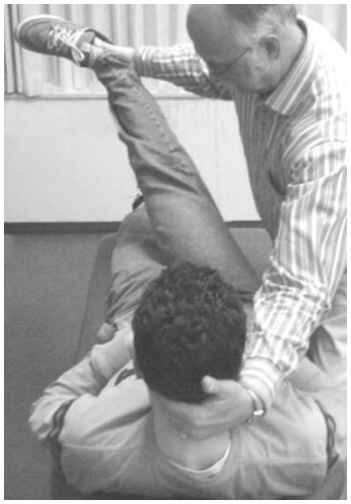
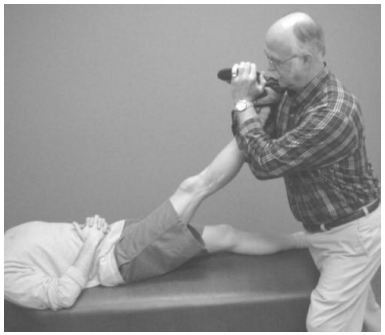
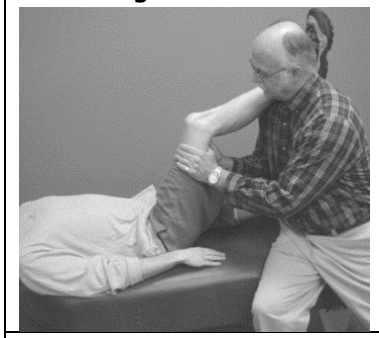
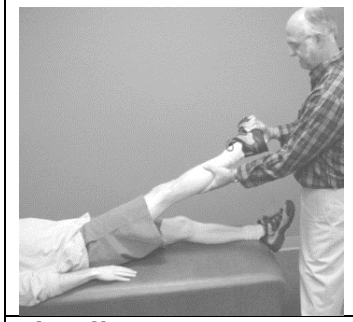
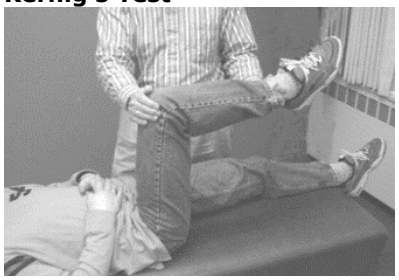
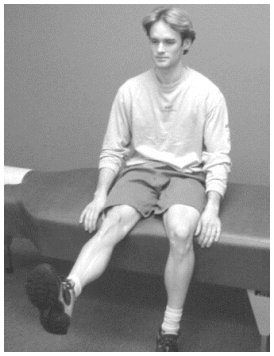
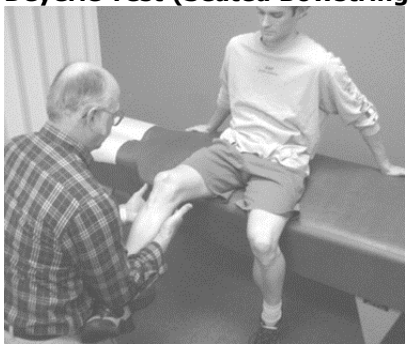
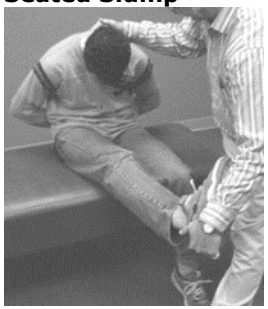
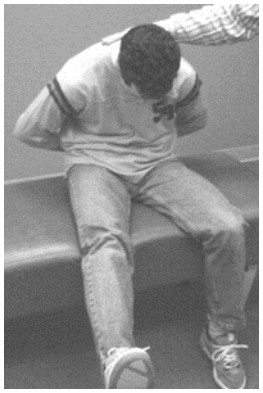
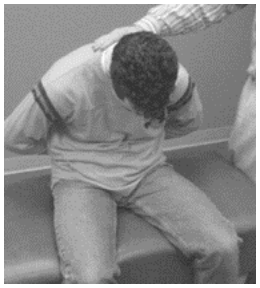
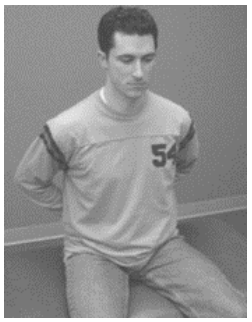
## Lower Extremity Neural Tension Tests

