### Practical Scenario 1 - SORENSEN TEST & DOUBLE LEG LOWERING TEST

A prospective employer is keen to screen potential employees for work involving repetitive manual handling. To establish baseline data on lumbar extensor muscle endurance you are to perform the **Double Leg Lowering Test** and the **Biering Sorensen Test**. Determine and interpret the findings and describe the implication of such test scores.

### Practical Scenario 2 - BUNKIE' TEST

It has been speculated that repetitive patterns of movement will lead to specific patterns of fascia contraction ultimately contributing to injury. A 20 year old woman presents complaining of lateral knee pain whilst running. To establish baseline data on fascial lines you are to perform the **Bunkie Test** and describe the outcomes and expected line of dysfunction.

### Practical Scenario 3 - FUNCTIONAL MOVEMENT SCREEN

A 14 year old netballer presents with a history of patella instability (recurrent giving way of her knee). She has never fully dislocated her patella however. To establish baseline data on lower limb strength, stability and flexibility you are to perform functional screen movement’s **Deep Squat**, **Hurdle Step** and **Inline Lunge**. Determine the raw scores, movement limitations and describe the implication of such test scores.

### Practical Scenario 4 - CKC UPPER EXTREMITY STABILITY TEST & SHOULDER MOBILITY

A collegiate baseball player presents with a well documented case of GH joint Instability which has not had surgically repaired. To establish baseline data on GH joint function (strength, stability, and mobility) you will conduct the **Closed Kinetic Chain Upper Extremity Stability Test** and the **FMS Shoulder Mobility Test**. Determine the raw score, power index and describe the implication of such test scores.

### Practical Scenario 5 - LOWER EXTREMITY HOP TESTS

A state level long jumper is now 12 weeks post partial right PCL tear. He is keen to return to high level training (plyometrics, sprinting). To establish baseline data on possible return to high level training you are to perform the three (3) **Lower Extremity Hop Tests**. Determine raw scores, bilateral comparisons and describe the implication of such test scores.

### Practical Scenario 6 - STAR EXCURSION BALANCE TEST

A female basketball player presents following an anterior cruciate ligament (ACL) injury which has been associated with a decrease in proprioceptive performance and postural control. Rupture of the ACL results in antero-lateral instability of the knee which manifests itself as a feeling of instability and repeated episodes of “giving away”, where the knee fails under conditions of rotary stress. To establish baseline data on proprioceptive performance and postural control you will conduct the **Star Excursion Balance Test**. Determine raw scores, bilateral comparisons and describe the implication of such test scores.
**CLINICAL ASSESSMENT OF CORE FUNCTION**

1. **Double leg-lowering test**

   **Purpose:** The Double leg-lowering test indicates the ability of the lower abdominal wall to preferentially stabilise the lumbo-pelvis-hip complex.

   **Description:**
   1. Have the patient remove their shoes to avoid additional external loads.
   2. Place patient in supine position with their legs maintained at full extension, flex the hips to 90°.
   3. Monitor the position of the low back from the subject’s right side by placing fingers between the low back (L4-L5) and the table.
   4. Slowly lower the legs counting at a rate so it would take approximately 10 seconds to lower the legs from a 0° vertical position to a 90° horizontal position.
   5. When the patient’s back began to lift from the monitoring fingers (pelvis first tilts-rotates anteriorly); this represented the end of the test.
   6. Determine hip angle and define the muscle grade.

   **Clinical notes:**
   - Look for rocking of the pelvis early in leg lowering.

<table>
<thead>
<tr>
<th>Angle</th>
<th>Muscle Grade 1</th>
<th>Muscle Grade 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>Poor</td>
<td>2</td>
</tr>
<tr>
<td>15°</td>
<td>Fair</td>
<td>3</td>
</tr>
<tr>
<td>30°</td>
<td>Fair plus</td>
<td>3+</td>
</tr>
<tr>
<td>45°</td>
<td>Good minus</td>
<td>4-</td>
</tr>
<tr>
<td>60°</td>
<td>Good</td>
<td>4</td>
</tr>
<tr>
<td>75°</td>
<td>Good plus</td>
<td>4+</td>
</tr>
<tr>
<td>90°</td>
<td>Normal</td>
<td>5</td>
</tr>
</tbody>
</table>

