Procedure (MOP) describes the steps to administer the Lower Quarter Y-Balance Test (LQ-YBT).

2.0 TEST EQUIPMENT & TRAINING
2.1 Single YBT equipment set: (Fig.1)
   2.1.1 Base Unit with Anterior Reach Pole
   2.1.2 Posterior Reach Poles (2)
   2.1.3 Metal stoppers (2)
   2.1.4 Indicator boxes (3)
   2.1.5 Tape measure (1)
2.2 Safety: Ensure rubber mats are secured underneath the center footplate.
2.3 Assembly of equipment: https://www.youtube.com/watch?v=MdypNR9Hx9Q
2.4 Limb Length: measured with a tape measure to the nearest half centimeter (cm)
   2.4.1 Measured from distal Anterior Superior Iliac Spine (ASIS) to distal medial malleolus
2.5 Training is supplemented by on-line material
   2.5.1 Website: http://www.ybalancetest.com/ and www.medbridgeeducation.com
   2.5.2 Online certification can be completed to administer the lower and upper quarter YBT, and the research team complete the following:
      2.5.2.1 View the YBT Home Study Course Introduction
      2.5.2.2 View the Lower Quarter YBT Procedure Video and Research Video (Part 2)
      2.5.2.3 View the YBT Interpretation Video
      2.5.2.4 Read Star Excursion Balance Test Systematic Review – Gribble, JAT, 2012
      2.5.2.5 View the Upper Quarter YBT Video (Part 3)
      2.5.2.6 Read Exploration of Upper Quarter YBT – Westrick, IJSPT, 2012
      2.5.2.7 View Upper Quarter YBT Instructions, and read YBT Instructions Detail
      2.5.2.8 View Putting It All Together Video (Part 4)
      2.5.2.9 View the Lower Quarter YBT Group Instruction Video
      2.5.2.10 View the Upper Quarter YBT Group Instruction Video
      2.5.2.11 Read Upper Quarter YBT Study Power Point

3.0 TEST PROCEDURES
3.1 Overview of Test Procedures: https://www.youtube.com/watch?v=MdypNR9Hx9Q
3.2 Dress Attire
   3.2.1 All Participants must wear PT clothing
   3.2.2 The test is performed with shoes and socks off.
3.3 Practice Trial
   3.3.1 Participant will perform six practice trials on each leg in each direction
   3.3.2 Direct supervision of practice trials is not required.
LOWER QUARTER Y-BALANCE  (Appendix A3)

3.4 Test Instructions

3.4.1 Starting Position: Participant will stand with foot on the center foot plate with the most distal aspect of the toes just behind the red starting line (toes should not be on or crossing the red line)

3.4.2 Reaching Direction: While maintaining single leg stance, the Participant will reach with the free limb in one of three directions (anterior, posteromedial, or posterolateral) and then return to the starting position. The direction is in regards to the stance limb. (Fig.2)

3.4.3 Reaching Instructions: The Participant stands on the platform with toes behind the line and pushes the reach indicator in the red target area in the direction being tested. 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)

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

3.4.5 A maximum of six trials will be performed for any stance leg in a single direction. If the participant has more than four failed attempts, then nothing should be recorded for that trial. **DO NOT enter “Zero” for a failed attempt**

3.4.6 Testing Order: The Participant will start with the right foot on the center footplate and perform three trials while reaching in one of three directions. Then the participant will place the left foot on the center footplate and repeat with the opposite limb. Alternating stance legs between trials will ensure adequate rest for accurate results. The specific testing order is:

- 3.4.6.1 Right Anterior Reach
- 3.4.6.2 Left Anterior Reach
- 3.4.6.3 Right Posteromedial Reach
- 3.4.6.4 Left Posteromedial Reach
- 3.4.6.5 Right Posterolateral Reach
- 3.4.6.6 Left Posterolateral Reach

