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### Hosford Differential Diagnosis Tables

This document details information about the differential diagnosis of the neuromusculoskeletal system of the human body. Many health professions will also find this document helpful, but it is especially suited to Physical Therapy.

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## W elcome to the Hosford Differential Diagnosis Tables!

This document details information about neuromusculoskeletal pathology and suggests a systematic method of problem solving. The student should look for broad principles to build their personal diagnostic skills. This document is only intended as a study tool for medical professionals, and does not substitute for medical training.

## E lectronic Document Background:

This document began as a personal study tool during my enrollment in the Doctor of Physical Therapy program at Slippery Rock University of Pennsylvania. The physical therapist must master a large number of differential diagnosis concepts and special tests. This document is a condensed summary of several resources. The listed references contain pictures and or diagrams that will be crucial for additional information and mastery of these tests. My personal love for both Physical Therapy and the Internet has made this document a reality.

## L ist of References:

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## O nline Study Materials:

Other study materials are available online! Our web site provides information on Physical Therapy and other related health care professions. We are developing several of these table information documents. Check out the listing of available documents and support this ongoing project by sending in the shareware fee of \$3.00 per person. Also available: Physical Therapy Evaluation Forms that have been made as a companion to this document.

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## M edical Disclaimer:

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E njoy reviewing these topics. I wish you the best of success.

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# Differential Diagnosis

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28 January, 2001

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## Introduction:

Differential diagnosis is used to differentiate between one or more conditions, diseases or injuries. Effective treatment requires specificity and accuracy in diagnosis through the careful comparison and contrasting of their signs and symptoms. Signs are those phenomenon which are directly tested and perceived by the clinician, where as symptoms consist of what the patient reports as their medical complaint.

The process of a differential diagnosis may involve a combination of clinical diagnosis, physical diagnosis, pathological diagnosis, a provocative diagnosis, laboratory diagnosis, and diagnostic imaging.

To perform a differential diagnosis, the clinician must have a working knowledge of pathology and the process of tissue healing. The specific characteristics (signs and symptoms) of the pathology must be understood for the clinician to recognize and then effectively treat the problem. A complete and detailed medical history would be taken. The objective exam represents the Hosford modified version of the 5 x 5 scheme of Frisch:

### I. Inspection

1. Activities of daily living: Gait, up and down from chair, dressing and personal hygiene.
2. Posture: What is the habitual posture? Compensatory position for avoiding pain?
3. Shape: Body type, swelling, atrophy, deformity, etc.
4. Skin: Color, wounds, scars, etc.
5. Assistive devices: Cane, crutches, brace, etc.

### II. Function

1. Active motion
2. Passive motion
3. Resisted isometric testing
4. Traction and compression
5. Joint play and end feel

### III. Palpation

1. Skin and subcutaneous tissue: Texture, temperature, etc.
2. Muscle and tendon: Point tenderness, spasm, defect, etc.
3. Tendon sheaths and bursae
4. Joints
5. Nerves and blood vessels

### IV. Neurological tests

1. Nerve trunk
2. Reflexes and key muscles
3. Sensation: Light touch, vibration, pain, and temperature.
4. Motor: Central and peripheral paresis
5. Balance and coordination

### V. Additional tests

1. Confirmatory special tests
2. Diagnostic imaging
3. Laboratory tests
4. Surgery and Puncture: Biopsy, aspiration, etc.
5. Referral to a specialist

Within the examination these sub items are not necessarily sequential in order. There will be situations where the clinician will want to minimize movement during the exam. A carefully thought-out exam will limit the number

of positional changes that are required of the patient. Work to have the patient feel better when they leave than when they came if at all possible.

**Keep in mind your goals in the evaluation:**

1. Learn as much as possible, leading to a differential diagnosis.
2. Gain the patient’s confidence, which is crucial to your success.
3. Keep your instructions simple and to the point.
4. Create an atmosphere where the patient can smile or laugh at least once during their visit.

## History

A complete medical history is a crucial component of the diagnostic process. Often, the examiner can make the diagnosis by simply listening to the patient. If the diagnosis is obvious, the background provided in the history will provide valuable information about the patient’s situation and possibly about their compliance, which will influence your prognosis, and the desired treatment.