   **Function of the Muscle**

<table>
<thead>
<tr>
<th>Function of the Muscle</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Movement</td>
<td></td>
</tr>
<tr>
<td>No contractions felt in the muscle</td>
<td>0</td>
</tr>
<tr>
<td>Tendon becomes prominent or feeble contraction felt in the muscle, but no visible movement of the part</td>
<td>T</td>
</tr>
<tr>
<td>MOVEMENT IN HORIZONTAL PLANE</td>
<td></td>
</tr>
<tr>
<td>Moves through partial range of motion</td>
<td>1</td>
</tr>
<tr>
<td>Moves through complete range of motion</td>
<td>2</td>
</tr>
<tr>
<td>ANTI GRAVITY POSITION</td>
<td></td>
</tr>
<tr>
<td>Moves through partial range of motion</td>
<td>3</td>
</tr>
<tr>
<td>Test Position</td>
<td></td>
</tr>
<tr>
<td>Gradiual release from test position</td>
<td>4</td>
</tr>
<tr>
<td>Holds test position (no added pressure)</td>
<td>5</td>
</tr>
<tr>
<td>Holds test position against slight pressure</td>
<td>6</td>
</tr>
<tr>
<td>Holds test position against slight to moderate pressure</td>
<td>7</td>
</tr>
<tr>
<td>Holds test position against moderate pressure</td>
<td>8</td>
</tr>
<tr>
<td>Holds test position against moderate to strong pressure</td>
<td>9</td>
</tr>
<tr>
<td>Holds test position against strong pressure</td>
<td>10</td>
</tr>
</tbody>
</table>

**References**


Sorensen Test

Purpose: The Sorensen test allows for a rapid, simple, and reproducible evaluation of the isometric endurance of the trunk extensor muscles. It discrimines between healthy individuals and patients with low back pain and may predict the occurrence of low back pain in the near future.

Description

1. Patient lies on the examining table in the prone position with the upper edge of the iliac crests aligned with the edge of the table.
2. Lower body is fixed to the table by three straps, located around the pelvis, knees, and ankles, respectively.
3. Arms folded across the chest, start with the upper body sloping downward toward the floor so that a concentric contraction of the trunk extensor muscles was needed initially to reach the horizontal position. Patient is asked to isometrically maintain the upper body in a horizontal position.
4. Time during which the patient keeps the upper body straight and horizontal is recorded. In patients who experience no difficulty in holding the position, the test is stopped after 240 s.
   - Healthy: male 198 s / female 197 s
     - Position-holding time: <176 s predicted low back pain during the next year in males, >198 s predicted absence of low back pain
5. Hip flexion: the hips remain fully extended throughout the Sorensen test.
6. Method for documenting the horizontal position: Measure ability to sustain position with goniometer.
7. Criteria for stopping the test: trunk down-sloping by more than 5–10°
2. Bunkie' Test

**Purpose:** The 'Bunkie' test, used as main assessment tool in the Lyno Method, as developed over a period of 12 years of study in clinical practice, involving team athletes (e.g., rugby, netball, cricket), cyclists, long-distance runners, and sprinters. It is an accurate test to measure the function of all muscles, involving all the different fascia lines. Assessments indicate that some muscles appear to be 'locked-long' and others 'locked-short'.

**Description**

1. Lie on mat in the required position, with feet or one foot on the Bunkie, supporting upper body on elbows
2. Lift body up into a neutral position, and takes weight off one foot to test the specific fascia line
3. Held for 20–40s
4. Novice 20 s; Intermediate 30; Advanced/Endurance athlete 40s,
The Functional Movement Screen™ (FMS) is designed to identify athletes who are at risk of sustaining injuries, specifically from non-contact injuries during athletic participation. The FMS was developed to improve the ability of the pre-participation examination to detect functional movement patterns by assessing mobility and stability using a simple grading system. The functional movement screen (FMS) attempts to quantify movement quality and fulfill the first requirement of baseline testing (mobility and stability assessment). The screen uses seven movements that represent the mobility and stability milestones in human growth and development, these include squatting, stepping, lunging, reaching, striding or kicking, and two movements that require trunk stability for anterior-posterior stress (pushing) and rotary stress (segmental stabilisation).

