

# A 10-step musculoskeletal examination

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## ABSTRACT

Incorporating this evaluation of musculoskeletal function into your physical examination can be particularly helpful when seeing patients for a regular preventive medicine visit or for back pain—one of the most common reasons for primary care visits. Containing certain features of manipulative medicine, this screening examination offers a head-to-toe approach for quick assessment of normal function as well as structural problems. In many cases, patients may benefit from exercise or simple orthotics.

Musculoskeletal complaints, especially back pain, are consistently among the top four reasons for patient visits to the family practitioner. Although few allopathic physicians have been formally trained to perform a basic structural examination, it can be fairly easily learned and worked into the physical examination.

This article presents a checklist for rapid screening of structural problems that can be treated or modified in a primary care setting. With some practice using this 10-step approach, a basic musculoskeletal examination can take as little as 5 minutes. And this goes beyond checking for neurologic deficits and gross motor movements; it will help you assess normal function and evaluate for the causes of back pain and musculoskeletal dysfunction.

Among the aims of this examination is to look

for asymmetry and restricted motion, both of which can ultimately lead to pain, deformity, and serious end results of musculoskeletal dysfunction such as plantar fasciitis and sciatica. By contrast, functional short-leg syndromes, excessive pronation, and scoliosis are potentially correctable dysfunctions. In some cases, the cause as well as the symptoms can be treated. When appropriate, you may want to refer patients to physiatrists or osteopathic physicians for manipulative or manual procedures.

### Patient preparation

Have the patient remove loose outer clothing, as well as shoes and socks, so that the musculoskeletal system can be observed, palpated, and evaluated as a whole. The patient may wait for you in the examining room in a gown or drape, but he or she should be clad in no more than underwear during the examination itself. At some point, you must watch the patient move, walk, and stand erect, crucial parts of the examination (see Table 1).

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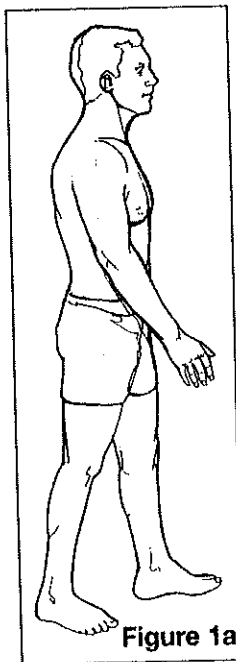
**Table 1** Key areas to observe

Area observed	Significance
Gait	Shuffling or ataxic gait may suggest neurologic deficits; stiff back or antalgic gait suggests musculoskeletal problems
Posture	Good posture denotes spinal flexibility and strength, allowing the spine to withstand stress
Symmetry	Asymmetry or scoliosis can lead to restricted motion and fascia
Pronation of feet	This suggests plantar fascia dysfunction, laxity of ligaments of the medial longitudinal arch, knee pain
Hamstring flexibility	Flexibility reduces strain and inflammation of the tendon attachments and contributes to stability of the pelvic and lumbar lordosis

Starting with the general examination of gait and posture and proceeding to specific muscle groups is the preferred method of examination. The examination usually starts at the top and works downward; a form is useful for recording your findings (see Appendix, page 28). We will take each phase in order.

### 1. GAIT

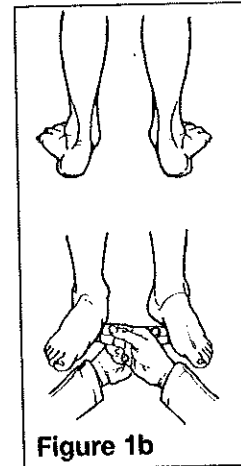
Observing gait is a logical place to start. If possible, it is preferable to observe the patient walking when he or she is unaware of being watched, such as before entering the examining room during preliminary procedures. Have the patient walk the length of the examining room with arms relaxed, and



**Figure 1a**

watch for a normal swinging motion of the arms (see Figure 1a).

Observe the action of the feet and Achilles tendons, and determine whether the person toes in (supination) or out (pronation). Pronation places abnormal stress on the ankle, knee, hip, and back, and a number of clues may point to it. Medial bowing of the Achilles tendon often indicates pronation (see Figure 1b), and an inward roll of the talocalcaneal articulation is another common indicator. Still another is excessive wear on the medial side of the heel of the patient's shoe. Severe pronation or collapsed arches may suggest the need for heel lifts, arch supports, or other orthotics.