The information gathered will be specifically geared toward the area of pathology. For an acute injury the mechanism, body positions, and a description of the forces involved in the trauma are very important. In chronic illness, questions of aggravating or alleviating factors, duration of the illness, and previous medical history are especially important. Following is a list of topics or questions to cover in the history section, and should be modified for each particular patient and condition.

### Introduction & Current Condition

- Observe the quantity and quality of patient movement at all times.
- Identify the patient’s complaints. “Tell me about your problem.” Or “What brings you to therapy today?” If more than one condition is given, have the patient rank them.
- Record the patient’s age, gender, race, occupation (tasks, activities and postures). Have the patient demonstrate if needed.
- Mechanism of injury: Specific episode, magnitude, and direction?
- Associated sounds and symptoms: A snap or pop at the time of injury / current.
- Current condition
  - Onset: Date, slow or sudden?
  - How long has it been present?
  - Has it occurred before?
  - What postures or activities intensify or mediate your symptoms?
  - Are the symptoms: Improving, getting worse, or unchanged?
- Pain
  - Where was the pain located initially? Has it moved or spread?
  - Record the pattern, intensity, frequency & duration of pain.
  - Type of pain exhibited?

Type of Pain	Possible Structure
Cramping, dull, aching	Muscle
Sharp, shooting	Nerve root
Sharp, bright, lightning-like	Nerve
Burning, pressure-like, stinging, aching	Sympathetic nerve
Deep, nagging, dull	Bone
Sharp, severe, intolerable	Fracture
Throbbing, diffuse	Vasculature

### **Past Medical History**

- Have you had any previous injuries, illness, or surgery?
- Past or concurrent treatment received and result of that treatment.
- Family medical history.
- Is there anything else that I should know about your medical history?

### **Current Medical / Social Status**

- Medications: (type, frequency, dose, effect)
- Have you had any diagnostic imaging tests? (X-ray, arthrogram, MRI)
- Secondary medical problems or health risks.
- Review of systems: (cardiac, respiratory, neurologic, vascular, metabolic, dermatologic, visual, gastrointestinal, genitourinary, endocrine)
- Mental status (alert to person, place & time)

### **Functional Implications**

- Motor or sensory symptoms:
  - Do you experience vertigo or dizziness?
  - Have you lost your balance? Have you had any falls?
  - Do you experience any numbness, tingling, burning, shooting pain or any patches of sensitive skin? If so, when and where?
  - Do you experience any weakness? If so where and when? Is it constant or intermittent?
  - Do you experience any muscle twitching?
  - Do you sometimes drop objects?
  - Do your arms or hands shake when you reach out to pick up an object? When you are at rest?
- Vascular symptoms or signs:
  - Do you experience any discoloration of your hands and feet? (time, intensity and duration)
  - Do you experience cold or hot sensations in your arms or legs?
  - Do you experience any swelling in your arms or legs?
- Functional assessment noting any limitations:
  - ADL's (hygiene, dressing, food preparation, eating, cleaning, child care, ambulation, etc.)
  - Occupational tasks.
  - Recreation activities: (type and frequency)
- Home / living situation:
  - Where do you live? (home, retirement community, etc.)
  - Home environment & architecture: Are there any home challenges you will face? (floor surface, presence of throw rugs, stairs, multilevel, etc.)
  - Marital and family status. Focus on care giving assistance available.

### **Functional Goals for Therapy**

- Relate all goals to function. Some therapists recommend a decrease focus on pain in your goals. It is important to have the patient share your rehabilitation goals, as their cooperation and compliance will be key to your success.
- Obtain informed consent as you progress to the objective portion of your evaluation. Explain that you will need to reproduce the same symptoms that brought them to therapy so that you can identify the specific area of the pain. Be sure that they understand the difference between normal discomfort during a special test, and the reproduction of "The Pain" in question.

# Observation

Your observations should begin when the patient enters the clinic, or as soon as you see the patient. This information is gathered as the “looking” part of the examination. The examiner should note the patient’s way of moving as well as the general posture, manner, attitude and willingness to cooperate. The patient must be adequately undressed to be observed properly. The purpose of the observation portion of the exam should be explained to prevent a potentially embarrassing situation.

- Standing posture (evaluate from both the front and the side, from head to toe)
- Is there any obvious deformity? (structural or dynamic)
  - Restricted ROM
  - Malalignment
  - Alteration of the shape of the bone
  - Joint deformity
- Are the bony contours of the body normal and symmetric?
- Are the soft-tissue contours normal and symmetric? Is there muscle loss or hypertrophy?
- Is the color and texture of the skin normal?

