

# International Standards for the Classification of Spinal Cord Injury

## Motor Exam Guide

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### C5 Elbow Flexors | Biceps Brachii, Brachialis

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#### Grade 3

**Patient Position:** The shoulder is in neutral rotation, neutral flexion/extension, and adducted. The elbow is fully extended, with the forearm in full supination. The wrist is in neutral flexion/extension.

**Examiner Position:** Support the wrist.

**Instructions to Patient:** “Bend your elbow and try to reach your hand to your nose.”

**Action:** The patient attempts to move through the full range of motion in elbow flexion.



#### Grades 4 & 5

**Patient Position:** The shoulder is in neutral rotation, neutral flexion/extension, and adducted. The elbow is flexed to 90° and the forearm is fully supinated.

**Examiner Position:** Place a stabilizing hand on the anterior shoulder. Grasp the volar aspect of the wrist and exert a pulling force in the direction of elbow extension.

**Instructions to Patient:** “Hold your arm. Don’t let me move it.”

**Action:** The patient resists the examiner’s pull and attempts to maintain the elbow flexed at 90°.



#### Grade 2

**Patient Position:** The shoulder is in internal rotation and adducted with the forearm positioned above the abdomen, just below the umbilicus. The elbow is in 30° of flexion. The forearm and wrist are in neutral pronation/supination. Sufficient flexion of the shoulder must be permitted to allow the forearm to comfortably move over the abdomen.

**Examiner Position:** Support the arm.

**Instructions to Patient:** “Bend your elbow and try to bring your hand to your nose.”

**Action:** The patient attempts to move the elbow through a full range of motion in elbow flexion.



**Grades 0 & 1**

**Patient:** The patient is in the grade 2 position with the shoulder in internal rotation and adducted. The palm and ventral forearm are positioned above the abdomen. The elbow is in 30° of flexion. The forearm and wrist are in neutral pronation/supination. Sufficient flexion of the shoulder must be permitted to allow the forearm to comfortably move over the abdomen.

**Examiner Position:** One hand supports the forearm while the other hand palpates the biceps tendon in the cubital fossa. The belly of the biceps brachii muscle may also be palpated or observed for movement.

**Instructions to Patient:** “Bend your elbow and try to bring your hand to your nose.”

**Action:** The patient attempts to move the elbow through a full range of motion in elbow flexion.

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**C 6 Wrist Extensors | Extensor Carpi Radialis Longus, Extensor Carpi Radialis Brevis**

**Grade 3**

**Patient Position:** The shoulder is in neutral rotation, neutral flexion/extension, and adducted. The elbow is fully extended, the forearm is fully pronated, and the wrist flexed.

**Examiner Position:** One hand supports the distal forearm to allow the wrist to be pre-positioned in sufficient flexion for testing.

**Instructions to Patient:** “Bend your wrist upwards. Lift your fingers toward the ceiling.”

**Action:** The patient attempts to extend the wrist through a full range of motion.

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**Grades 4 & 5**

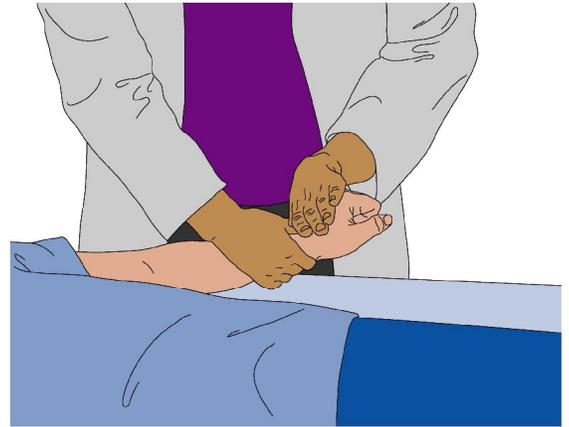
**Patient Position:** Same as grade 3, except the wrist is fully extended.

**Examiner Position:** Grasp the distal forearm to stabilize the wrist. Apply pressure across the metacarpals in a downward direction toward flexion and ulnar deviation. The force applied should be angled toward the ulnar side of the wrist rather than directly downward, since it is the radial wrist extensors that are being tested.