**Figure 1b**

In determining the degree of pain the patient has, if any, it is helpful to remember that most musculoskeletal gait dysfunctions are antalgic and are characterized by a short stance phase and a rapidly executed swing phase. A person will also try to avoid standing on a painful extremity. A shuffling gait, scissors gait, or ataxic gait points to more serious medical problems.

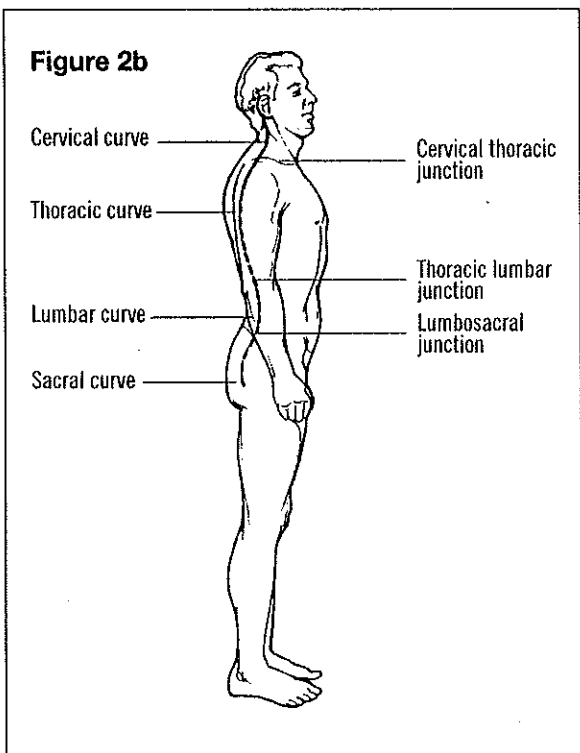
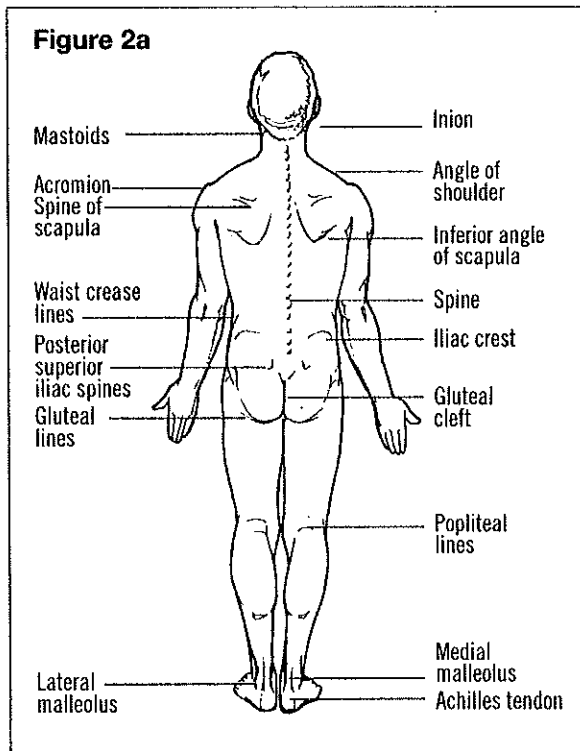
A mild exercise program that includes walking or swimming will often improve a patient's overall conditioning and help relieve back pain. Aquatic exercise programs may be particularly helpful for older persons or those who are overweight.

### 2. STANDING

• *Posterior view* In a completely symmetrical posture, a plumb line dropped from the ceiling to the floor would pass through the following points (see Figure 2a, page 22):

1. The inion.
2. The midline of the vertebrae.
3. The midline of the sacrum.
4. The midline of the coccyx.
5. A point midway between the medial malleoli.

Muscles and ligaments can pull the spine out of alignment, in response to asymmetrical forces,



and this may cause scoliosis, which, over time, may become fixed.

To inspect posture, have the patient stand without shoes on a level surface. Place his feet 6-8 inches apart with the toes abducted 15 degrees. Keep your eyes at the level of the part being viewed. Observe the patient in the following sequence, starting at the head and moving caudally:

1. Head tilt.
2. Shoulder levels.
3. Inferior angles of the scapula.
4. Waist crease lines.
5. Iliac crest heights.
6. Gluteal creases.
7. Fingertip lengths.
8. Popliteal lines.
9. Achilles tendons.
10. Arches.