Skin Condition	Implication
Loss of skin elasticity, skin becoming shiny, hair loss on the skin, skin breakdown and slow healing. Nails may become brittle or ridged.	Trophic changes in the skin resulting from peripheral nerve lesions.
Cyanosis, or a bluish color to the skin.	Poor blood perfusion.
Redness	Increased blood flow and/or inflammation.

- Are there any scars? Recent scars will be red, while older ones will be white.
- Is there any sign of inflammation? (heat, swelling, redness, pain)
- Is there any crepitus or abnormal sound in the joints when the patient moves them?
- Any functional limitations that you observed? Was the patient moving?
- Patient’s attitude toward you as the therapist, and their condition?
- What is the patient’s facial expression? Discomfort or lacking sleep?

# Examination Principles

In the examination portion of the assessment, a number of principles must be followed:

1. The normal side is tested first, allowing the examiner to establish a baseline of normal movement, and shows the patient what to expect, resulting in increased patient confidence.
2. Active movements are done before passive movements. (If the patient is able to demonstrate full range of motion, then passive range may not be necessary.) Resisted isometric movements would be performed after passive movements.
3. While testing myotomes, each contraction is held for a minimum of 5 seconds to see if weakness becomes evident. Remember that myotomal weakness takes time to develop.
4. Any movements that are painful are done last if possible to prevent the overflow of painful symptoms to the next movement.
5. In passive ROM, the degree and the quality of movement are both important.
6. Resisted isometric movement is done with the joint in the physiologic neutral or open pack position in the middle of the available range of motion. The joint should be adequately stabilized to avoid motion at the joint during the isometric test. Your goal is to differentiate contractile and non-contractile tissue involvement.
7. Joint end feel should be ascertained carefully and as not to exacerbate symptoms.
8. In ligamentous tests, the appropriate stress is applied gently and repeated several times; the stress is increased up to but not beyond the point of pain. By doing the test this way, maximum instability can be demonstrated without causing muscle spasm.
9. Note whether symptoms increase or decrease, strength changes, and whether there is possible vascular insufficiency.
10. After an exam, modalities should be used to relax the patient and reduce their pain evoked during the evaluation.

## Sensory and Reflexes

Sensory information gathered from the patient can provide a wealth of information regarding the integrity of the nervous system and how this could relate to pathology. The combination of sensory and reflex changes within a specific dermatome or in the distribution of a distal sensory nerve can help pinpoint the area of pathology. HNP commonly presents with sensory changes in the distal extremity, being described as tingling, numbness or perceived temperature changes (such as the feeling of cold water running down the leg). Carpal Tunnel Syndrome or Thoracic Outlet Syndrome often present with sensory changes distal to the nerve compression, but occasionally pain is referred proximally.

Sensory perception is measured in these categories: light touch, two point discrimination, deep pressure, and thermoreceptors. As mentioned above, the areas of sensory changes on the body are indicative of the area where the pathology is occurring. Sensation is generally affected before motor control, as the sensory nerve fibers are smaller, and more sensitive to pressure on the nerve. In this area, you should keep in mind that systemic disease can produce nerve damage, such as the sensory loss of sock and glove common in advanced diabetes.

# Screening Examinations

## Objective:

The purpose of the screening examinations is to enable the examiner to rapidly focus on the area in which a lesion is situated. The screening examinations do not tell the examiner what the problem is-- only its location(s). Screening exams are utilized to provide short cuts in the examination process and include active, passive, and resisted tests, which have been selected for their ability to demonstrate dysfunction in the appropriate area(s). If the screening examination indicates a problem to lie in the shoulder, for example, a detailed examination of the shoulder should then be done. This principle applies for any region of the musculoskeletal system.

## Upper Quarter Screen

### Areas Included:

Cervical spine, temporomandibular joint (TMJ), thoracic spine (to T6), shoulder complex, elbow, forearm, wrist, and hand.