**Instructions to Patient:** “Hold your wrist up. Don’t let me push it down.”

**Action:** The patient resists the examiner’s push and attempts to maintain the wrist in the fully extended position.

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**Grades 0, 1 & 2**

**Patient Position:** Position the patient with the arm resting on the exam table. The shoulder is in neutral flexion/extension, neutral rotation, and adducted. The elbow is fully extended. The forearm is in neutral pronation-supination and the wrist fully flexed

The patient may also be positioned with the shoulder in slight flexion, internal rotation, and adducted, with the patient’s arm above the abdomen. The elbow is flexed to 90° and the forearm is in full supination. The wrist is flexed.

**Examiner Position:** Support the forearm and ask the patient to bend the wrist backwards into extension. For trace function, palpate the radial wrist extensors just proximal to the wrist, on the radial aspect of the distal forearm. Observe the muscle belly for movement.

**Instructions to Patient:** “Bend your wrist backwards.”

**Action:** The patient attempts to extend the wrist through a full range of motion in wrist extension.

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**C6 Common Muscle Substitution**

Wrist extension can be mimicked by forearm supination and the use of gravity. The examiner needs to make sure the forearm is stabilized and is in proper position.

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## C7 Elbow Extensors | Triceps

### Grade 3

**Patient Position:** The shoulder is in neutral rotation, adducted, and 90° of flexion. The elbow is fully flexed with the palm of the hand resting by the ear.

**Examiner Position:** Support the upper arm.

**Instructions to Patient:** “Straighten your arm.”

**Action:** The patient attempts to move through the full range of elbow extension.



### Grades 4 & 5

**Patient Position:** Same as grade 3, except the elbow is in 45° of flexion.

**Examiner Position:** Support the upper arm. Grasp the wrist and apply resistance to the distal forearm in the direction of elbow flexion.

**Instructions to Patient:** “Hold this position. Don’t let me bend your elbow.”

**Action:** The patient resists the examiner’s pressure and attempts to maintain the position of the elbow in 45° of flexion.



### Grade 2

**Patient Position:** The shoulder is in internal rotation and adducted, with the forearm positioned above the abdomen. The forearm is in neutral pronation/supination. The elbow is fully flexed. When checking Grade 2, sufficient flexion of the shoulder must be permitted to allow the forearm to clear and move over the chest and abdomen.

**Examiner Position:** Support the patient’s arm.

**Instructions to Patient:** “Straighten your arm.”

**Action:** The patient attempts to move through the full range of elbow extension.



**Grades 0 & 1**

**Patient Position:** Maintain the grade 2 position with the shoulder in internal rotation and adduction, and the forearm positioned above the abdomen. The forearm is in neutral pronation/supination and the elbow is in 30° of flexion.

**Examiner Position:** Support the arm. For trace function, palpate the distal triceps at its insertion on the olecranon. The belly of the triceps muscle may also be palpated and observed for movement.



**Instructions to Patient:** “Straighten your arm.”

**Action:** The patient attempts to fully extend the elbow.

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**C7 Common Muscle Substitution**

Elbow extension can be mimicked by externally rotating the shoulder, by quickly flexing the elbow and then relaxing, and with spasticity of the triceps. These substitutions can be minimized by maintaining the correct position for testing, correct instructions to the patient, and avoiding elbow flexion. Palpation of the triceps should be done to confirm the patient is using the correct muscle for the test.

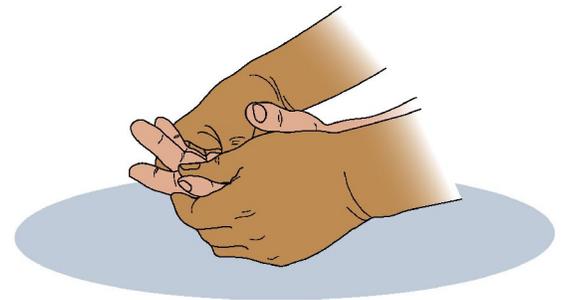
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**C8 Long Finger Flexors | Flexor Digitorum Profundus**

**Grade 3**

**Patient Position:** The shoulder is in neutral rotation, neutral flexion-extension, and adduction. The elbow is fully extended with the forearm fully supinated. The wrist is in neutral flexion-extension. The metacarpal phalangeal (MCP) and proximal interphalangeal joints (PIP) are stabilized in extension.