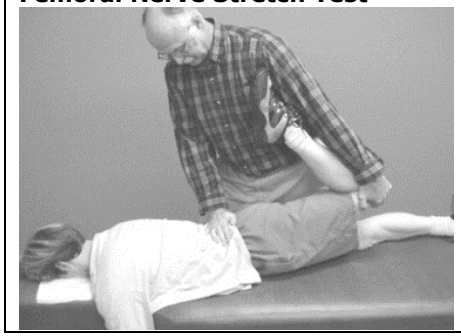
These tests are designed to create tension in the sciatic nerve and L4, L5, S1 nerve roots (which are the nerve roots most commonly involved in patients with radicular pain), or the femoral nerve and upper lumbar nerve roots. They are useful for patients with low back pain and leg pain to help differentiate deep referred pain from radicular pain.

| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Straight Leg Raise (Lasègue test), Cross Straight Leg Raise**  | With the patient supine, the examiner places one hand under the patient's heel or lower leg and raises the patient's relaxed leg passively from the table while holding the knee straight.<br><br>The test is repeated on the asymptomatic leg. When performed on the asymptomatic leg it is called the Cross SLR or well leg raise. | Pain radiating past the knee within a hip flexion range of approximately 35-70 degrees suggests sciatic nerve irritation or nerve root irritation.<br><br>Pain radiating into the lower extremity but not past the knee may be considered a "soft" positive. Correlate with other signs and symptoms of nerve root involvement. | The SLR recorded a mean sensitivity of 0.84 (0.72-0.92) and specificity of 0.78 (0.67-0.87). (Tawa 2017)<br><br>A positive Cross SLR suggests nerve root irritation, especially when caused by a lumbar disc herniation (specificity of .90) with a positive LR of 2.8. A negative test has little value (sensitivity of 0.28) (Van der Windt 2010).<br><br>Reliability data support using SLR. Crossed SLR reliability data are inconclusive. (Nee 2022) |
| **Maximum Straight Leg Raise**  | The supine patient's leg is raised by the evaluator to the angle where equivocal SLR signs appear. The leg is then internally rotated and adducted. If no further signs occur, the evaluator flexes the cervical spine. If no signs occur, the patient is asked to bear down (Valsalva). | If the procedure recreates radicular pain down the leg, especially past the knee, then it increases the likelihood of a nerve root lesion. | Unknown |

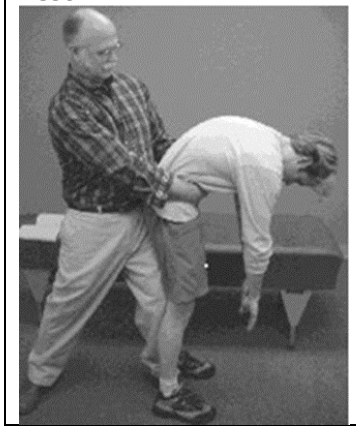
| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Bragard's Test**<br>  | With the patient lying supine, the examiner raises the leg of the affected side until lower extremity symptoms are reproduced (see straight leg raise). The leg is then lowered 5-10º or until leg symptoms are relieved. The foot of the affected side is then fully dorsiflexed. | Radiating pain of a radicular nature suggests nerve root irritation of a variety of possible etiologies. | Sensitivity of the Bragard test was 69.3%, and specificity was 67.42%. Positive and negative predictive values were 73.15% and 63.16%, respectively. Positive likelihood ratio was 2.13, and negative likelihood ratio was 0.46. Diagnostic odds ratio was 4.63. (Homayouni 2017) |
| **Bowstring Test**<br>  | With a supine patient the examiner elevates the patients' leg and rest the distal leg on doctor's shoulder. Using thumbs on both hands, they then compress firmly over the sciatic nerve in the popliteal fossa, or just above it, and distract gently. | Initiating or reproducing symptoms past the knee can help confirm a positive SLR test, suggesting an L4, L5, or S1 nerve root irritation.<br><br>Local pain is considered a negative test for nerve involvement. | This test has been shown to have poor specificity but sensitivity from .55 to .69.<br><br>One study showed a *K* value of .80 for interexaminer reliability. (Berthelot 2021) |
| **Bonnet's Test**<br>  | With a supine patient, the examiner performs a SLR to the point of pain then lowers the leg just to the point that the symptoms are no longer aggravated and internally rotates and adducts the hip across the midline. | Initiating or reproducing symptoms past the knee can help confirm a positive SLR test suggesting an L4, L5, or S1 nerve root irritation. | Unknown |
| **Sicard's Test**<br>  | With the patient lying supine, the examiner raises the leg of the affected side until lower extremity symptoms are reproduced (see straight leg raise). The leg is then lowered 5-10º or until leg symptoms are relieved. The big toe is then passively extended. | Re-creation of the patient's symptoms is a positive confirmation to the SLR findings suggesting nerve root irritation. | Unknown |