### Inspection:

- Posture of the head and neck
- Posture of the shoulder girdle and contour
- Posture of the upper extremity

### Functional:

- Active elevation of the shoulder Pain, ROM
- Active ROM of the cervical spine Pain, ROM, Overpressure
  - Forward bending
  - Right and left rotation
  - Right and left sidebending
  - Backward bending
- Mandibular opening and closing Pain, ROM, Click, Deviation
- Resisted rotation of the cervical spine Pain, ROM, C1
- Resisted shoulder girdle elevation Pain, ROM, C2, C3, C4 and CN 11
- Resisted glenohumeral abduction Pain, ROM, C5
- Resisted elbow flexion Pain, ROM, C6
- Resisted elbow extension Pain, ROM, C7
- Resisted wrist extension Pain, ROM, C6
- Resisted wrist flexion Pain, ROM, C7
- Resisted thumb extension Pain, ROM, C8
- Resisted abduction & adduction of the fingers at the McP's Pain, ROM, T1
- Spring testing of the thoracic vertebrae Pain, ROM
- Biceps DTR
- Triceps DTR
- Sensory

## Lower Quarter Screen

### Areas Included:

Thoracic spine (T6-T12), lumbar spine, sacroiliac region, hip, knee, foot and ankle.

Do not terminate the screening examination when one area of dysfunction is found. Do a detailed examination of the area at fault. Do not persist in the examination procedure if it is apparent that the condition is being exacerbated.

### Inspection:

#### Posture of:

Thoraco-lumbar spine

Pelvis

Knees

Feet

Gait evaluation

### Functional:

#### Standing

Iliac crest heights

AROM of lumbo-sacral spine (BB, FB, RSB, LSB)

Toe walking S1, S2

Heel walking L4, L5

#### Sitting

AROM of thoraco-lumbar rotation Pain, ROM, Overpressure if painfree

Patellar DTR L2, L3, L4

Achilles DTR S1

#### Supine position

Passive straight leg raise Pain, ROM, Variations

(including neck flexion ankle dorsiflexion, bowstring)

Long sitting test

ROM of the hip Pain, ROM, Sign of buttock

Resisted hip flexion Pain, ROM, L1, L2

Resisted knee extension Pain, ROM, L2, L3, L4

Resisted ankle dorsiflexion Pain, ROM, L4, L5

Resisted eversion of foot Pain, ROM, L5, S1

#### Prone position

Femoral nerve stretch

Achilles DTR S1

Resisted knee flexion Pain, ROM, S1

Observation of gluteal mass

Spring testing of thoraco-lumbar spine and sacrum

## Segmental Innervation of Muscles

Body Region	Action	Nerve Root Level
Neck	flexion	C1,2,3,4
	extension	
	rotation	
Shoulder	flexion	C5,6
	abduction	
	adduction	C5,6,7,8
	extension	
Elbow	flexion	C5,6
	extension	C7,8
Forearm	pronation	C6,7
	supination	C5,6,7
Wrist	extension	C6,7
	flexion	C6,7,T1
Hand	gross extension of fingers	C6,7,8
	gross flexion of fingers	C7,8,T1
	fine digital motion	C8,T1
Back	extension	C4 - L1
Chest muscles	for breathing	T2 - T12
Diaphragm	for breathing	C3,4,5
Abdominal muscles	side bending, breathing	T6 - L1
Hip	flexion	L2,3,4
	adduction	
	abduction	L4,5,S1
	extension	
	rotation	
Knee	extension	L2,3,4
	flexion	L4,5,S1
Ankle		L4,5,S1,2
Foot		L5,S1,2
Bladder		S2,3,4
Bowel	rectum and anal sphincter	
Penile erection	sacral cord	
Ejaculation	lumbar cord	
		L1,2,3

## Diagnostic Imaging & Special Tests

Many special tests can be used for each joint to determine whether a particular type of disease, condition, or injury is present. While these tests are strongly suggestive of a particular problem when they yield positive results, they do not necessarily rule out the disease when they yield negative results.

