

The slump test: Clinical applications and interpretations

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ABSTRACT. *The slump test is a physical examination procedure used for evaluating patients with spinal and lower extremity complaints. The test seeks to rule out or identify tension in the neuromeningeal tract. The performance of the test places traction on the neuromeningeal tract from head to foot. Traction on non-neurological tissues also occurs during testing. To localize pathology to specific regions or structures, the test is performed in steps. During the testing process, mechanisms for a variety of standard orthopedic and neurological maneuvers are duplicated, increasing the number of possible clinical interpretations. Despite multiple interpretations, the test is efficient in clinical use. Application of the slump test is described to assist the clinician with differential diagnosis of spinal and lower extremity complaints.*

KEY WORDS: Low Back Pain—Meninges—Spine—Sciatica—Straight Leg Raise Test

INTRODUCTION

Spinal pathologies that are described as ominous have a low rate of occurrence [1–3]. For example, malignant tumors represent only 1% of all causes for lower back pain, and spinal infections represent only 0.01% [2]. Despite their rare occurrence, ominous pathologies should always be considered during examination. The slump test provides the clini-

cian an opportunity to screen quickly for ominous pathology before focusing on more common pathologies that are mostly of a mechanical nature. The slump test also provides information regarding the mechanics of the spine, pelvis, and lower extremities that may be used as the diagnostic process continues [4]. Overlapping mechanisms between the slump test and other physical exam procedures allow substantial clinical data to be gathered in a short period of time. Changes in patient positioning are reduced due to the versatility of the test.

DISCUSSION

Testing Method

The slump test is a series of seven basic steps [4, 5]. Performance of the test involves active and passive movements by the patient. Variations of the test do exist and will be discussed under interpretations and confirmatory tests [5, 6].

Step 1

The patient is seated in an erect posture on the edge of an examination table. The examiner stands next to the patient on the side to be tested first (Figure 1).

Step 2

The examiner places one hand on the patient's upper thoracic region and the other hand under the patient's chin. The patient is then instructed to flex the thoracic and lumbar areas (slump). The examiner supports the patient's chin to maintain neutral positioning of the cervical spine during this maneuver. Pressure is applied to the upper thoracic region to help maintain the patient's slumped position (Figure 2). The patient's response and symptoms are noted.

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Fig. 1. Slump test starting position.



Fig. 2. Step 2, "the slump."

Step 3

The examiner discontinues support of the patient's chin and asks the patient to flex the cervical spine (Figure 3). The patient's response and symptoms are noted.

Step 4

While applying pressure to maintain full spinal flexion, the examiner instructs the patient to extend the knee on the side of testing (Figure 4). The patient's response and symptoms are noted. Emphasis is on the degree of knee extension.

Step 5

The examiner places the patient's foot on the side of testing in dorsiflexion (Figure 5). The patient's response and symptoms are noted. The effect on knee extension is emphasized [5].

Step 6A

If the patient is unable to extend the knee completely or knee extension decreases with dorsiflexion of the foot, the examiner releases pressure

meant to maintain cervical flexion and instructs the patient to extend the cervical spine. Thoracic flexion, lumbar flexion, and foot dorsiflexion are maintained. The patient actively extends the cervical spine and then attempts full knee extension a second time (Figure 6). The patient's response and symptoms are noted. Emphasis is on the difference in knee extension achieved during cervical extension vs. knee extension achieved during cervical flexion [5].

Step 6B

If the patient is able to achieve full knee extension in Step 5, the test is repeated using the opposite extremity.

Step 7

The test is repeated with both legs simultaneously (Figure 7).

Test Interpretation

Step 1

Patients with lower back and lower extremity complaints often report an increase in symptoms



Fig. 3. Step 3, full spinal flexion.

when sitting, especially if intervertebral disk pathology is involved [6, 7]. Nachemson measured pressure in the third lumbar disk during numerous postures and activities [8]. Pressure while sitting erect was measured at 140 kg [8, 9]. Other postures frequently used during orthopedic and neurological testing were reported to be the following: standing, 100 kg; lying supine, 50 kg; and lying on one side, 75 kg [8, 9]. Increased symptoms for patients in a seated position can be linked to increased intervertebral disk pressure [9]. To improve accuracy, physical tests for lumbar disk pathologies should be performed in a seated posture as compared to standing, lying supine, or lying on one side [9, 10].