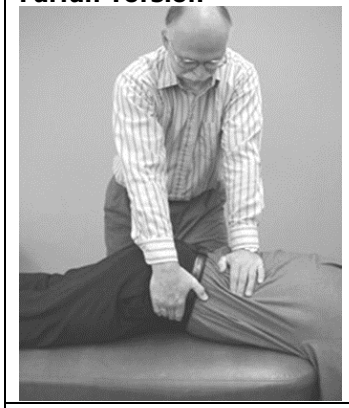
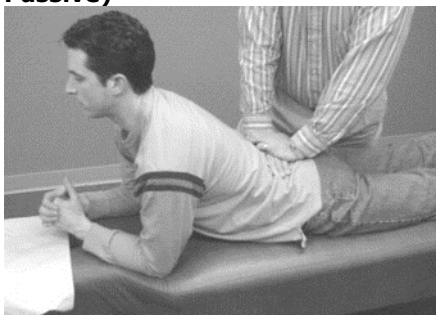
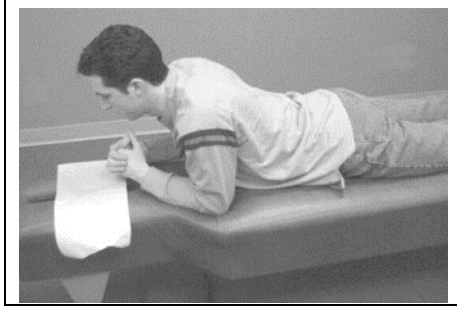
| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Kernig's Test**  | With the patient supine, the examiner flexes hip and knee to 90° and then extends knee while maintaining hip at 90°. | Leg pain that increases or radiates upon knee extension and is relieved by flexion is suggestive of nerve root involvement.<br><br>Resistance felt by the examiner with no pain experienced by the patient indicates tight hamstrings. | 61.26% Sensitivity, 70.21% specificity |
| **Bechterew's Test (seated straight leg raise)**  | Patient is seated. Examiner asks patient to fully extend the knees, one leg at a time. The clinician may also passively extend each of the patient's legs. | Creation or reproduction of symptoms past the knee suggests L4, L5, or S1 nerve root irritation. If the patient leans back on their supporting arms (tripod sign) trying to reduce the stretch on the nervous system this would also be considered positive. | Sensitivity .41 (Rabin 2007). |
| **Deyerle Test (Seated Bowstring)**  | With the patient seated, the knee is slowly extended to the position where pain is reproduced. The examiner then flexes the knee slightly and immobilizes the patient's foot by holding the foot between the examiner's knees. The examiner then places the fingers of both hands on the popliteal fossa and presses on the sciatic nerve to produce tension. | Reproduction of pain referral down the leg suggests nerve root irritation. | Unknown |