## Diagnostic Imaging Summary Tables

Modality	Description	Patient Preparation	Indications / Findings	Precautions	Adverse Reactions
<b>X-ray Plain Film</b>	X-rays pass through the body, and where not absorbed by dense body material, expose the film, turning the exposed areas black.	Prior to your exam, you may be asked to remove earrings, hairpins or necklaces. You may also be asked to change into a gown. When you are in the exam room, the technologist will explain the procedure to you and help position you for your exam.	<p>Acute trauma which may have disrupted bone alignment or integrity.</p> <p>Lesions can be studied to reveal if they are malignant or benign, aggressive or slow growing. These do not cross the joint space.</p> <p>Inflammation and infection processes are described by crossing the joint space and tend to be localized.</p>	X-rays are a form of radiation and cumulative doses can pose danger. Any X-ray you may have exposes you to radiation. Most X-rays are only the equivalent of six months or less of natural background radiation. Having a chest X-ray is only the equivalent of three days of this type of radiation.	If you are pregnant, or if there is any possibility that you might be pregnant, please report it before having your x-ray, as this may pose a risk to the developing fetus.
<b>CT</b>	Computed Tomography (CT) is an x-ray technique that uses a special scanner and a computer to create cross-sectional. Unlike standard x-rays, which take a picture of the whole structure being examined, CT has the ability to image that same structure one cross-section or "slice" at a time.	<p>Some CT scans require prior medication or special dietary preparations. Please ask your doctor if advance preparations will be required for your scan and refer to this site for specific instructions.</p> <p>Prior to your exam, you may be asked to remove eyeglasses, earrings, hairpins or other metal objects. If you are having a CT scan of your head, you may wear your own clothes for the exam. For other exams, you may need to change into a gown.</p> <p>The technologist will explain the procedure to you and help position you on the scanning table. The table will move within the scanner all you do is relax and remain as still as possible. It is normal to hear whirring, clicking and other mechanical noises during your exam.</p> <p>You may be asked to hold your breath for short periods of time. If your exam requires a contrast medium to highlight certain parts of your body, it will be given by intravenous injection. It may cause a warm sensation throughout your body and a metallic taste in your mouth.</p> <p>If you experience any other discomfort, please tell the technologist immediately. The technologist will be visually monitoring your exam from an adjoining room, and you will be able to talk to him or her at all times.</p>	<p>CT Guided Biopsy</p> <p>Same information as plain film with the added advantages of cross section detail.</p>		