**Scoring:**
The scoring criteria for the test are quite simple. If the athlete is able to produce the required movements without any of the common compensations described, he or she receives a score of 3.

**Interpretation:**
- 0 scores will be considered first by the team physician and athletic trainer, who will conduct a sports medicine evaluation of the painful site considering the movement pattern that produced the pain.
- Score of 1 demonstrates that an athlete does not have a functional base of mobility and stability and is therefore probably experiencing microtrauma, poor efficiency, and poor technique with common athletic movements.
- Score of 2 demonstrates areas of priority in conditioning and flexibility. It is advisable that the athletic trainer, strength coach, and sport coach work together to develop complementary exercise, conditioning, and sport-specific training programs around these areas of limitation.
- Score of 3 demonstrates appropriate or optimal mobility and stability for a particular movement pattern; screening is still periodically necessary to check for common imbalances acquired in training.
- Five of the seven screens are performed on the left and right sides of the body, allowing for comparison. If testing on one side of the body produces a lower score, then that is the score given for the test.
1. Deep Squat

Purpose: The deep squat assesses bilateral, symmetrical and functional mobility of the hips, knees and ankles. The dowel held overhead assesses bilateral, symmetrical functional mobility of the shoulders as well as the thoracic spine.

Description:
1. The athlete places the feet slightly farther than shoulder-width apart and places the hands on the dowel so as to form a 90-degree angle at the elbows with the dowel overhead.
2. The athlete presses the dowel overhead with the shoulders flexed and abucted and with the elbows extended, then descends slowly into a squat position with the heels on the floor, the head and chest facing forward, and the dowel maximally pressed overhead.
3. The athlete is allowed up to three chances to perform the test.

What to look for:
1. Upper torso is parallel with tibia or toward vertical;
2. Femur below horizontal;
3. Knees are aligned over feet;
4. Dowel aligned over feet.
5. Upper torso mobility; poor glenohumeral / thoracic-spine mobility.
6. Lower extremity mobility; poor CKC dorsiflexion ankle / poor flexion of the hip.
2. In-Line Lunge

**Purpose:** The in-line lunge assesses hip mobility and stability, quadriceps flexibility, and ankle and knee stability.

**Description**
1. The tester measures the length of the tibia with a yardstick.
2. The athlete places one foot on the line and holds the dowel behind the back, with the right arm up and the left arm down, so that it is touching the head, thoracic spine and sacrum.
3. The tester then places the yardstick at the end of the athlete’s toes and makes a mark on the line equal to the length of the tibial height.
4. The athlete takes a step with the left leg and places the heel on the mark, then lowers the back knee enough to touch the line behind the front foot. The feet should be on the same line and pointing straight throughout the movement.
5. The athlete is allowed up to three chances to perform the test.
6. Have the athlete perform the test again, with arms and legs in the opposite positions. If testing produces a lower score with either the left or the right leg in front, record the lower score.

**What to look for:**
1. The front leg identifies the side being scored;
2. Dowel remains in contact with the head, thoracic spine, and sacrum during the lunge;
3. The front heel remains in contact with the surface and back heel touches surface when returning to starting position;
3. Hurdle Step

**Purpose:** The hurdle step assesses bilateral functional mobility and stability of the hips, knees, and ankles.

**Description**
1. The individual assumes the starting position by first placing the feet together and aligning the toes touching the base of the hurdle.
2. The hurdle is then adjusted to the height of the athlete’s tibial tuberosity.
3. The dowel is positioned across the shoulders below the neck.
4. The individual is then asked to step over the hurdle and touch their heel to the floor while maintaining the stance leg in an extended position.
5. The moving leg is then returned to the starting position.
6. The hurdle step should be performed slowly and as many as three times bilaterally.
7. If testing produces a lower score with either the left or the right leg in front, record the lower score.