3.5 Reason for the reach/attempt to be repeated and not counted:

- 3.5.1 The participant fails to maintain unilateral stance on the platform (e.g. touches down to the floor with the reach foot or falls off the stance platform)
- 3.5.2 The participant fails to maintain reach foot contact with the reach indicator in the target area while the reach indicator is in motion (e.g. kicks the reach indicator)
- 3.5.3 The participant uses the reach indicator for support (e.g. places foot on reach indicator)
- 3.5.4 The participant fails to return the reach foot on the starting position under control. The starting position for the reach foot is defined by the area immediately between the standing platform and the pipe opposite the stance leg
LOWER QUARTER Y-BALANCE  (Appendix A3)

3.6 Measurement of limb length:

3.6.1 Leg Length

3.6.1.1 Instruct the Participant to lay on their back with feet together

3.6.1.2 Have the Participant bend their knees so that their feet are on the floor with knees bent (hook lying position)

3.6.1.3 Have the Participant push through their feet until their hips come off the floor (bridging position) and then lower their hips back down to the ground gently

3.6.1.4 The Tester then passively extends both of the Participant’s legs into a fully extended position with legs straight

3.6.1.5 Using a tape measure, measure from distal ASIS (find ASIS, move inferior to soft tissue, move finger back up onto ASIS) to distal medial malleolus to the nearest half centimeter

3.6.1.6 Measure the Right limb only

4.0 SCORING

4.1 Each indicator will be read from the Tester standing near the center footplate

4.2 The best of the 3 trials for each direction will be used for comparison and computing the composite scores.

4.3 If the Participant mentions pain, mark the box “yes”

5.0 DEFINITIONS

5.1 Stance Leg: The leg that is standing on the foot plate; stance leg = tested leg

5.2 Anterior Reach: When the free limb reaches forward in the anterior direction

5.3 Posteromedial: When the free limb reaches backwards and medially away from stance limb

Posterolateral: When the free limb reaches backwards and laterally towards the stance limb
1.0 GOAL/PURPOSE
This Manual Operating Procedure (MOP) describes the steps to administer the Upper Quarter Y-Balance Test (UQ-YBT).

2.0 EQUIPMENT & TRAINING
2.1 Testing Station: Single YBT equipment set (Fig. 1):
   2.1.1 Base unit with Medial Reach Pole (1)
   2.1.2 Lateral Reach Poles (2)
   2.1.3 Metal stoppers (2)
   2.1.4 Indicator boxes (3)
   2.1.5 Tape measure (1)
2.2 Safety: Ensure rubber mats are secured underneath the center foot plate
2.3 Assembly of equipment:
   https://www.youtube.com/watch?v=MdypNR9Hx9Q
2.4 Limb Length: measured with tape measure to the nearest half centimeter (cm)
   2.4.1 Measured from C7 spinous process to tip of longest finger with hand held palm facing forward at 90 degrees of abduction
2.5 Training is supplemented by online material
   2.5.1 Website: http://www.ybalancetest.com/ and www.medbridgeeducation.com
   2.5.2 Online certification can be completed to administer the lower and upper quarter YBT, and the research team complete the following:
      2.5.2.1 View the YBT Home Study Course Introduction
      2.5.2.2 View the Lower Quarter YBT Procedure Video and Research Video (Part 2)
      2.5.2.3 View the YBT Interpretation Video
      2.5.2.4 Read Star Excursion Balance Test Systematic Review – Gribble, JAT, 2012
      2.5.2.5 View the Upper Quarter YBT Video (Part 3)
      2.5.2.6 Read Exploration of Upper Quarter YBT – Westrick, IJSPT, 2012
      2.5.2.7 View Upper Quarter YBT Instructions, and read YBT Instructions Detail
      2.5.2.8 View Putting It All Together Video (Part 4)
      2.5.2.9 View the Lower Quarter YBT Group Instruction Video
      2.5.2.10 View the Upper Quarter YBT Group Instruction Video
      2.5.2.11 Read Upper Quarter YBT Study Power Point