Modality	Description	Patient Preparation	Indications / Findings	Precautions	Adverse Reactions
<b>Myelogram</b>	An X-ray exam of the spinal cord and/or spinal canal with the use of radiopaque contrast medium which is injected into the intrathecal (subarachnoid - CSF) space.	<p>Pt can expect a hospital stay of 4-6 hours. Before the test, a contrast medium is introduced into the spinal cord through a lumbar spinal tap with the pt's head upright to encourage pooling of the contrast medium in the lumbar spine.</p> <p>X-ray images are then taken to show the progression / migration of the contrast medium.</p>	<p>This tool is used to define space occupying lesions, indicating the size and general location of the lesion.</p> <p>A variety of imaging methods can be used, including static and dynamic images.</p> <p>Abnormal findings:</p> <ul style="list-style-type: none"> <li>• Spinal cord compression / obstruction</li> <li>• Nerve root injuries</li> <li>• Ruptured disc</li> <li>• Spinal stenosis</li> <li>• Intervertebral tumors</li> </ul>	Any allergies to the contrast medium which is injected into the CSF.	<p>Spinal headache, nausea and vomiting.</p> <p>Possible neurotoxicity leading to CNS compromise.</p> <p>Confusion, disorientation, hallucination, light sensitivity, hot flashes.</p>
<b>MRI</b>	Magnetic Resonance Imaging (MRI) is one of the most advanced diagnostic imaging tools available in medicine today. Using magnetic fields and radio frequency coils, remarkably detailed cross-sectional images highlighting soft tissues and bones.	<p>There is usually no advance preparation required for MRI. Some MRI exams require a contrast agent to highlight certain parts of your body. If contrast is required for your exam, it will be given by intravenous injection. There are usually no side effects from the contrast agent used in MRI.</p> <p>During the exam, you will hear a dull, pounding sound coming from the scanner. This is normal and is caused by the radio frequency signals being turned on and off. You will be given ear plugs to wear to decrease this noise and to protect your hearing, while still allowing you to hear the technologist. The time of scanning varies from about 15 minutes to one hour depending on the part of the body being imaged.</p> <p>Although most people are able to tolerate this exam well, some become very anxious inside the scanner. If you know that you become very uncomfortable in small, enclosed spaces, please tell our staff or your physician before scheduling your exam. We will either schedule you for an open MRI exam, or schedule extra time to give you a mild sedative to help you relax. If you require this medication, please make arrangements for someone to drive you home.</p>	<p><b>CINE-MRI:</b> multiple movements (ROM: flex to ext) to see carpal sublux; static pictures put together as an animation sequence</p> <p><b>shoulder:</b> identify Neer Stages; arthrogram is more accurate for full thickness rotator cuff tear; rotator cuff tears and soft tissue masses/tumors</p> <p><b>wrist and hand:</b> avascular necrosis, soft tissue, fibrocartilage tears, carpal subluxations</p> <p><b>spine:</b> HNP (CT scans probably better), congenital anomalies, metastatic lesions, C1-C2 subluxations</p> <p><b>hip:</b> avascular necrosis</p> <p><b>knee:</b> 90-94% accurate with MRI; meniscal tears and ligamentous injuries; fluid is typically white; meniscus is black because no precession</p> <p><b>ankle and foot:</b> Achilles tendon tear, avascular necrosis</p>	<p>If you had surgery resulting in metallic implants such as a cardiac pacemaker, aneurysm clips in the brain, TENS units, or cochlear implants, you may be prevented from having an MRI exam.</p> <p>In addition, if you are a welder or sheet metal worker or have had similar occupations or hobbies, where metal filings may be imbedded in your skin or eyes, you may be prevented from having this exam due to the high magnetic forces used during the procedure.</p>	MRI does not use x-ray or radiation, and the magnetic fields used in MRI are not known to be harmful in any way.
<b>Ultra-sound</b>	<p>Ultrasound uses sound waves to bounce off internal organ structures. The returning sound waves are picked up and used to create a 2 dimensional real time image which may be videotaped or photographed.</p> <p>Ultrasound is noninvasive, no needles or tubes.</p>	<p>The ultrasound probe will come in contact with the skin over the organ of interest. There is no discomfort other than pressure of the ultrasound head over the affected structure.</p> <p>Depending on the type of study, you may be instructed to drink water at specific times before your appointment.</p> <p>At high intensity levels there may be a sensation of warmth. Any pain or discomfort should be communicated to the technician.</p>	<p><b>Gallbladder Ultrasound:</b> is very effective in detecting gallstones which show up as bright echo-dense stones with acoustic shadowing. Used to differentiate solid <b>tumors</b> from cystic (fluid filled) tumors.</p> <p><b>Kidney Ultrasound</b> is very good for showing hydronephrosis, blockage of the kidney, kidney stones, kidney tumors cysts.</p> <p><b>Gestational dating and fetal position:</b> Ultrasound is very useful for examining and measuring the size of the fetus in the uterus, which then can be used to estimate gestation age. It also gives information about the placenta, the amniotic fluid and fetal presentation.</p> <p><b>Doppler</b> studies of blood flow.</p>	<p>This is a very safe and non invasive modality.</p> <p>Some patients report increased pain when an ultrasound head is moved over a fracture site.</p>	<p>Ultrasound consists of only very high frequency sound waves, which are not damaging to the tissues.</p> <p>Theoretical possibility of the sound heading getting too warm if held statically in one area for a long time.</p>

## Cervical Spine

Tests for Neurological Symptoms. Also see Shoulder: Neurologic and Vascular

Special Test	Position of patient	Position of examiner	Evaluative procedure	Positive test results	Implications
<b>Foraminal Compression Test</b>	The patient stands. The patient will laterally flex the head to one side. (Note: The Jackson's Compression Test calls for head rotation.)	Place your hands on top of the patient's head, directly over the neck.	Carefully and slowly press straight down on the head.	Pain radiating down the arm toward which the head was laterally flexed.	Nerve root(s) involvement. The distribution of pain and/or altered sensation can give an indication of which nerve roots are receiving pressure.
<b>Distraction Test</b>	The patient sits. Head in neutral.	Place your hands along the sides of the patient's face prepared to lift the head.	Carefully and slowly lift the patient's head.	Pain is relieved or decreased.	Nerve root compression being relieved by this test. Have the patient move the arms while traction is applied to rule out any shoulder involvement.
<b>Valsalva Test</b>	The patient sits. Head in neutral.		Have the patient hold the breath and bear down as if they were moving the bowels.	Any increase in pain. Note the sensation, severity and the location of the pain. Note that this is a very subjective test.	Increase in intrathecal pressure, relating to symptoms caused by herniated disc or tumor. Pain radiation would follow the dermatome of the involved nerve root.