**Examiner Position:** Using two hands grasp the patient’s hand and stabilize the wrist in neutral. Secure the PIP and MCP joints in extension with both hands while isolating the middle finger for testing. Stabilize the volar aspect of the 3<sup>rd</sup> middle phalanx with the thumb of the opposite hand.



As an alternate method, 1 hand may be used to stabilize instead of 2. The PIP and MCP joints are stabilized as previously described, with the thumb of the stabilizing hand now securing the middle phalanx.

**Instructions to Patient:** “Bend the tip of your middle finger.”

**Action:** The patient attempts to flex the distal interphalangeal (DIP) joint through the full range of motion in flexion.

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**Grades 4 & 5**

**Patient Position:** The same as grade 3, except the DIP joint is fully flexed.

**Examiner Position:** Stabilize the wrist, MCP and PIP joints as in grade 3. Apply pressure with the tip of the finger or thumb against the distal phalanx of the patient's middle finger.

**Instructions to Patient:** "Hold the tip of your finger in this bent position. Don't let me move it."

**Action:** The patient attempts to maintain the fully flexed position of the DIP joint, and resist the pressure applied by the examiner in the direction of finger extension.



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**Grades 0, 1 & 2**

**Patient Position:** The shoulder is in neutral rotation, neutral flexion-extension, and adduction. The elbow is fully extended. The forearm is in neutral pronation-supination and the wrist in neutral flexion-extension. The MCP and PIP joints are stabilized in extension.

**Examiner Position:** Stabilize the wrist in neutral and the MCP and PIP joints in extension. For trace function, palpate the tendons of the long finger flexors or observe the muscle belly for movement.

**Instructions to Patient:** "Bend the tip of your middle finger."

**Action:** The patient attempts to flex the distal interphalangeal (DIP) joint through the full range of motion in flexion.



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**C8 Common Muscle Substitution**

When testing grades 1 through 3, the wrist must be carefully stabilized. Involuntary movement of the distal phalanx can occur in the presence of active wrist extension. This tenodesis movement could be misinterpreted as voluntary contraction of the long finger flexors.

While testing grades 4 and 5, the proximal phalanges must be well stabilized. This will avoid misinterpretation of distal phalanx movement caused by contraction of the hand intrinsics or the flexor digitorum superficialis.

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## T1 Small Finger Abductor | Abductor Digiti Minimi

### Grade 3

**Patient Position:** The shoulder is in internal rotation adducted, and at 15° flexion. The elbow is at 90° flexion, the forearm is pronated, and the wrist is in neutral flexion/extension.

**Examiner Position:** Support the patient's hand, taking care to assure that the MCP joints are stabilized to prevent hyperextension.

**Instructions to Patient:** "Move your little finger away from your ring finger."

**Action:** The patient attempts to move the little finger through the full range of motion in abduction.



### Grades 4 & 5

**Patient Position:** Same as grade 3, except the little finger is fully abducted.

**Examiner Position:** Support the patient's hand, taking care to assure that the MCP joints are stabilized to prevent hyperextension. Use the index finger to apply pressure against the side of the patient's distal phalanx.

**Instructions to Patient:** "Hold your little finger away from your ring finger. Don't let me push it in."

**Action:** The examiner exerts a pushing force against the side of the distal phalanx, and the patient attempts to resist the examiner's force and keep the little finger fully abducted.



**Grades 0, 1 & 2**

**Patient Position:** The shoulder is in neutral rotation, neutral flexion/extension, and adducted. The elbow is in full extension. The forearm is in full pronation and the wrist in neutral flexion-extension. The MCP joint is stabilized.

An alternate position is with the shoulder in internal rotation, adducted, and neutral flexion/extension. The elbow is in 90° of flexion, the forearm and wrist are in neutral flexion /extension, and the MCP joint is stabilized.

**Examiner Position:** Stabilize the dorsal wrist and hand by pressing down lightly on the back of the hand. Be sure that the MCP joints are stabilized to prevent hyperextension. Palpate the abductor digiti minimi muscle and observe the muscle belly for movement.