Record your findings, and repeat from a sagittal view.

• *Sagittal view* In an ideal erect posture, a plumb line dropped from the ceiling along the body's midline would pass through the following points (see Figure 2b):

1. External auditory meatus.
2. Through the shoulder joint.
3. Through the bodies of the lumbar vertebrae.
4. Just posterior to the hip joint.
5. Just anterior to the knee joint.
6. Just anterior to the lateral malleolus.

When observing the patient from the side, note the head position over the shoulders and the various physiologic curves—cervical, thoracic, and lumbar. The three normal sagittal curves in adults are as follows:

1. C1-C7 convex forward, normal lordosis.
2. T2-T12 concave forward, normal kyphosis.
3. L1-L5 convex forward, normal lordosis.

In the sacral region, the fused sacrum is concave forward.

The sagittal spinal curves are interrelated in function to withstand stress, allowing elasticity under force. An increase in lumbar lordosis will result in increased thoracic kyphosis and increased cervical lordosis, which may cause local strain and dysfunction. The examination must therefore include areas above and below any painful structures.



### 3. SQUAT TEST

In this test, which screens for hip and knee joint restriction, the patient attempts to squat while holding onto support (see Figure 3). Restriction may indicate degenerative changes in the joints, general lack of flexibility, or muscle weakness. If the patient can't do the squat test, more specific evaluation of the hip or knee joints will be necessary to make an accurate diagnosis.

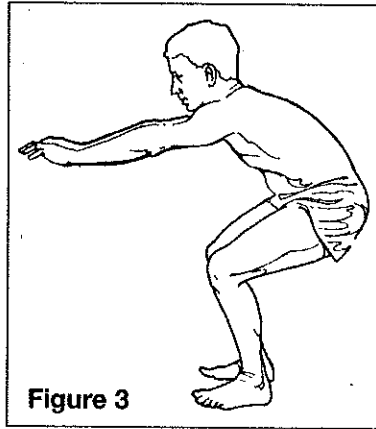


Figure 3

### 4. STANDING LUMBAR MOTION

• *Side-bending* In this maneuver which tests for lateral lumbar flexibility, the patient slowly slides one hand down the lateral aspect of the ipsilateral leg without deviating into lumbar flexion or extension (see Figure 4a). The patient continues this motion until the physician can feel movement of the contralateral iliac crest, which indicates the normal angle of side bending. This

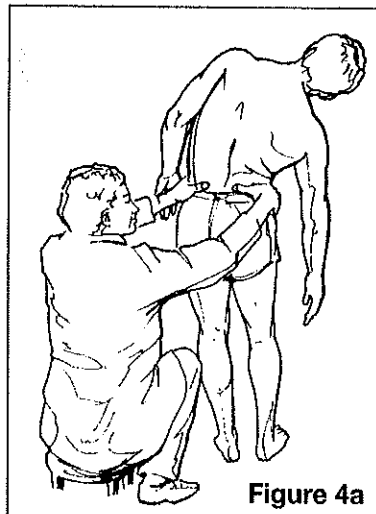


Figure 4a

is approximately 40 degrees. Repeat the procedure for the other side of the body, and compare right-side with left-side bending.

• *Hip-drop test* The purpose of this test is to detect restricted lateral flexion where flexion produces pain or sciatica. With the patient standing in a relaxed position, face his or her back with your eyes level with the lumbar region. Tell the patient to bend one knee and keep the other knee straight (see Figure 4b). Note the de-

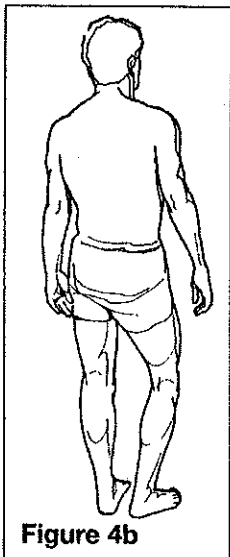


Figure 4b

gree of curve created as measured by the drop in the iliac crest. Lateral flexion is more restricted on the side where the iliac crest is lower. Have the patient return to the neutral position, and repeat the procedure with the other knee.

### 5. STANDING FLEXION TEST

Iliosacral dysfunction is a common source of back pain. It is easily tested by weight-bearing and involves the relationship between the hip and the lumbosacral spine, which can be assessed with these maneuvers (see Figure 5).