Tests for Vascular Signs

<b>Vertebral Artery Test</b>	The patient lies supine. The patient's will be moved into full rotation, lateral bend and then extension. Instruct the patient to report any sensory changes.	Cradle the head with one hand and stabilize the patients shoulder with the other hand. Instruct the patient to keep their eyes open and to look at your forehead during the test.	Fully rotate the head to one side, lateral bend and extend. Passively stretch the head and neck and hold for 30 seconds. A caudal force can also be applied to the shoulder.	Eye nystagmus, ringing in the ears, complaints of dizziness or queasy in the stomach. Ask the patient how they feel, and end test upon any sensory changes.	Vertebral artery compression, opposite of the side of rotation.
<b>Static Vertebral Artery Tests</b>	The patient lies supine.	At the head of the patient.	Passive movements held for 10 - 30 seconds: Full head and back extensions. Full head & neck rotation: right and left. Full head & neck rotation in extension, right and left.	Eye nystagmus and complaints of dizziness, lightheadedness, or visual disturbances. Ten seconds should elapse between each test to ensure that there are no latent symptoms.	Vascular occlusion. Extension is more likely to test the patency of the intervertebral foramen, whereas rotation and side flexion are more likely to test the vertebral artery.
<b>Adson Test</b>	The patient sits or stands. The patient's head is rotated to face the test shoulder. The	Stand lateral and behind the tested side. Palpate the radial pulse with the patient's arm in neutral.	Monitor the pulse as you move the patient's arm into abduction, extension and external rotation. Have the patient hold their breath and turn the head.	Marked diminution or disappearance of the radial pulse.	Thoracic outlet syndrome and the integrity of the subclavian artery. This artery may be compressed by an extra cervical rib or by tightened scalene muscles. (This test is the most common test for TOS.)

Ligamentous Instability Tests

<b>Alar Ligament Test</b>	The patient lies supine. Test indicated posttraumatic event.	Behind the patient. Place index finger next to C2 spinous process.	Tilt the patient's head laterally to the opposite side.	Delay in motion of the C2 spinous process to rotate into the therapist's finger.	Alar ligament laxity. This type of laxity should be treated as an emergency with head stabilization.
<b>Transverse Ligament Test</b>	The patient lies supine. Test indicated posttraumatic event.	Cradle the patient's head with both hands.	Move the head into neck flexion. Test the end ranges of capital flexion.	Diffuse soreness in the neck and lack of ligamentous end feel.	Possible rupture of the transverse ligament.
<b>Sharp-Purser Test</b> (Use test with caution.)	The patient sits.	Behind the patient. Place one hand on the patient's forehead, while the thumb of the other hand is on the spinous process of the axis for stabilization.	The patient is asked to slowly flex the neck. At the same time apply a posteriorly directed force to the forehead.	The head slides backward during the movement.	Hypermobility at the atlantoaxial articulation. Indicative that the subluxed atlas has been reduced. Often accompanied with a "clunk".

## Shoulder: Joint Instability

### Anterior Shoulder Instability

Special Test	Position of patient	Position of examiner	Evaluative procedure	Positive test results	Implications
<b>Anterior Drawer Test</b>	The patient lies prone. The shoulder to be tested is abducted 80-120°, slightly forward flexed and externally rotated.	Place the patient's hand in your axilla, holding the patients arm so that it remains relaxed.	Stabilize the scapula with one hand, while the other hand draws the humerus forward	The movement may be accompanied by a click and or patient apprehension. Joint laxity is compared bilaterally.	Anterior glenohumeral (GH) instability.
<b>Apprehension (Crank) Test</b>	The patient lies supine. The patient's arm can be bent at the elbow.	Stand lateral to the elbow. One hand supports the elbow and the other holds the wrist.	Slowly abduct and externally rotate the humerus.	A look or feeling of alarm or apprehension in the patients face.	Anterior GH instability. If the examiner applies a posterior force to the arm (relocation test), the patient will loose the apprehension, and further external rotation is possible.
<b>Clunk Test</b>	The patient lies supine.	Stand at the head of the patient. Place one hand under the posterior aspect of the shoulder. The other hand holds the humerus just proximal to the elbow.	Fully abduct the arm over the patient's head. Lift the head of the humerus with one hand, and externally rotate the humerus with the other.	A "clunk" or grinding. Relocate the humerus with horizontal adduction, and again the "clunk" may be heard.	The "clunk" may indicate a tear of the labrum. The test may also cause apprehension if anterior GH instability is present.