**Instructions to Patient:** “Move your little finger away from your ring finger.”

**Action:** The patient attempts to abduct the little finger through the full range of motion.



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**T1 Common Muscle Substitution**

Finger extension can mimic 5th finger abduction. Proper positioning and stabilization will minimize this error.

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**L2 Hip Flexors | Iliopsoas**

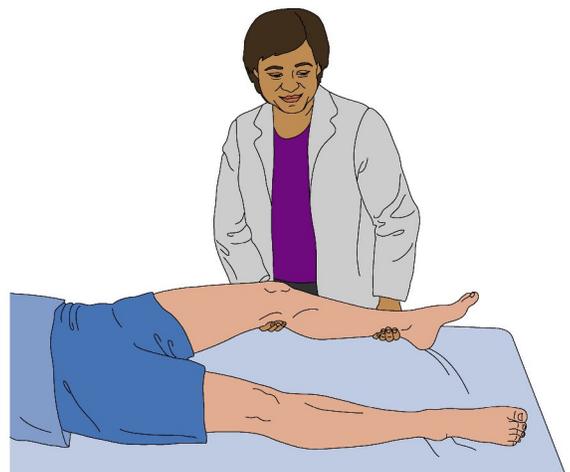
**Grade 3**

**Patient Position:** The hip is in neutral rotation, neutral adduction/abduction, with both the hip and knee in 15° of flexion.

**Examiner Position:** Support the dorsal aspect of the distal thigh and leg. Do not allow flexion beyond 90° when examining acute thoraco-lumbar injuries due to the kyphotic stress placed on the lumbar spine.

**Instructions to Patient:** “Lift your knee towards your chest as far as you can, trying not to drag your foot on the exam table.”

**Action:** The patient attempts to flex hip to 90° of flexion.



**Grades 4 & 5**

**Patient Position:** The hip is in 90° of flexion with the knee relaxed.

**Examiner Position:** Brace the anterior superior iliac spine on the opposite side and place a hand on the distal anterior thigh, just above the knee. Pressure is applied in the direction of hip extension

**Instructions to patient:** “Hold your knee in this position. Don’t let me push it down.”

**Action:** The patient attempts to resist the examiner’s push and keep the hip flexed at 90°.



**Grade 2**

**Patient Position:** Place the patient in the gravity eliminated position with the hip in external rotation and 45° of flexion. The knee is flexed at 90°.

**Examiner Position:** Support the leg.

**Instructions to Patient:** “Try to bring your knee out to the side,” or “Try to flex your thigh toward the side of the body.”

**Action:** The patient attempts to move through the full range of motion in hip flexion.



**Grades 0 & 1**

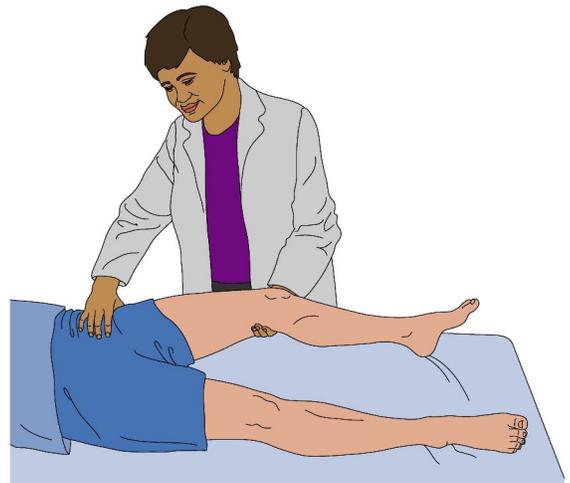
**Patient Position:** Place the patient in the grade 3 position, with the hip in neutral rotation, neutral adduction/abduction and the hip and knee flexed to 15°.

**Examiner Position:** Support the thigh to eliminate friction while palpating the superficial hip flexors just distal to the anterior superior iliac spine.

**Instructions to Patient:** Ask the patient to “lift your knee towards your chest as far as you can.”

**Action:** The patient attempts to flex the hip.

**Note:** For Grade 1, the examiner is actually palpating the more superficial hip flexors, i.e. sartorius and rectus femoris rather than the iliopsoas. The insertion of the iliopsoas is too deep to be seen or felt when it possesses only Grade 1 strength. When examining a patient with an acute traumatic lesion below T8, the hip should not be allowed to flex passively or actively beyond 90°. Flexion beyond 90° may place too great a kyphotic stress on the lumbar spine.