3.0 TEST PROCEDURES
3.1 Overview of Test Procedures: https://www.youtube.com/watch?v=MdypNR9Hx9Q
3.2 Dress Attire
   3.2.1 All participants must wear PT clothing
   3.2.2 The test is performed with shoes and socks off.
3.3 Practice Trial
   3.3.1 Participant will perform two practice trials on each arm in each direction
   3.3.2 Direct supervision of practice trials is not required
3.4 Test Instructions
   3.4.1 Starting Position (Fig. 2): Participant will start by placing right thumb along the red line in a push up position with feet shoulder width apart and hands directly under shoulders
   3.4.2 Reaching Direction: The participant will push the to the left with the left hand in the red target area as far as possible to the left. Maintaining the same position, the participant then pushes the inferior box as far as possible. Then, pushes the superior box as far as possible
   3.4.3 Testing Order (Fig. 3): The participant will start with the right hand on the center platform in a push-up position and perform one trial reaching in all three directions. The participant will repeat this two more times and then complete three trials with the opposite limb. Unlike the Lower Quarter YBT, the participant performs all three-reach directions sequentially, and returns to the starting position to rest. When the participant is ready to
perform the next repetition, the participant returns to the starting position and performs the trial. The specific testing order is:

3.4.3.1 Right Medial Reach, Inferolateral reach, and Superolateral reach
3.4.3.2 Left Medial Reach, Inferolateral reach, and Superolateral reach

Fig. 3: Pictures of test directions for Right arm (Left to Right): Medial, Inferolateral, Superolateral

3.4.4 Measurement of Reach Distance: The participant places their hand on the platform with thumb along the red line in a push up position with feet shoulder width apart and hands directly under shoulders. The participant pushes the reach indicator in the red target area in the direction being tested. The maximal reach distance is measured by reading the tape measure at the proximal 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)

3.4.5 Three trials in each direction for each hand will be collected and the maximal reach in each direction will be included for analysis

3.4.6 A maximum of six trials will be performed for each limb. If the participant is unable to complete a reach in all three directions in one good attempt, then nothing should be recorded for the failed direction for that trial. Do not enter “zero” for a failed attempt.

3.5 Reason for the reach/attempt to be repeated and not counted:

3.5.1 Touching down to the floor with the reach hand or falling off the stance platform
3.5.2 The participant fails to maintain contact with the reach indicator on the target area while in the reach indicator is in motion (e.g. shoves the reach indicator)
3.5.3 The participant uses the reach indicator for support (e.g. places hand on indicator)
3.5.4 The participant fails to return the reach hand to the starting position under control

3.6 Measurement of upper quarter limb length:

3.6.1 Instruct the participant to stand facing away from the tester with feet together
3.6.2 Have the participant extend their right arm to the side in 90 degrees of abduction with the palm facing the same direction as the participant
3.6.3 Locate the participant’s C7 spinous process (bony prominence at base of the neck)
3.6.4 Measure the distance from C7 spinous process to the distal tip of the longest finger to the nearest half centimeter
3.6.5 If unable to locate the C7 spinous process, have the participant flex and extend their neck as the C7 spinous process will remain prominent throughout
3.6.6 Only measure the Right arm

4.0 SCORING

4.1 Each indicator will be read from the Tester standing near the center plate and will read all three prior to resetting the indicators for the next trial
4.2 Input the best 3 trials in each direction for each arm measured to nearest half-centimeter (cm)
4.3 The software will compute the best scores and standardize them for comparison
4.4 If the participant mentions pain, mark the box “yes”
4.5 If a measure is > 20% different from the other measures (across trials not limbs) the test instructor will be asked to confirm the data entered is correct.

5.0 DEFINITIONS

5.1 Stance Arm: Arm on the platform while in the push-up position; stance arm = tested arm
5.2 Medial Reach: When free limb reaches sideways medially or away from the reach arm
5.3 Inferolateral Reach: When the free limb reaches underneath and towards the reach arm
5.4 Superolateral Reach: When the free limb reaches above and towards the reach arm
SINGLE, TRIPLE, and Crossover Hop Tests (Appendix A5)

1.0 GOAL/PURPOSE
This Manual Operating Procedure (MOP) describes the steps to administer the Single, Triple, and Crossover Hop Tests.