What to look for:
1. Excessive hip hiking and body sway;
2. Triple extension: ankle – knee – hip;
3. Dowel and string remain parallel, Shift centre of gravity;
4. Poor stability (stance leg), poor mobility (step leg);
5. Hips, knees and ankles remain aligned in the sagittal plane
6. Asymmetric hip mobility;
7. Minimal to no movement is noted in lumbar spine
4. Shoulder Mobility

**Purpose:** The shoulder mobility screen assesses bilateral shoulder range of movement, combining internal rotation with adduction and external rotation with abduction. It also requires normal scapular mobility and thoracic spine extension.

**Description**

1. The tester determines the athlete’s hand length by measuring the distance from the distal wrist cease to the tip of the third digit.
2. The athlete makes a fist with each hand, placing the thumb inside the fist, and assumes a maximally adducted and internally rotated position with one shoulder and an abduced and externally rotated position with the other. In one movement the athlete places the hands on the back. During the test the hands should remain clenched.
3. The tester then measures the distance between the two fists.
4. Have the athlete perform the test again, with arms and hands in the opposite positions. If testing produces a lower score with either the left or right arm up, record the lower score.

![Image of shoulder mobility test]

**What to look for:**

1. GH joint; stability vs mobility
2. Hyper / hypo mobile
3. Excessive development / shortening (pectoralis minor or latissimus dorsi)
4. Scapulothoracic dysfunction.
## Functional Movement Screen Recording Sheet

Name: _________________________  Time: _____________  Date: ___ / ___/ ___

Testing Venue: ___________________________________________________________

Sport: ______________________________  Position: ____________________________

Hand Dominance: L / R  Leg Dominance: L / R  Eye Dominance: L / R

Age: ____________  Height: __________  Weight: __________  o Male  o Female

Injury Details:  ______________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

<table>
<thead>
<tr>
<th>Test</th>
<th>Score</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep Squat</td>
<td>3 2 1 0</td>
<td></td>
</tr>
<tr>
<td>Hurdle Step</td>
<td>3 2 1 0</td>
<td></td>
</tr>
<tr>
<td>Inline Lunge</td>
<td>3 2 1 0</td>
<td></td>
</tr>
<tr>
<td>Shoulder Mobility</td>
<td>3 2 1 0</td>
<td></td>
</tr>
<tr>
<td>Active Straight Leg Raise</td>
<td>3 2 1 0</td>
<td></td>
</tr>
<tr>
<td>Truck Stability Push Up</td>
<td>3 2 1 0</td>
<td></td>
</tr>
<tr>
<td>Rotatory Stability</td>
<td>3 2 1 0</td>
<td></td>
</tr>
</tbody>
</table>

Total

Compensatory Movement Patterns

__________________________________________________________________________

__________________________________________________________________________

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Closed Kinetic Chain Upper Extremity Stability Test

**Purpose:** The Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) is a tool developed and used in the clinic to evaluate progress during upper extremity rehabilitation.

**Description**
1. The test is performed in the push-up position (males) or modified push-up position on knees (females) between two markings that are three (3) feet apart.
2. The subject moves their hands back and forth (criss – cross fashion) from each line marking as many times as possible in 15 seconds.
3. The number of lines touched with each hand is then totalled.
4. Begin with one sub-maximal warm-up trial, followed by three (3) test trials.
5. The average of the three (3) trials is then used as the final score value.