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**L2 Common Muscle Substitution**

Any muscle of the trunk that can elevate or rotate the pelvis can trick the examiner into thinking that the hip flexor muscles are active. This could include the rectus abdominus, the adductor muscles, obliques, or the quadratus lumborum. With accurate palpation, correct patient instructions, and observation of any trunk movement, this substitution can be avoided.

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**L3 Knee Extensors | Quadriceps**

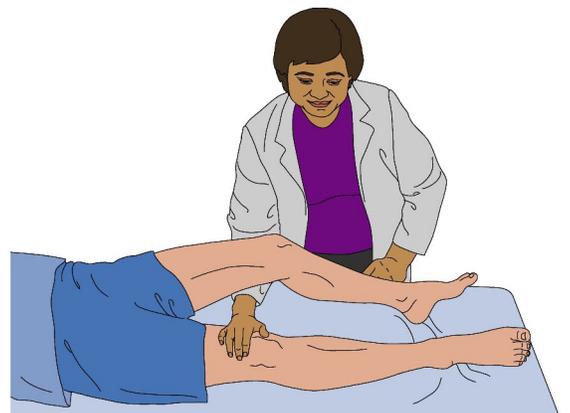
**Grade 3**

**Patient Position:** The hip is in neutral rotation, neutral adduction/abduction and 15° of flexion. The knee is in 30° of flexion.

**Examiner Position:** Place the arm under the tested knee and rest the hand on the patient's distal thigh. This causes the tested knee to flex to approximately 30°.

**Instructions to Patient:** “Straighten your knee.”

**Action:** The patient attempts to straighten the knee through the full range of motion in extension.



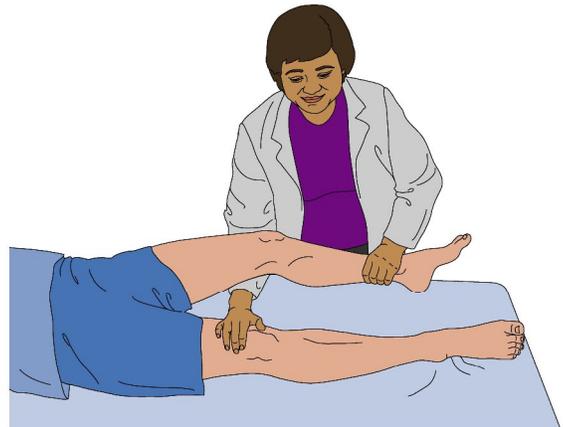
**Grades 4 & 5**

**Patient position:** Same as grade 3, except the knee is in 15° of flexion.

**Examiner Position:** Place the arm under the tested knee and rest the hand on the patient's opposite thigh. Grasp the leg to be tested, just proximal to the ankle.

**Instructions to Patient:** "Hold this position. Don't let me bend your knee."

**Action:** Examiner exerts downward force into knee flexion while the patient attempts to hold the knee in 15 degrees of flexion.



**Grade 2**

**Patient Position:** The hip is in external rotation and 45° of flexion. The knee is flexed at 90°.

**Examiner position:** Support the distal thigh and leg.

**Instructions to Patient:** "Straighten your knee."

**Action:** The patient attempts to move through the full range of motion.



**Grades 0 & 1**

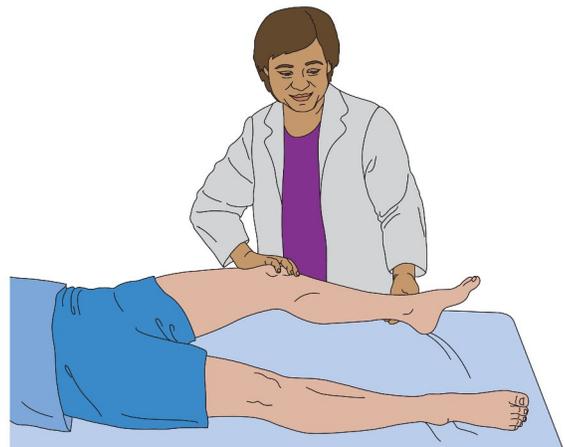
**Patient Position:** Place the patient with the hip in neutral rotation, neutral adduction/abduction with both the hip and knee in 15° of flexion.