• *Motion testing* With the patient standing in a relaxed position, stand or kneel facing his or her back, and place your thumbs at the inferior aspect of the posterior superior iliac spine (PSIS), which is usually visible as a skin dimple. Compare the position of your thumbs. Have the patient slowly bend forward from the waist with knees locked and the arms hanging loosely toward the floor. Observe the movement of the PSIS as the patient returns to the standing position.

During this movement, any scoliosis will become apparent to the examiner. In

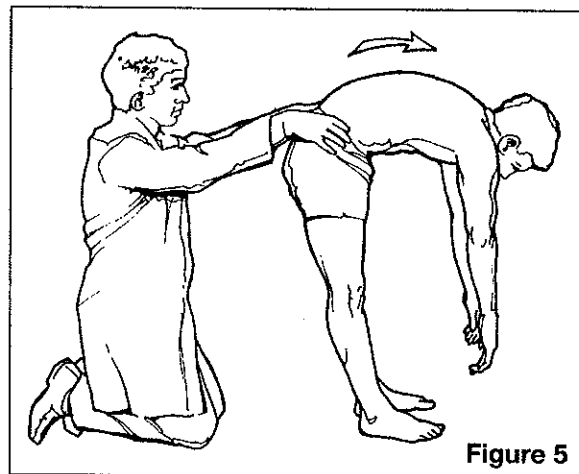


Figure 5

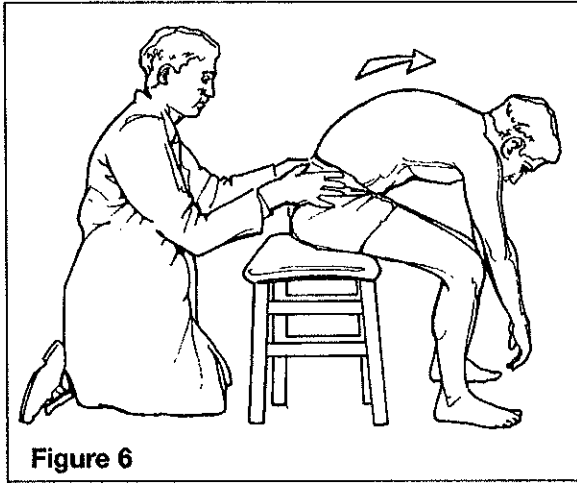


Figure 6

addition, restriction on one side causes the iliosacral joint to lock prematurely on that side, which in turn causes the PSIS to elevate sooner and farther than that on the other side. This is considered a positive result of testing the iliosacral joint on the ipsilateral side.

A word of caution: If the patient has an acute back strain or possibility of a herniated disk where flexion produces pain or sciatica, this test may not produce accurate results due to guarding. It will also take some practice to feel the ilium move on the sacrum, but gross dysfunctions will be apparent. With experience, you will palpate more subtle changes.

### 6. SEATED FLEXION TEST

This is an excellent test for detecting sacroiliac restriction or dysfunction, and sacroiliitis is fairly easy to treat once it is detected. Because the patient is seated, the hips and pelvis are eliminated as factors in evaluating the motion. The same landmark, the PSIS, is used.

Place your thumbs at the PSIS, and have the patient bend forward slowly from the waist (see Figure 6). Observe the movement of the PSIS as it rises. The result is considered positive if one side rises sooner or farther than the other. One thumb being deeper or more anterior than the other suggests sacral rotation, and correcting this problem will increase mobility in the pelvis and lower back.

### 7. SEATED NECK MOTION

A common problem in office workers who routinely use computers is stiffness in the neck and shoulders. These tests will help you evaluate the degree of dysfunction. Ask the patient to describe how he or she sits at a desk, uses the computer, and talks on the telephone (prolonged cradling of the phone can also cause a stiff neck). You may want to give the patient exercises to help relieve stress and stiffness (see the FYPI, "Reducing muscle stress and strain: An office exercise routine," page 29).