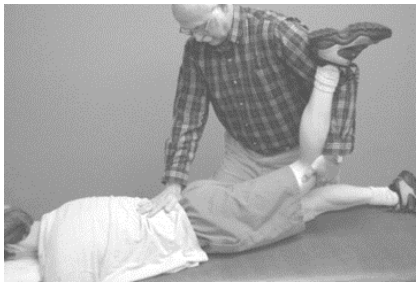
| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Seated Slump**<br>  <br>  <br>  <br>  | The test is performed in a specific sequence with the patient describing symptoms or lack of symptoms at each step.<br>• Patient sits upright with knees at the edge of the examining table, arms behind back.<br>• The patient "slumps," flexing lumbar and thoracic spine while keeping cervical spine extended; examiner may apply overpressure.<br>• The cervical spine is fully flexed; examiner may apply overpressure.<br>• One knee is extended maximally with overpressure.<br>• The ankle of the extended leg is dorsiflexed with overpressure applied.<br>• If symptoms do not change with single leg raising, both legs may be extended simultaneously. | Creation or reproduction of radicular pain is suggestive of nerve root irritation. | Sensitivity has been shown to be from .83 to 1.0 and Specificity at .84 (Tawa 2017) |

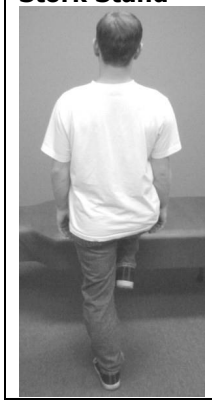
| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Femoral Nerve Stretch Test**<br>  | The patient lies in a prone position and the examiner flexes the leg at the knee, attempting to touch the heel to the same side buttock. To increase the femoral nerve tension the examiner may lift the leg creating hip extension as well. This test may also be done in a side lying position. | Production or recreation of neurological type pain radiating into the thigh may suggest femoral nerve or L2-L4 nerve root irritation. | Femoral nerve stretch test had a high sensitivity of 1.00 (0.40-1.00) and specificity of 0.83 (0.52-0.98). (Tawa 2017) |

## Lumbar Special Tests

| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Supported Forward Bending/Belt Test**<br>  | This test would be performed on a patient who reports low back pain with forward bending.<br><br>The examiner stands behind the standing patient and stabilizes the patient's sacrum against the examiner's hip by grasping bilateral ASIS and iliac crests. The patient is asked to "bend forward as far as possible." | If the pain is pelvic in origin, flexing the spine with the pelvis immobilized should not provoke pain. If the problem is lumbar in origin, pain will be provoked in both instances. | Unknown |

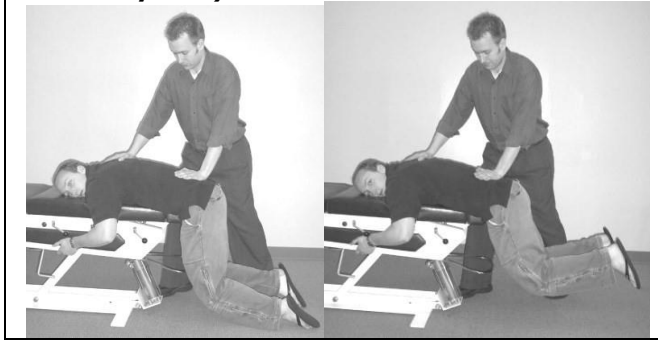
| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Farfan Torsion**<br>  | With the patient prone, the examiner stands contralateral to the side being tested. A stabilizing hand is placed over the lower ribs and spine near T12. The other hand reaches around the ilium with fingertips grasping the ASIS and pulls up and back, causing rotation of the spine. | Reproduction of the patient's symptoms suggests a mechanical intolerance to rotation. Performing the test on the right causes left torsion and on the left causes right rotation. | Unknown |
| **Prone Extension (Active and Passive)**<br>  <br>  | With the patient prone, the examiner asks the patient to actively extend their trunk, using the back muscles only, arms at their sides. If this does not produce symptoms the examiner stabilizes the pelvis and applies resistance to lumbar extension.<br><br>The patient is then instructed to place their elbows or hands on the table, and push back into extension, *using only their arms to do so,* while the pelvis remains on the table.<br><br>If the patient reports no symptoms, the examiner can then gently apply a posterior to anterior load to the lumbar spine, seeking complete end range. | Local pain during the active portion suggests possible muscle strain but may also occur in patients with facet irritation. Local pain during the passive portion suggests intolerance to extension possibly due to facet irritation or ligamentous sprain. | Unknown |

| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Kemps Test (Extension-Rotation Test)**<br>  | Kemps can be performed with the patient standing or sitting. The examiner is positioned behind the patient. To test the right side, the patient is guided into right rotation, right lateral flexion and extension.<br><br>The examiner may apply axial pressure through the shoulders to increase the compressive load. | If low back pain is aggravated, a lumbar joint lesion should be considered. Conventional wisdom suggests that if a patient's pain is aggravated by ipsilateral extension, the facets may be the source of pain.<br><br>However, at least one injection study has questioned this interpretation. Reproduction of leg symptoms suggests potential radiculopathy. May also be positive in a patient with spondylolysis. | Literature supporting the use of the Kemp's test for facet joint pain is limited and indicates that it has poor diagnostic accuracy. (Stuber 2014) |
| **Quadrant Test**<br>  <br>  | With a seated patient, the examiner is positioned behind the patient.<br>• Position 1: The patient is flexed forward, laterally flexed and rotated to one side.<br>• Position 2:While still flexed, the patient is then laterally flexed and rotated to the opposite side.<br>• Position 3:The patient is then extended, rotated and laterally flexed to one side.<br>• Position 4:The patient is extended, rotated, and laterally flexed toward the side other side. In each position, if pain is not reported, axial overpressure may be applied. | If low back pain is aggravated in any of the four quadrants, a lumbar joint lesion should be considered. A specific lesion may be suspected based on the tissues being loaded in each position (facets, disc, ligaments, etc.). | Unknown |
| **Yeoman' Test**<br>  | With the patient prone, the examiner stabilizes the SI joint while extending the patient's hip with the knee flexed. | Local pain in the SI joint suggests SI joint pathology. Lumbar pain suggests lumbar spinal joint or facet pathology. Anterior Hip pain suggests hip joint pathology. Pain or paresthesia in the anterior thigh suggests femoral nerve pathology. | Unknown |

| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Stork Stand**<br>  | Standing patient is instructed to stand on one foot with eyes open raising the other foot to knee level with arms relaxed at the side.<br><br>The patient then extends backwards, shifting more weight over the facets. The test is repeated on the other leg. | Aggravation of back pain is consistent with spondylolisthesis or with spondylolysis.<br><br>However, the test is nonspecific and may be painful with other conditions. | One study of 71 people reported sensitivity of 50-55, specificity of 46-58, +LR 1.0-1.6, LR 0.8-1.0 using radiologic investigation as a reference standard. (Reiman 2016) |

## Special tests for Suspected Lumbar Instability

Thes tests are for structural instability of the lumbar spine. This condition primarily occurs in older patients and is most often secondary to degenerative changes to the lumbar segments. Because of this, the subjects of these studies were primarily elderly individuals, therefore it is unclear whether the results apply to the general public.

| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Lumbar Segmental Instability Test (Prone Instability Test)**<br>  | The patient lies with the pelvis and torso on the examination table and the legs hanging over the edge with feet supported on the floor. The examiner applies a P-A glide at each lumbar level. Painful levels are identified. The patient next slightly raises their legs from the floor using the low back extensors while the examiner repeats the P-A glide on any painful segments. | A painful segment that is improved or no longer painful with the legs lifted suggests possible segmental instability. | One study found a sensitivity of 61 and a specificity of 57, +LR of 1.4,<br>LR of 0.69 using<br>flexion extension x rays as a reference standard.<br>Reliability is reported as<br>K = 0.87 0.94. (Reiman 2016) |

| Test | Description | Interpretation | Reliability and Validity |
|---|---|---|---|
| **Passive Lumbar Extension Test**<br>  | With the patient lying prone, the examiner passively lifts and extends both lower extremities at the same time to about a foot (30 cm) above the table. The examiner then gently pulls the legs. | The test is considered positive if the patient complains of pain in the lumbar region or a very heavy feeling in the low back that disappears when the legs are lowered to the starting position. May also be positive in cases of lumbar clinical stenosis. | One study showed +LR of 8.8 and -LR of 0.17 for structural lumbar instability, using radiographic evaluation as a reference standard (Alqarni 2011) |

## Author(s)

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