**Examiner Position:** Support the leg. Palpate the patellar tendon or the belly of the quadriceps muscle for trace function. The muscle belly may also be observed for movement.

**Instructions to Patient:** "Straighten your knee."

Note: In this position, asking the patient to push the back of the knee downward toward the exam table may be better to elicit trace contraction in the quadriceps.

**Action:** The patient attempts to straighten the knee.



**L4 Ankle Dorsiflexors | Tibialis Anterior**

**Grade 3**

**Patient Position:** The hip is in neutral rotation, neutral adduction/abduction, with the hip and knee slightly flexed. The hand may be placed under the knee of the tested leg to incorporate slight flexion. The ankle is plantarflexed.

**Examiner Position:** At the patient's side. Support the leg.

**Instructions to Patient:** "Pull your toes upward toward your head, letting your ankle bend."

**Action:** The patient attempts to dorsiflex ankle through a full range of motion.



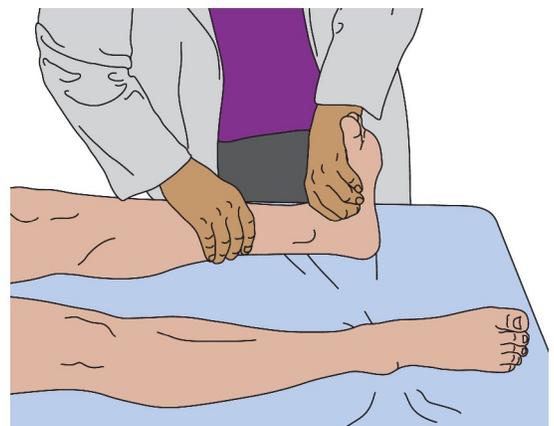
**Grades 4 & 5**

**Patient Position:** Same as grade 3, except the ankle is fully dorsiflexed.

**Examiner Position:** In the grade 3 position, place the hand on the dorsum of the foot and apply pressure downward in the direction of plantarflexion.

**Instructions to Patient:** "Hold your ankle in this position. Don't let me push it down."

**Action:** The patient attempts to resist the examiner and maintain the ankle in full dorsiflexion.



**Grade 2**

**Patient Position:** The hip is in external rotation and 45° of abduction. The knee is flexed, and the ankle is fully plantar flexed.

**Examiner Position:** Support the leg.

**Instruction to Patient:** "Lift the toes upward toward the head, allowing the ankle to bend."

**Action:** The patient attempts to dorsiflex ankle through the full range of motion.



### Grades 0 & 1

**Patient Position:** Place the hip in neutral rotation, neutral adduction/abduction, and neutral flexion/extension. The knee is fully extended and the ankle slightly plantarflexed.

**Examiner Position:** Palpate the proximal lower leg over the tibialis anterior muscle belly or on the tendon of the tibialis anterior muscle as it crosses the anterior ankle. Observe the muscle belly for movement.

**Instructions to Patient:** “Bring your toes upward toward your head, letting your ankle bend.”

**Action:** The patient attempts to dorsiflex the ankle.



### L4 Common Muscle Substitution

Ankle dorsiflexion can be mimicked by the long toe extensors, particularly the extensor hallucis longus. Correct stabilization and observation along with proper patient instruction and palpation can eliminate this substitution.

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## L5 Long Toe Extensors | Extensor Hallucis Longus

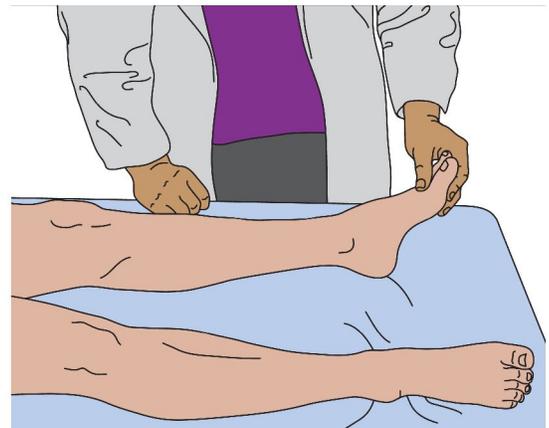
### Grade 3

**Patient Position:** The hip is in neutral rotation, neutral adduction/abduction, and neutral flexion/extension. The knee is fully extended.