- *Forward bending—flexion* With the patient seated, place one hand on the occiput and fingers of your other hand on the cervicothoracic

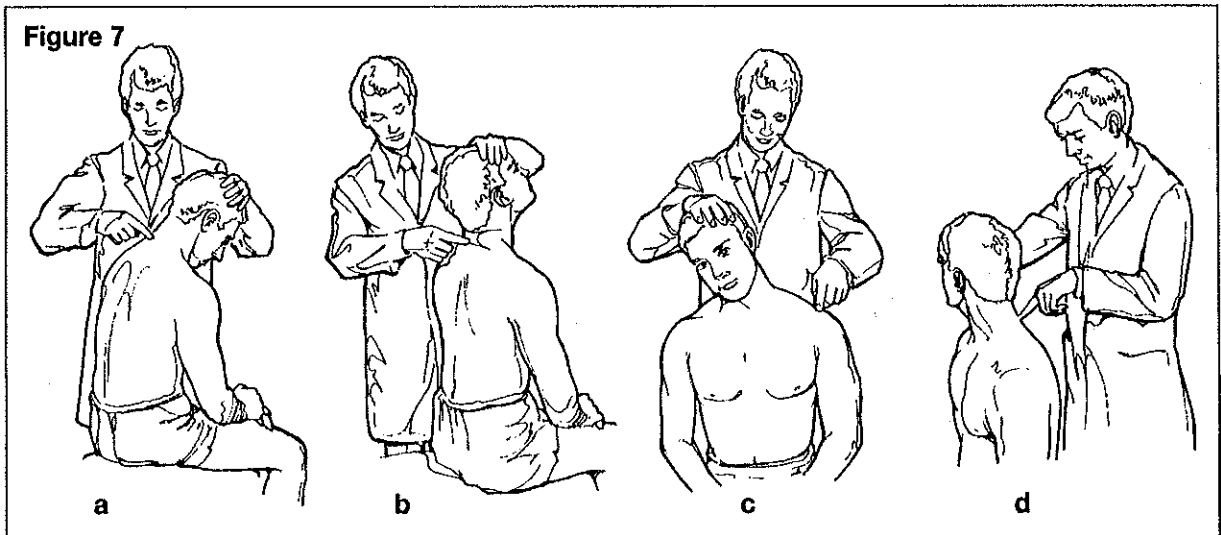


Figure 7

**Brief Summary:**

**Contraindications:** Patients who have had allergic reactions to NAPROSYN<sup>®</sup>, ANAPROX<sup>®</sup> or ANAPROX<sup>®</sup> DS or in whom aspirin or other NSAIDs induce the syndrome of asthma, rhinitis, and nasal polyps. Because anaphylactic reactions usually occur in patients with a history of such reactions, question patients for asthma, nasal polyps, urticaria, and hypotension associated with NSAIDs before starting therapy. If such symptoms occur, discontinue the drug.

**Warnings:** Serious GI toxicity such as bleeding, ulceration, and perforation, can occur at any time, with or without warning symptoms, in patients treated chronically with NSAIDs. Remain alert for ulceration and bleeding even in the absence of previous GI tract symptoms. In clinical trials, symptomatic upper GI ulcers, gross bleeding or perforation occur in about 1% of patients treated for 3-6 months, and in about 2-4% of patients treated for one year. Inform patients of signs and/or symptoms of serious GI toxicity and what steps to take if they occur. Studies have not identified any subset of patients not at risk of developing peptic ulceration and bleeding. Except for a prior history of serious GI events and other risk factors associated with peptic ulcer disease, such as alcoholism, smoking, etc., no risk factors (e.g., age, sex) have been associated with increased risk. Elderly or debilitated patients seem to tolerate ulceration or bleeding less well and most spontaneous reports of fatal GI events are in this population. In considering the use of relatively large doses (within the recommended dosage range), sufficient benefit should be anticipated to offset the potential increased risk of GI toxicity.