Step 2

Generalized discomfort in the mid- to lower thoracic region during Step 2 has been described as a common occurrence and is not considered pathological in origin [5, 6, 11]. Thoracic and lumbar flexion may also stretch painful or spasmodic muscles in the thoracic and lumbar regions. Muscular hypertonicity may limit the patient's ability to achieve and maintain the slumped position. I have observed multiple patients with sacroiliac joint dysfunction



Fig. 4. Step 4, knee extension in full spinal flexion.

who report pain in the involved sacroiliac joint and/or the insertion of paravertebral muscles into the medial crest of the ilium during the slump procedure. Bending forward (slumping) increases disk pressure at L3 by approximately 150% [6, 8, 9]. If lower back and leg pains are related to disk pathology, symptoms may increase significantly as the patient slumps.

Step 3

Cervical flexion may increase the generalized discomfort felt in the mid- to lower thoracic region without being a true pathological finding [11]. Indications for a positive slump test are the reproduction of the patient's symptoms and/or limitation of movement [5, 11].

Cervical flexion also reproduces several orthopedic and neurological tests, including Soto-Hall's test, Lhermitte's test, Lindner's test, and Brudzinski's test. The Soto-Hall test is a non-specific orthopedic test for pathologies in the cervical and upper thoracic regions. The test is positive when pain is reproduced in the cervicothoracic region upon cervical flexion [6, 12-15]. Pain may be the product of



Fig. 5. Step 5, foot dorsiflexion.



Fig. 6. Step 6A, cervical extension.

sprains, strains, fractures, arthritic conditions, disk conditions, or other pathologies.

Lhermitte's test is for detection of spinal cord pathology [6, 13, 15]. Cervical flexion producing pain or paresthesias along the spine or into one or more extremities is said to reflect a positive Lhermitte's test. Pathologies capable of producing myelopathy and a positive Lhermitte's test include spinal stenosis, multiple sclerosis, tumors, disk herniation, and spondylitic changes. Lindner's test is for radicular pathologies in the lower extremity [6, 12–15]. The test is reported to be positive when cervical flexion reproduces radicular signs or sciatica in the lower extremity.

Brudzinski's test is used for detecting meningeal irritation [6, 12–15]. The test is positive when cervical flexion results in bilateral flexion of the knees or the inability to extend the knees. Headache, cervical spine stiffness, and spinal pain may also be reported during this maneuver. The patient's avoidance of cervical flexion to prevent symptoms is a possible positive finding. All findings indicate meningeal irritation or inflammation. Noting the patient's response and area of symptomology during testing is vital in the interpretation of the overall testing process.

Step 4

Traction on the neuromeningeal tract escalates when the patient extends the knee [10]. If the patient is unable to achieve full extension of the knee, a lack of extension may be due to tension in the neuromeningeal tract (a positive slump test) or tight hamstring muscles [5, 6]. Differentiation between neural tension and muscular tension occurs as the test proceeds.

Knee extension in Step 4 duplicates several orthopedic and neurological tests. Tests include straight leg raising (SLR), crossed straight leg raising (CSLR), Bechterew's test, Kernig's test, and the tripod sign. Straight leg raising is the most common test for nerve root tension in the lower back and lower extremities and it requires no explanation. Crossed straight leg raising is also a test for nerve root tension in the lower back and lower extremities [6, 13, 15]. The test is positive if straight leg raising of the uninvolved leg reproduces symptoms in the involved leg. Pain in the symptomatic leg when raising the well leg indicates medial herniation of a disk. Straight leg raising and crossed straight leg raising are traditionally performed with the patient lying supine. Testing in a seated position should



Fig. 7. Step 7, bilateral slump test.

increase test sensitivity for detecting intervertebral disk pathology (see Test Interpretations, Step 1).