2.0 EQUIPMENT & TRAINING
2.1 Single Leg Hop and Triple Hop
2.1.1 10-meter tape measure
2.1.2 Tape measure is laid down and secured with tape measuring two feet in length at the starting line and at 10 meters
2.1.3 Yardstick or dowel to measure TOE strike at landing

2.2 Triple Crossover Hop
2.2.1 Add a second 10 meter tape measure or another straight line on the floor 6” from and aligned parallel to the first tape measure with the lateral edges of the tape measures being 6” apart
2.2.2 Tape measure is laid down and secured with duct or painter’s tape measuring two feet length at the starting line and at 10 meters
2.2.3 Label Right and Left starting positions for Crossover hop so that the first hop will be lateral to testing leg
2.2.4 Yardstick or dowel to measure TOE strike at landing

2.3 Safety
2.3.1 Shoes
2.3.2 Dry Surface
2.3.3 Adequate testing area clear of any obstruction

3.0 TEST PROCEDURES
3.1 Dress Attire
3.1.1 All participants must wear PT clothing
3.1.2 Sweatpants are not allowed as tester needs to visualize entire lower extremity
3.1.3 The test is performed with shoes and socks on

3.2 Single Leg Hop (Fig. 1)
3.2.1 Instructions:
3.2.1.1 The participant will start on a single foot as close to the starting line as they can without allowing toes to extend onto or past the line
3.2.1.2 For the hop, instruct the participant to assume a single leg stance, not to move the feet, but flex at the knee, hip and ankle, and jump forwards as far as they can and as safely as they can
3.2.1.3 Let the participant know that they may use their arms in any fashion, and that they may use any type of method to begin their first hop as long as they do not take a running start
3.2.1.4 Let the participant know that they may start when they are ready since this is not a timed test
3.2.1.5 Advise the participant that they do not have to stick their landing; feel free to let your momentum carry you forward (they may put the non-tested foot down at the end as long as the tested leg lands first)
3.2.1.6 Use the yardstick/dowel to mark the landing for the measurement which is taken at the TOE to the nearest half centimeter (e.g. 120.0, 120.5, 121.0 cm)
3.2.1.7 Allow the participant to return to the start line and test the opposite foot (about 15-20 seconds)

3.2.2 Reason for the attempt to be repeated and not counted:
3.2.2.1 A test is considered failed if the participant loses balance or the non-test leg makes contact with the floor at any time other than the end position where the participant may put their non-test leg down as their momentum carries them forward
3.2.2.2 Running start
3.2.2.3 Hand touches the ground

Fig.1: Diagram for Single Leg Hop

https://clinicaltrials.gov/ct2/show/NCT02776930
3.2.3 Verbal cues provided to the participant:
3.2.3.1 “Please jump as far and as safely as you can”
3.2.3.2 “You do not have to stick your landing, feel free to let your momentum continue to carry you forward and put your non-testing leg down”
3.2.3.3 “You may use your hands any way you wish to keep your balance or propel you further as long as they do not touch the ground”
3.2.3.4 “Do you have any questions? If not, you may start when you are ready as this is not a timed test.”

3.2.4 Scoring:
3.2.4.1 There will be one practice trial per side and then three test trials per side
3.2.4.1.1 There will be a maximum of 6 trials
3.2.4.1.2 If the participant is unable to perform three recordable trials within the six attempts, then the remaining attempts are left blank
3.2.4.2 All measurements will be taken at the end of the participant’s hop, where the TOE strikes the ground