**Precautions:** DO NOT GIVE NAPROSYN<sup>®</sup> (NAPROXEN) CONCOMITANTLY WITH ANAPROX<sup>®</sup> OR ANAPROX<sup>®</sup> DS (NAPROXEN SODIUM) SINCE THEY CIRCULATE IN PLASMA AS THE NAPROXEN ANION. Acute interstitial nephritis with hematuria, proteinuria, and nephrotic syndrome has been reported. Patients with impaired renal function, heart failure, liver dysfunction, patients taking diuretics, and the elderly are at greater risk of overt renal decompensation. If this occurs, discontinue the drug. Use with caution and monitor serum creatinine and/or creatinine clearance in patients with significantly impaired renal function. Use caution in patients with baseline creatinine clearance less than 20 ml/minute. Use the lowest effective dose in the elderly or in patients with chronic alcoholic liver disease or cirrhosis. Borderline elevations of liver tests may occur in up to 15% of patients. Elevations of SGPT or SGOT occurred in controlled trials in less than 1% of patients. Severe hepatic reactions, including jaundice and fatal hepatitis, have been reported rarely. If liver disease develops or if systemic manifestations occur (e.g., eosinophilia or rash), discontinue therapy. If steroid dosage is reduced or eliminated during therapy, do so slowly and observe patients closely for adverse effects, including adrenal insufficiency and exacerbation of arthritis symptoms. Determine hemoglobin values periodically for patients with initial values of 10 grams or less who receive long-term therapy. Peripheral edema has been reported. For patients with restricted sodium intake, note that each tablet contains approximately 25 or 50 mg (1 or 2 mEq) sodium. Use with caution in patients with fluid retention, hypertension or heart failure. The drug may reduce fever and inflammation, diminishing their diagnostic value. Conduct ophthalmic studies if any change or disturbance in vision occurs. **Information for Patients:** Side effects can cause discomfort and, rarely, more serious side effects, such as GI bleeding, may result in hospitalization and even fatal outcomes. Physicians may wish to discuss with patients potential risks and benefits of NSAIDs, particularly when they are used for less serious conditions where treatment without NSAIDs may be acceptable. Patients should use caution for activities requiring alertness if they experience drowsiness, dizziness, vertigo or depression during therapy. **Laboratory Tests:** Because serious GI tract ulceration and bleeding can occur without warning symptoms, follow chronically treated patients and inform them of the importance of the follow-up. **Drug Interactions:** Use caution when giving concomitantly with coumarin-type anticoagulants; a hydantoin, sulfonamide or sulfonylurea; furosemide, lithium, beta-blockers; probenecid, or methotrexate. **Drug/Laboratory Test Interactions:** May decrease platelet aggregation and prolong bleeding time or increase urinary values for 17-ketogenic steroids. Temporarily stop therapy for 72 hours before adrenal function tests. May interfere with urinary assays of 5HIAA. **Carcinogenesis:** A 2-year rat study showed no evidence of carcinogenicity. **Pregnancy:** Category B. Do not use during pregnancy unless clearly needed. Avoid use during late pregnancy. **Nursing Mothers:** Avoid use. **Pediatric Use:** Single doses of 2.5-5 mg/kg (as naproxen suspension), with total daily dose not exceeding 15 mg/kg/day, are safe in children over 2 years of age.

**Adverse Reactions:** In a study, GI reactions were more frequent and severe in rheumatoid arthritis patients on 1650 mg/day naproxen sodium than in those on 825 mg/day. In children with juvenile arthritis, rash and prolonged bleeding times were more frequent, GI and CNS reactions about the same, and other reactions less frequent than in adults. Incidence Greater Than 1%, Probable Causal Relationship: GI: The most frequent complaints related to the GI tract: constipation; heartburn; abdominal pain; nausea; dyspepsia, diarrhea, stomatitis. CNS: headache, dizziness, drowsiness; light-headedness, vertigo. Dermatologic: itching (pruritus); skin eruptions; ecchymoses; sweating, purpura. Special Senses: tinnitus; hearing disturbances, visual disturbances. Cardiovascular: edema; dyspnea; palpitations. General: thirst. \*Incidence of reported reaction 3%-9%. Where unmarked, incidence less than 3%. Incidence Less Than 1%: Probable Causal Relationship: GI: abnormal liver function tests, colitis, GI bleeding and/or perforation, hematemesis, jaundice, melena, peptic ulceration with bleeding and/or perforation, vomiting. Renal: glomerular nephritis, hematuria, hyperkalemia, interstitial nephritis, nephrotic syndrome, renal disease, renal failure, renal papillary necrosis. Hematologic: agranulocytosis, eosinophilia, granulocytopenia, leukopenia, thrombocytopenia. CNS: depression, dream abnormalities, inability to concentrate, insomnia, malaise, myalgia and muscle weakness. Dermatologic: alopecia, photosensitive dermatitis, skin rashes. Special Senses: hearing impairment. Cardiovascular: congestive heart failure. Respiratory: eosinophilic pneumonitis. General: anaphylactoid reactions, menstrual disorders, pyrexia (chills and fever). Causal Relationship Unknown: Hematologic: aplastic anemia, hemolytic anemia. CNS: aseptic meningitis, cognitive dysfunction. Dermatologic: epidermal necrolysis, erythema multiforme, photosensitivity reactions resembling porphyria cutanea tarda and epidermolysis bullosa, Stevens-Johnson syndrome, urticaria. GI: non-peptic GI ulceration, ulcerative stomatitis. Cardiovascular: vasculitis. General: angioneurotic edema, hyperglycemia, hypoglycemia.