Bechterew's test is a third root tension test for the lower back and lower extremities [6, 12–15]. The interpretation of Bechterew's test is the same as for straight leg raising in a seated position. Kernig's test is for detection of meningeal irritation [6, 12, 13, 15]. Knee extension with 90° of hip flexion, which produces head pain, cervical spine pain, and/or spinal pain, is a positive Kernig's test. The patient's avoidance of knee extension to prevent symptoms can also be a positive sign.

The tripod sign is an indication of nerve root tension in the lower extremities [1, 6, 13–15]. A positive test is not dependent upon symptom reproduction but on the patient's physical response. The patient attempts to relieve neural tension produced during the seated straight leg raise by leaning back on the exam table. Patients rest their weight on their hands, forming a tripod with their trunk and upper extremities. Leaning back decreases hip flexion and neural tension. The tripod posture can be seen in patients who have tight hamstrings. The patient will lean back and possibly report a dull ache or stretching sensation in the posterior thigh. Radicular symptoms are not typically present in

this situation. The tripod sign is often referred to as the flip sign.

Step 5

Dorsiflexion of the foot may produce or increase symptoms of neuromeningeal tract tension or produce a dull ache in posterior thigh and calf musculature [5, 10, 11]. Cervical extension in Step 6A will help differentiate between neural tension and muscular tension [16]. Asking the patient to flex the knee and to repeat dorsiflexion is also helpful. A reduction in symptoms would suggest neural tension. A persistence of symptoms would suggest muscular tension [5].

Dorsiflexion of the foot with the knee extended in Step 5 simulates three orthopedic and neurological tests. Braggard's test, Fajersztajn's test, and Homan's test all involve dorsiflexion of the foot as their primary procedure. Braggard's test is for detecting nerve root tension in the lower extremity [6, 12–15]. The test is used as a confirmatory test following a positive straight leg raising test. If a positive straight leg raising test is elicited in the involved extremity, the leg is lowered slightly and the foot is dorsiflexed. Reproduction of the symptoms reported during the preceding straight leg raise is a positive Braggard's test.

Fajersztajn's test is used as a confirmatory test for crossed straight leg raising [12–15]. Following a positive crossed straight leg raising in which testing the uninvolved extremity reproduces symptoms in the involved extremity, the uninvolved leg is lowered slightly and the foot dorsiflexed. Recreation of the crossed straight leg raising result is a positive Fajersztajn's test.

Homan's test is used to identify venous thrombophlebitis in the lower leg [6, 12–15]. Traditionally this test combines dorsiflexion of the foot with squeezing of the ipsilateral calf musculature. Reproduction of the patient's symptoms is a positive result, indicating thrombophlebitis. The slump test does not include squeezing of calf musculature, decreasing the likelihood of identifying thrombophlebitis. However, awareness of the similarities between Homan's test and the dorsiflexion component of the slump test is important for differential diagnosis. Homan's test is recommended as a follow-up procedure to SLR and Braggard's tests [14]. Homan's test can also be performed following the slump test for differential diagnosis.

Step 6A

Cervical extension reduces the amount of tension placed on the neuromeningeal tract [5, 16]. An increase in knee extension following cervical extension is a positive indication that tension in the neuromeningeal tract is present. If knee extension does

not increase, muscular tightness should be considered the primary cause for limited extension.

Step 6B

Both extremities are examined individually regardless of unilateral or bilateral presentation of symptoms. All diagnostic possibilities described from Step 1 through Step 6A apply when testing the second extremity.

Step 7

Testing the lower extremities simultaneously places peak tension on the neuromeningeal tract [5, 17]. Bilateral testing is most important when symptoms are reproduced during testing of the uninvolved extremity. Patients experiencing only muscular discomfort in the full slumped position during unilateral and/or bilateral testing have a negative slump test. In this situation, Soto-Hall's, Lhermitte's, Lindner's, Brudzinski's, SLR, CSLR, Bechterew's, Kernig's, tripod sign, Braggard's, Fajersztajn's, and Homan's tests are negative. Performing the slump test early during examination covers a variety of tests and can rule out several ominous pathologies. The examiner can then proceed in testing for more common conditions.