**Conversion factors**
- 1 foot = 30.48 centimetres
- 1 pound = 0.45359237
- 1 inches = 2.54 centimetres

<table>
<thead>
<tr>
<th>Trial 1:</th>
<th>Trial 2:</th>
<th>Trial 3:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av Touches:</td>
<td>Height (inches):</td>
<td>BW (lbs):</td>
</tr>
<tr>
<td>a) Score:</td>
<td>b) Power:</td>
<td></td>
</tr>
</tbody>
</table>

*a) Scores are then normalised for body height (inches).*

Score = \( \frac{\# \text{ of lines touched}}{\text{Height (inches)}} \)

*b) Power is then determined by applying the following formula:*

Power = \( \frac{68\% \text{ BW (lbs)} \times \# \text{ of lines touched}}{15 \text{ sec}} \)

Compare your scores with the norms in the table provided below:

<table>
<thead>
<tr>
<th>Norm</th>
<th>Male (av)</th>
<th>Female (av)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Touches</td>
<td>14.5</td>
<td>20.5</td>
</tr>
<tr>
<td>Power</td>
<td>150</td>
<td>135</td>
</tr>
<tr>
<td>Score</td>
<td>.26</td>
<td>.31</td>
</tr>
</tbody>
</table>
FUNCTIONAL TESTS

LOWER EXTREMITY HOP TESTS


1. **Single-Leg Hop for Distance**

**Purpose:** The Single Leg Hop for Distance test is used to assess functional performance and considered useful as part of a battery of tests to determine readiness to participate in activity.

**Description**
1. Patient stands on one leg and hop as far forward as possible landing on the same leg.
2. Measure the distance travelled.
3. The average of three trials is used in calculating the limb symmetry score (see below).

<table>
<thead>
<tr>
<th>Dominant / Un-injuries</th>
<th>Non-Dominant / Injured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1: ______________</td>
<td>Trial 1: ______________</td>
</tr>
<tr>
<td>Trial 2: ______________</td>
<td>Trial 2: ______________</td>
</tr>
<tr>
<td>Trial 3: ______________</td>
<td>Trial 3: ______________</td>
</tr>
</tbody>
</table>

**Limb Symmetry Score:**
- To calculate the limb symmetry score, the mean score of the involved limb is divided by the mean time (or distance) of the unininvolved limb and the result multiplied by 100. Symmetry index of < 85% is usually considered abnormal.
2. **Single-Leg Timed Hop**

**Purpose:** The Single-Leg Timed Hop test is used to assess functional performance and considered useful as part of a battery of tests to determine readiness to participate in activity.

**Description**
1. Instruct patient to use explosive single-leg hops from start to finish across a distance of 6 m.
2. Record the time required to perform the test using the average of three trials.
3. Perform the test on both legs to calculate the limb symmetry score.

<table>
<thead>
<tr>
<th>Dominant / Un-injuries</th>
<th>Non-Dominant / Injured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1: ______________</td>
<td>Trial 1: ______________</td>
</tr>
<tr>
<td>Trial 2: ______________</td>
<td>Trial 2: ______________</td>
</tr>
<tr>
<td>Trial 3: ______________</td>
<td>Trial 3: ______________</td>
</tr>
</tbody>
</table>

Limb Symmetry Score: ___________________

- To calculate the limb symmetry score, the mean score of the involved limb is divided by the mean time (or distance) of the unininvolved limb and the result multiplied by 100. Symmetry index of < 85% is usually considered abnormal.

3. **Single-Leg Cross-over for Distance**

**Purpose:** The Single-Leg Cross-over for Distancetest is used to assess functional performance and considered functional tests useful as part of a battery of tests to determine readiness to participate in activity.

**Description**
1. Place a 15 cm wide strip of tape extending down the centre of the 6 m hop wide strip of tape extending down the centre of the 6 m hop course. This will designate the “centre line”.
2. Have patient hop three (3) consecutive times on the same foot crossing the centre line with each hop.
3. Measure the distance from the beginning to the third hop.
4. The average of three trials is used to calculate the limb symmetry score. Perform the hops on both legs.