**Overdosage:** May have drowsiness, heartburn, indigestion, nausea, vomiting. A few patients have had seizures. Empty stomach and use usual supportive measures. In animals 0.5g/kg of activated charcoal reduced plasma levels of naproxen. **Dosage and Administration for Mild to Moderate Pain, Dysmenorrhea and Acute Tendinitis and Bursitis:** Recommended starting dose is 550 mg, followed by 275 mg every 6 to 8 hours. Total daily dose should not exceed 1375 mg. **Dosage and Administration for Rheumatoid Arthritis, Osteoarthritis and Ankylosing Spondylitis:** Recommended dose in adults is 275 mg or 550 mg twice daily. In patients who tolerate lower doses well, the dose may be increased to 1650 mg per day for limited periods when a higher level of anti-inflammatory/analgesic activity is required. At this dosage, physicians should observe sufficient increased clinical benefits to offset potential increased risk. **Caution:** Federal law prohibits dispensing without prescription. See package insert for full Prescribing Information.

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junction (see Figure 7a, page 24). Gently push the patient's head forward until you feel the motion at the cervicothoracic junction. The normal angle of displacement is 80-90 degrees, or until the patient's chin touches the sternum.

• **Backward bending—extension** With the patient seated, place one hand on the patient's forehead and fingers of your other hand at the cervicothoracic junction (see Figure 7b, page 24). Gently push the patient's head backward until you feel motion at the cervicothoracic junction. The normal angle of displacement is usually 80-90 degrees, or until the patient looks directly at the ceiling.

• **Side-bending (lateral flexion) of the neck** Stand behind the seated patient. Flex his or her spine laterally to the right. Place one hand on the left parietal area and the other hand on the patient's left shoulder to monitor elevation (see Figure 7c, page 24). The normal angle of displacement is usually 40-45 degrees in either direction. Reverse hands to test the left side.

• **Neck rotation** Stand behind the seated patient. To evaluate right rotation, place your right hand on his or her left frontal area, and use your left hand to monitor shoulder rotation or motion at the thoracic junction. With your right hand, gently turn the patient's head to the right until you detect motion at the thoracic junction (see Figure 7d, page 24). Normal displacement from the midline is usually at 80-90 degrees or until the chin is over the shoulder. Reverse your hands to evaluate left rotation.

## 8. SEATED TRUNK ROTATION

Stand behind the seated patient, and place your hands on his or her acromion processes. Draw one shoulder toward you while pushing away the opposite shoulder (see Figure 8). Normal rotation is approximately 40 degrees in each direction. Observe for symmetry and location of pain.

The extent of rotation is influenced by the resistance of the intact rib cage and shearing forces in the intervertebral disk. Facet hypertrophy can further restrict rotation. This motion gradually diminishes with age, but the extent of restriction depends more on the life experiences, activities, and prior injuries than age alone. Monitor asymmetry to determine a restriction for that individual.



### 9. SEATED STRAIGHT-LEG TOE TOUCH

Have the patient seated on the examining table with knees fully extended. Tell him or her to reach forward and try to touch the toes. Measure the distance between fingertips and toes. Patients should be able to touch the toes or reach beyond them. This measures lumbar spine and hamstring flexibility in combination.

Tight hamstrings and hyper-tonia of lumbar paravertebral muscles lead to a higher rate of injury to the tendons and muscles of these structures, especially during exercise. Arthritis of the facets and degenerative disks in the lumbar spine further reduce flexibility.