Test Use

Patient history is the starting point for determining if the slump test is used. All patients describing lower back pain, leg pain, radicular symptoms, trauma, spinal cord symptoms, headaches, cervical pain, and thoracic spine pain are candidates for the slump procedure [4-6]. Additional candidates are identified by reports of symptom reproduction during daily activities similar to the slump test. Possibilities include extending the legs to operate foot pedals while driving, sitting in a recliner and sitting in a bathtub [6, 18].

Positive results of individual orthopedic and neurological tests described under interpretations (Soto-Hall, SLR, Braggard's, etc.) warrant the use of the slump test for differential diagnosis [10]. The slump test as a treatment procedure has been described [5, 11, 19]. Use as a therapeutic procedure will not be discussed.

Slump Test Variations

Several variations of the slump test exist. The principal difference between variations is test order. One variation uses dorsiflexion of the foot prior to knee extension (Figure 8) [6, 17]. Another uses cervical flexion after knee extension and foot dorsiflexion [5]. This is reversing Steps 5 and 6A described above. A third begins with the patient in a seated position on the exam table with the lower extremi-



Fig. 8. Slump test variation: dorsiflexion of the foot prior to knee extension.

ties extended along the table (Figure 9) [5]. Changing the order of the procedure or breaking the procedure into its component parts assists with localization of lesions and differential diagnosis [5, 10].

The sciatic nerve is the principal neural structure tested in the lower extremities during the slump procedure. Variations of the slump test for testing the obturator and femoral nerves exist [6]. These variations are not the focus of this writing and are not detailed.

Confirmatory Tests

Repositioning the patient in a supine posture and repeating the key slump components is beneficial for confirming slump test results. Reilly advocates combining straight leg raising with foot dorsiflexion and cervical flexion when testing patients with lower back pain and leg pain [1]. This procedure combines straight leg raising, Kernig's, Braggard's, Lindner's, Lhermitte's, Soto-Hall, and Brudzinski's tests when performed for the symptomatic extremity. Crossed straight leg raising, Kernig's, Fajersztajn's, Lindner's, Lhermitte's, Soto-Hall, and Brudzinski's are combined when the asymptomatic



Fig. 9. Alternate starting position for the slump test.

extremity is tested. Confirmatory testing in a supine position may not be as accurate as testing in the seated position. However, the extreme positioning of combination testing should produce at least a mild reproduction of the symptoms encountered with the patient seated. Failure to reproduce symptoms or a complete change in symptoms may indicate malingering or pain of psychogenic origin [3, 6].

I routinely combine the slump procedure with the Valsalva maneuver. The increased intrathecal pressure produced during the Valsalva maneuver places additional stress on the neuromeningeal tract and helps rule out or identify space occupying lesions.

Once history and physical examination procedures are complete, imaging and laboratory tests (Magnetic Resonance Imaging, Computed Tomography, Electromyography, Nerve Conduction Velocity, etc.) are recommended to confirm any findings of neuromeningeal tract tension.

Test Synonyms

Frequently, a single orthopedic or neurological procedure will have more than one name or the names of two similar tests are used interchangeably. Straight leg raising and Lasegue's tests are examples. Clinicians may use the names of other

orthopedic and neurological tests interchangeably with the slump test. The sitting straight leg raise test, the sitting root test, and Bechterew's test are possibilities. The practice of interchanging names is incorrect, as these tests are at best components of the slump test and not complete substitutes.

Remarkably, two separate procedures have been described as the slump test in medical literature. The slump test detailed here is as described by Maitland for neuromeningeal tract evaluation [5]. The second slump test described by White and Pape is for measuring trunk control in individuals with neuromuscular disabilities [20]. The similarity between the two tests ends with the name.

CONCLUSION

Multiple steps, similarities with other tests, and a variety of interpretations make the slump test more complicated than most orthopedic and neurological tests. Fortunately, the factors that make it complicated also make the test versatile, efficient and reliable [4-6,10,11]. Clinicians should strive to understand the intricacies of the slump test and incorporate the procedure into all spinal and lower extremity evaluations.

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