**Examiner Position:** At the patient’s side. Support the foot.

**Instructions to Patient:** “Lift your big toe upwards toward your knee.”

**Action:** The patient attempts to move the great toe through the full range of motion.



**Grades 4 & 5**

**Patient Position:** Same as grade 3, except the toe is fully extended.

**Examiner Position:** At the patient's side. Place the thumb on the distal phalanx of the great toe and apply pressure downward in the direction of toe flexion.

**Instructions to Patient:** "Keep your toe lifted upward. Don't let me push it down."

**Action:** The patient attempts to resist the examiner and maintain the great toe in full extension.



**Grade 2**

**Patient Position:** The hip is in external rotation, 45° abduction. The knee is flexed. The ankle and long toe are in a relaxed, neutral position.

**Examiner Position:** Support the leg.

**Instructions to Patient:** "Lift your big toe upwards toward the knee."

**Action:** The patient attempts to extend the great toe through the full range of motion.



**Grades 0 & 1**

**Patient Position:** Place the patient in the grade 3 position.

**Examiner Position:** Support the leg and palpate the extensor tendon of the long toe for trace function.

**Instructions to Patient:** "Lift your big toe upwards toward your knee."

**Action:** The patient attempts to extend the great toe.



### **L5 Common Muscle Substitution**

Great toe extension can be facilitated by plantarflexion. If a patient actively plantar flexes the entire foot, passive extension of extensor hallucis longus can be achieved during the active plantarflexion of the foot. This is a type of tenodesis for the foot and can be avoided by proper stabilization to eliminate foot and ankle movement.

Another possible muscle substitution for L5 can occur when the patient actively flexes the big toe and then relaxes. Passive relaxation into a neutral position can be perceived as active extension.

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## **S1 Ankle Plantarflexors | Gastrocnemius, Soleus**

### **Grade 3**

**Note:** Checking for Grades 3-5 is significantly different from what is described in standard manual muscle testing texts. This departure is required for examining patients in the supine position.

**Patient Position:**

The hip is in neutral rotation and 45° of flexion, with the knee fully flexed and ankle in full dorsiflexion.

**Examiner Position:** Place one hand behind the knee to assist in stabilizing the leg. The other hand is positioned under the sole of the patient's foot, pushing the foot into dorsiflexion. The patient's heel remains resting on the exam table.

**Instructions to Patient:** "Push your foot down into my hand and lift your heel off the table."

**Action:** The patient pushes the forefoot downward into the examiner's hand and raises the heel off the exam table, through a full range of motion in plantarflexion.

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**Grades 4 & 5**

**Patient position:** The hip is in neutral rotation, neutral flexion-extension, and neutral abduction-adduction. The knee is fully extended and the ankle is in full plantarflexion.

**Examiner Position:** Place one hand on the distal lower leg while the other hand grasps the foot across the plantar surface of metatarsals. Apply pressure on the bottom of the foot in the direction of dorsiflexion.

**Instructions to patient:** "Hold your foot pointed down. Don't let me push it up."

**Action:** Examiner gives pressure on the plantar aspect of the metatarsals in the direction of dorsiflexion. The patient attempts to resist the examiner by maintaining the foot and ankle in full plantarflexion.



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**Grades 0, 1, & 2**

**Patient Position** The hip is in external rotation and 45° of flexion. The knee is flexed.

**Examiner Position:** Support the lower leg. For trace function palpate either the gastrocnemius muscle belly or the achilles tendon, or observe the muscle belly for movement.

**Instructions to Patient:** "Point your toes downward like a ballet dancer."

**Action:** The patient attempts to plantar flex the foot through a full range of motion.



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**S1 Common muscle substitution**

Visually monitor the hip flexors to assure that these muscles are not being used to facilitate plantarflexion.

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