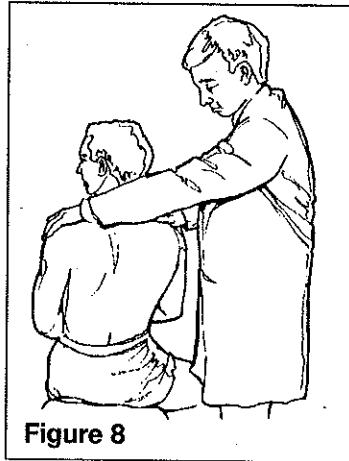


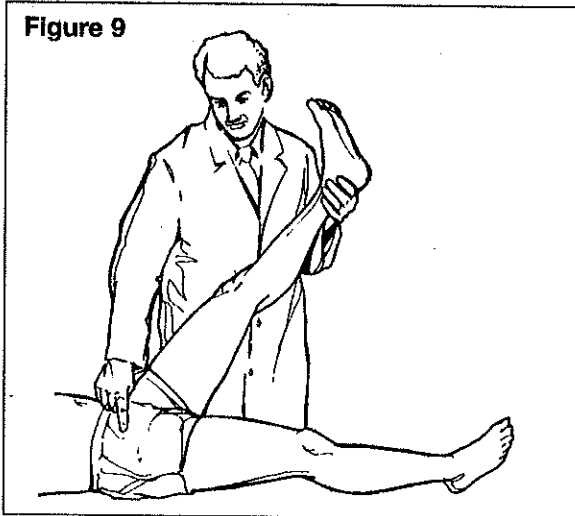
Figure 8

Flexion of more than 90 degrees indicates good extensibility of the erector spinal muscle; flexion of 80-90 degrees indicates good extensibility of the gluteus maximus muscle; flexion of less than 60 degrees suggests loss of hamstring extensibility. Tight hamstrings can flatten the normal lordotic curve of the lumbar region and thus increase stress to the back. A word of caution: The interpretation of this test can be invalidated by radiculitis or hip joint restriction.

### 10. SUPINE STRAIGHT-LEG RAISING

This test can be used to determine flexibility of the hamstrings (see Figure 9). It has been used traditionally to detect sciatic nerve root irritation. With the patient supine and both legs fully extended, stand at one side, and place one hand under the patient's heel. Fingers of your other hand are at the contralateral anterior superior iliac spine. Passively raise the fully extended leg off the table until you feel rotary motion at the anterior superior iliac spine. Note the degree of hip flexion.

Figure 9



### Conclusion

A brief examination can help you assess the patient's musculoskeletal function and evaluate for the causes of pain and dysfunction. In some cases, simple measures such as orthotics and exercises can help relieve symptoms. In others, the physician may feel more comfortable referring the patient to a physiatrist or osteopathic physician for manipulative or rehabilitative procedures. §

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**10-STEP SCREENING EXAM**

**1. GAIT**

**Walking**

- Toe-out (pronation)
- Toe-in (supination)
- Straight

Normal _____	Abnormal _____
Left foot	Right foot
1) _____	1) _____
2) _____	2) _____
3) _____	3) _____

**Shoes: Are the heels wearing:**

- To the outside (lateral)
- To the inside (medial)
- Evenly to the back

Left shoe	Right shoe
1) _____	1) _____
2) _____	2) _____
3) _____	3) _____

**2. STATIC POSTURE**

**Posterior view**

- a) Head side-bent to
- b) Shoulder level low on
- c) Inferior angle of the scapula lower on
- d) Iliac crest low on
- e) Popliteal line low on
- f) Achilles tendon bows
- g) Arch
- Low
- High
- Normal

L _____	R _____	equal _____
L _____	R _____	equal _____
L _____	R _____	equal _____
L _____	R _____	equal _____
L _____	R _____	equal _____
in _____	out _____	straight _____
Left foot	Right foot	
1) _____	1) _____	
2) _____	2) _____	
3) _____	3) _____	

**Lateral view**

- a) Cervical lordosis
- b) Thoracic kyphosis
- c) Lumbar lordosis
- d) Forward head tilt

increased _____	decreased _____	normal _____
increased _____	decreased _____	normal _____
increased _____	decreased _____	normal _____
yes _____	no _____	

**3. SQUAT RESTRICTED**

yes _____	no _____
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**4. STANDING LUMBAR MOTION**

- Side-bending restricted
- Hip-drop test low on

L _____	R _____	normal _____
L _____	R _____	normal _____

**5. STANDING FLEXION TEST**

negative _____	positive _____	L _____	R _____
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**6. SEATED FLEXION TEST**

negative _____	positive _____	L _____	R _____
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**7. SEATED NECK MOTION**

- a) Flexion restricted
- b) Extension restricted
- c) Rotation restricted
- d) Side-bending restricted

yes _____	no _____
yes _____	no _____
yes _____	no _____
yes _____	no _____

**8. SEATED TRUNK ROTATION RESTRICTED**

yes _____	no _____
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**9. SEATED STRAIGHT-LEG TOE TOUCH RESTRICTED**

yes _____	no _____
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**10. SUPINE STRAIGHT-LEG RAISING RESTRICTED**

yes _____	no _____
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