<table>
<thead>
<tr>
<th>Dominant / Un-injuries</th>
<th>Non-Dominant / Injured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1: ______________</td>
<td>Trial 1: ______________</td>
</tr>
<tr>
<td>Trial 2: ______________</td>
<td>Trial 2: ______________</td>
</tr>
<tr>
<td>Trial 3: ______________</td>
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</tbody>
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Limb Symmetry Score: ___________________

- To calculate the limb symmetry score, the mean score of the involved limb is divided by the mean time (or distance) of the unininvolved limb and the result multiplied by 100. Symmetry index of < 85% is usually considered abnormal.
Star Excursion Balance Test

**Purpose:** The SEBT offers a simple, reliable, low-cost alternative to more sophisticated instrumented methods that are currently available to assess balance. The SEBT is a functional test that incorporates a single-leg stance on one leg with maximum reach of the opposite leg. The SEBT was performed with the subject standing at the centre of a grid placed on the floor, with eight lines extending at 45° increments from the centre of the grid. The eight lines positioned on the grid were labelled according to the direction of excursion relative to the stance leg: anterolateral, anterior, anteromedial, medial, posteromedial, posterior, posterolateral and lateral.

**Description**

1. To perform the test each subject will maintain a single-leg stance at the centre of the grid with both hands on the hips.
2. They then are instructed with the opposite leg to reach as far as possible along the appropriate vector. The subject is asked to lightly touch the line to ensure that stability is achieved and then return to the upright centre position.
3. The distance from the centre of the grid to this touch point is measured in centimetres and recorded.
4. A total of 3 reaches/trials along each vector are while standing on both the right and left foot. All trials are performed in sequential order working in either a clockwise or counterclockwise direction at the outset.
5. The average of the 3 trials is used in the scoring.
6. Trials are discarded if the subject (1) did not touch the vector line, lifts the stance leg from the centre, (2) loses balance, or (3) did not maintain the start and return positions for 1 second.
### Stance Foot: Left

#### Vector: 

<table>
<thead>
<tr>
<th></th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av Distance</td>
<td>cm</td>
<td>cm</td>
<td>cm</td>
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#### Vector: 

<table>
<thead>
<tr>
<th></th>
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Stance Foot: Right

Vector: ________________________
Trial 1: ____ cm  Trial 2: ____ cm  Trial 3: ____ cm

Av Distance: ________________ cm

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_________________________________________________________________________

Vector: ________________________
Trial 1: ____ cm  Trial 2: ____ cm  Trial 3: ____ cm

Av Distance: ________________ cm

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Trial 1: ____ cm  Trial 2: ____ cm  Trial 3: ____ cm

Av Distance: ________________ cm

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Av Distance: ________________ cm

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Trial 1: ____ cm  Trial 2: ____ cm  Trial 3: ____ cm

Av Distance: ________________ cm

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Exercise Prescription and Functional Progression


Fundamental goals of rehab

1. Restore range of motion
2. Reestablish neuromuscular control
3. Regain muscular strength, endurance and power

Rehabilitation phases

Outline the 4 phases and goals of related to program design

**Phase 1:** Acute phase/controlling inflammation
- **Timeframe:** Day 3-7 days
- Recommended brief period of immobilisation of injured area
- Initiate joint ROM, muscular activation exercise (ISO)

**Phase 2:** Repair phase/restoration of motion
- **Timeframe:** Days 7-28 (3 weeks)
- Controlled activity directed toward restoring ROM
- Initiate NM control activities
- Incorporate proprioception

**Phase 3:** Maturation-Remodelling phase/developing muscular strength
- **Timeframe:** Days 28-49 (3 weeks)
- Sport-specific / Work-specific functional re-integration
- Initiate strength exercises
- Continue ROM/neuromuscular control

**Phase 4:** Return to sport/activity phase
- **Timeframe:** Days 49-70 (3 weeks)
- Sport-specific / Work-specific functional re-integration
- Force interplay: force production-force reduction
- Initiate plyometric exercise (levels 1-4)

- Return to Work/Sport criteria
  - Physician’s release
  - Pain free, no swelling
  - Normal ROM, strength
  - Completion of functional testing minus adverse effects
- Reactivation continuum – exercise progressions

Order of instruction: Exercise prescription: Teach patient appropriate exercise for rehab phase

1. Outline goal of exercise and characteristic targeted for development; 2) name the piece of equipment; 3) demonstrate the exercise; 4) observer patient performing exercise; 5) provide feedback; 6) repeat steps 4 and 5.

Key Training Principles

- SAID
- GAS
- DOMS