3.3 Single Leg Triple Hop (Fig.2)
3.3.1 Instructions:
3.3.1.1 The participant will start on a single foot as close to the starting line as they can without allowing toes to extend onto or past the line
3.3.1.2 For the triple hop, instruct the participant to assume a single leg stance, not to move the feet, but flex at the knee, hip and ankle, and jump forwards as far as they can and as safely as they can three times without pausing to compose themselves between hops
3.3.1.3 Let the participant know that they may use their arms in any fashion, and that they may use any type of method to begin their first hop as long as they do not take a running start and they only hop on their testing foot
3.3.1.4 Let the participant know that they may start when they are ready since this is not a timed test
3.3.1.5 Advise the participant that they do not have to stick their landing on the third hop; feel free to let your momentum carry you forward (they may put the non-tested foot down at the end as long as the tested leg lands first)
3.3.1.6 Use the yardstick/dowel to mark the landing for the measurement which is taken at the TOE to the nearest half centimeter (e.g. 420.0, 420.5, 421.0 cm)
3.3.1.7 Allow the participant to return to the start line and test the opposite foot (about 15-20 seconds)

3.3.2 Reason for the attempt to be repeated and not counted:
3.3.2.1 A test is considered failed if the participant loses balance or the non-test leg makes contact with the floor at any time other than the end position where the participant may put their non-test leg down as their momentum carries them forward
3.3.2.2 Running start
3.3.2.3 Hand touches the ground

3.3.3 Verbal cues provided to the participant:
3.3.3.1 “Please jump as far as you can and safely as you can for three hops”
3.3.3.2 “On your third hop, you do not have to stick your landing, feel free to let your momentum continue to carry you forward and put your non-testing leg down”
3.3.3.3 “You may use your hands any way you wish to keep your balance or propel you further as long as they do not touch the ground”
3.3.3.4 “Do you have any questions? If not, you may start when you are ready as this is not a timed test.”

3.3.4 Scoring:

Fig.2: Diagram for Triple Hop

https://clinicaltrials.gov/ct2/show/NCT02776930
3.3.4.1 There will be one practice trial per side and then three test trials per side
3.3.4.1.1 There will be a maximum of 6 trials
3.3.4.1.2 If the participant is unable to perform three recordable trials within the six attempts, then the remaining attempts are left blank
3.3.4.2 All measurements will be taken at the end of the participant’s third hop, where the TOE of the testing leg strikes the ground

3.4 Single Leg Triple Crossover Hop (Fig.3)
3.4.1 Instructions:
3.4.1.1 The participant will start on a single foot as close to the starting line as they can without allowing toes to extend onto or past the line
3.4.1.2 For the hop, instruct the participant to hop as far as they can and as safely as they can three times crossing over the lines 6” apart without pausing to compose themselves between hops with the first hop being lateral to the testing leg
3.4.1.3 Let the participant know that they may use their arms in any fashion, and that they may use any type of method to begin their first hop as long as they do not take a running start and they only hop on their testing foot
3.4.1.4 Let the participant know that they may start when they are ready since this is not a timed test (e.g. first jump on right is to right and first jump on left is to the left)
3.4.1.5 Advise the participant that they do not have to stick their landing on the third hop; feel free to let your momentum carry you forward (they may put the non-tested leg down as their momentum carries them forward)
3.4.1.6 Use the yardstick/dowel to mark the landing for the measurement which is taken at the TOE to the nearest half centimeter (e.g. 450.0, 450.5, 451.0 cm)
3.4.1.7 Allow the participant to return to the start line and test the opposite foot (about 15-20 seconds)

3.4.2 Reason for the attempt to be repeated and not counted:
3.4.2.1 A test is considered failed if the participant loses balance or the non-test leg makes contact with the floor at any time other than the end position where the participant may put their non-test leg down as their momentum carries them forward
3.4.2.2 Running start
3.4.2.3 First hop is not lateral to testing leg
3.4.2.4 Hopping foot does not cross over the 6” gap or lands on the tape measure
3.4.2.5 Hand touches the ground

3.4.3 Verbal cues provided to the participant:
3.4.3.1 “Please jump as far as you can and safely as you can for three hops crossing over the two lines each time”
3.4.3.2 “On your third hop, you do not have to stick your landing, feel free to let your momentum continue to carry you forward and put your non-testing leg down”
3.4.3.3 “You may use your hands any way you wish to keep your balance or propel you further”
3.4.3.4 “Do you have any questions? If not, you may start when you are ready as this is not a timed test.”

3.4.4 Scoring:
3.4.4.1 There will be one practice trial per side and then three test trials per side
3.4.4.1.1 There will be a maximum of 6 trials
3.4.4.1.2 If the participant is unable to perform three good trials within the six attempts, then the remaining attempts are left blank
3.4.4.1.3 All measurements will be taken at the end of the participant’s third hop, where the TOE of the testing leg strikes the ground.
1.0 GOAL/PURPOSE
This Manual Operating Procedure (MOP) describes the steps to execute the 300-yard shuttle run.

2.0 EQUIPMENT & TRAINING
2.1 Equipment
  2.1.1 Stopwatch
  2.1.2 Four cones
  2.1.3 Weighted vest standardized to participant’s gender and weight
  2.1.4 Simulated weapon
  2.1.5 Kevlar helmet
  2.1.6 One tester

3.0 TEST PROCEDURE
3.1 Shuttle Run Set Up
  3.1.1 A pair of cones are placed four feet apart forming the starting line
  3.1.2 The second pair of cones are placed 25 yards (75 feet) downfield and four feet apart to form the end line
  3.1.3 There are two sprints that should have a five minute rest between trials
  3.1.4 The two sprints are weighted and non-weighted with the non-weighted performed first

3.2 Shuttle Run Procedures
  3.2.1 The participant is instructed to line up behind the starting line
  3.2.2 When instructed he/she must run to the opposite line and back
  3.2.3 The Participant must complete six laps (down and back) for a total of 300 yards
  3.2.4 The participant will touch each line with one hand
  3.2.5 The participant will turn opposite directions each time
  3.2.6 The participant will rest five minutes between trials
  3.2.7 The participant will then put on the weighted vest, helmet, and grab the simulated weapon (Fig.1)
    3.2.7.1 Males weighing <140 pounds and all females will wear 20-pound vest
    3.2.7.2 Males weighting 141-185 pounds will wear 25-pound vest
    3.2.7.3 Males weighing 186+ pounds will wear 30-pound vest
  3.2.8 The Participant will then rerun the course with the above directions

3.3 Verbal Commands:
  3.3.1 “You will run as quickly as you can down and back for a total of six laps”
  3.3.2 “You must touch the line with one hand each time”
  3.3.3 “You must turn opposite directions each time”
  3.3.4 “The second trial will be performed wearing the weighted vest, helmet, and holding the simulated weapon”
  3.3.5 “You will have a five-minute rest between trials”
  3.3.6 “Do you have any questions at this time? If not, you will start on my Ready, Set, Go and I will start the timer”

3.4 Scoring:
  3.4.1 The participant’s time for each trial will be recorded to the nearest tenth of a second
The participant touches each line and turns opposite directions, both of which will also be
1.0 GOAL/PURPOSE
This Manual Operating Procedure (MOP) describes the steps to execute the Carry Test.

2.0 TESTING EQUIPMENT/FORMS
2.1 Equipment
   2.1.1 Stopwatch
   2.1.2 Sandbags/weights
   2.1.3 4 cones on a straight 25-yard (75 feet) course
   2.1.4 Tape measure

2.2 Safety:
   2.2.1 Beforehand, the tester will ask the participant “Is there any reason you should not lift XX pounds?”
   2.2.2 Ensure that the course is cleared of debris that may trip the participant.

3.0 TESTING PROCEDURES
3.1 The Carry Setup:
   3.1.1 Cones are set at 0, 25, 50, and 75 feet (total course length is 25 yards) to indicate distance traveled.
   3.1.2 There are two carries which should have a 5-minute rest between trials.
   3.1.3 The first carry is a clearing test, with 50% body weight (25% in each hand) for 50 feet (16.67 yards) (Down and around first cone). The second carry is the performance test with 75% body weight (37.5% in each hand) for maximal distance (full length of the course as many times as possible).

3.2 The Carry Procedure: (Figure 1)
   3.2.1 The participants lines up behind the starting cone with the front edge of the weights (1st trial with a total of 50% Body Weight and the 2nd trial being with 75% Body Weight) lined up with the front of the starting cone.
   3.2.2 The participant is instructed to pick up the weights (one in each hand) and start walking when ready. The participant must walk at a March pace with tall posture, head straight forward and arms straight at sides. The tester will start the stopwatch once the front of the weight crosses the start line.
   3.2.3 For the clearing test, the participant will walk with 50% body weight down and around the first cone for a total of 50 feet, and then place the weight down. If the participant is unable to perform the full 50 feet (to include it being too painful), the distance is recorded and they move on to next performance test without performing the 75% body weight.
   3.2.4 The participant will then rest for 5 minutes.
   3.2.5 The participant will perform the performance test with 75% Body Weight, attempting to walk the entire length of the course as many times as possible.
   3.2.6 The test is terminated when the participant can no longer maintain tall posture with head forward, becomes unsafe while holding the weights as seen with increased lateral swaying or pendulum swing of the weights, or they feel they can no longer continue (Participant will carefully place both weights down with a squatting motion when can no longer continue and the tester will stop the timer).
   3.2.7 The distance traveled is measured by the front part of the weight as well as total carry time.

3.3 Verbal Instructions:
   3.3.1 Prior to the testing, the tester will ask the participant “Is there any reason you cannot not lift XX pounds?” (giving 50% body weight as an example)
   3.3.2 Any time the participant is not in tall posture with head forward, or the gait becomes unstable, they will receive a reminder. If the participant requires more than one correction, they will be instructed to put the weights down gently and the test ends with distance and time then recorded.

3.4 Scoring:
   3.4.1 The participant is assessed for carry distance in yards and time in seconds to nearest whole second.
   3.4.2 If pain is noted, check the “yes” box.

MP3-RD
https://clinicaltrials.gov/ct2/show/NCT02776930
CLOSED KINETIC CHAIN DORSIFLEXION RANGE OF MOTION TEST
(Appendix A8)

1.0 TEST EQUIPMENT & TRAINING

1.1 Equipment

1.1.1 Y-Balance test Kit (1)
1.1.2 Bubble goniometer (1)
1.1.3 Cushion/airex pad (1)

1.2 Safety: Ensure participant is able to get up and down from one knee and place cushion under down knee for comfort

2.0 TEST PROCEDURES

2.1 Dress Attire

2.1.1 All participants must wear shorts & t-shirt
2.1.2 The test is performed with shoes and socks off

2.2 Test Instructions

2.2.1 Starting position: (Fig.1)

2.2.1.1 Participant will kneel beside the Y-balance test kit on one knee with a cushion under the down knee for comfort with the foot of the ankle being tested placed on the foot plate of the Y-balance test kit

2.2.1.2 The tester will then align the participant’s medial aspect of the whole foot (1st metatarsal to calcaneus) that is on the foot plate of the Y-balance test kit along the medial edge of the foot plate

2.2.1.3 The tester will “zero” the bubble goniometer on the floor by aligning the indicator up with the 90 degree as that will allow the bubble goniometer to read “0 degrees” in start position on tibia

2.2.1.4 The tester will locate the participant’s tibia tuberosity (bony prominence on the proximal anterior surface of the tibia) and position the bubble goniometer vertically two finger breadths below the distal tibial tuberosity on the tibial crest

2.2.2 Testing and End Position:

2.2.2.1 Instruct the participant to bring the up knee forward over the 4th ray while maintaining calcaneal contact with the foot plate (Tester will palpate the calcaneus until the participant’s calcaneus lifts from the board)

2.2.2.2 Tester will then manually shift the participant’s tibia backwards until calcaneus touches the foot plate

2.2.2.3 Record the measurement on the bubble goniometer to the nearest whole degree

2.2.2.4 The tester will perform two trials on each leg

3.0 SCORING

3.1 Measure both right and left legs and place the numeric scores in the appropriate boxes

If the Participant states that he/she has pain during the test, check the box “yes”.

https://clinicaltrials.gov/ct2/show/NCT02776930