### Posterior Shoulder Instability

<b>Posterior Drawer Test</b>	The patient lies supine.	Stand at the level of the shoulder and grasp the patient's proximal forearm with one hand, flex the elbow to 120°, 80° of abduction, and 30° of forward flexion. With the other hand, stabilize the scapula.	Rotate the forearm internally and forward flex the shoulder to 80° while with the other hand push the head of the humerus posteriorly.	The test is usually pain free, but the patient may exhibit apprehension.	Posterior GH instability.
<b>Jerk Test</b>	The patient sits. The arm is internally rotated and forward flexed to 90°	Stand lateral to the shoulder and grasp the patient's elbow with one hand. Stabilize the back under the scapula with the other hand.	Axially load the humerus in a proximal direction. While maintaining the axial loading, the examiner moves the humerus horizontally across the body.	The production of a sudden jerk is caused by the humeral head sliding off (subluxes) the back of the glenoid. The head of the humerus will reduce (with another jerk) by reversing the motion of the test.	Posterior GH instability.
<b>Posterior Apprehension Test</b>	The patient lies supine. The test extremity is forward flexed and internally rotated.	Stand lateral to the shoulder and stabilize the shoulder with one hand, and grasp the patient's elbow with the hand that is distal to the patient.	Apply a posterior force on the patient's elbow.	A look of apprehension or alarm on the patient's face, and resistance to further movement.	Movement of the humeral head more than 50% of its size indicates posterior instability. The movement may be accompanied by a clunk.

### Inferior Shoulder Instability

<b>Sulcus Sign</b>	The patient sits with the humerus by the side and the shoulder muscles relaxed. The elbow is bent to 90°.	Stand lateral to the shoulder and stabilize the wrist with one hand.	The other hand applies a distracting force by pushing downward distal to the cubital fossa.	The presence of a sulcus (or step off) at the acromioclavicular joint.	Inferior GH instability.
<b>Feagin Test</b>	The patient stands with the arm abducted to 90° resting on the examiner's shoulder.	Stand lateral to the shoulder and clasp hands together over the proximal humerus.	A downward and forward force is applied.	A look of apprehension or alarm on the patient's face, and resistance to further movement.	Anteroinferior GH instability.

## Shoulder: Muscle / Tendon Pathology

### Impingement

Special Test	Position of patient	Position of examiner	Evaluative procedure	Positive test results	Implications
<b>Painful Arc Test</b>	The patient sits or stands. The upper extremity should be relaxed in neutral.	Positioned lateral or forward of the involved side to observe the patient's range and quality of motion.	With the elbow extended, the upper extremity is elevated by actively abducting the shoulder.	Pain beginning at 45-60° and continues to no more than 120°.	1° Suprahumeral impingement. 2° Note if pain continues above 120° then the AC joint is implicated.
<b>Impingement Test (Nears)</b>	The patient sits or stands. The upper extremity should be relaxed in neutral.	Positioned lateral or forward of the involved side. The patient's shoulder is stabilized on the posterior aspect. The examiner's other hand grips the patient's arm at the elbow joint.	With the elbow extended, the glenohumeral joint is passively moved upward through forward flexion. Alternative: Active movement to pain, then further passively.	Pain with motion, especially near the end of the range of motion.	Rotator cuff pathology (especially the supraspinatus) or involvement of the long head of the biceps brachii tendon. The motion of the test causes impingement of these structures.
<b>Modified Impingement Test (Hawkins-Kennedy)</b>	The patient sits or stands. The glenohumeral joint is forward flexed to 90°. The elbow is flexed with the forearm positioned horizontally in front of the chest.	Positioned lateral or forward of the involved side. The patient's shoulder is stabilized on the posterior aspect. The examiner's other hand grasps the patient's arm at the elbow joint.	The examiner places force to internally rotate the shoulder, which causes the hand to lower in the frontal plane.	Pain with motion, especially near the end of the range of motion.	Rotator cuff pathology (especially the supraspinatus) or involvement of the long head of the biceps brachii tendon. The motion of the test impinges the supraspinatus tendon against the anterior surface of the coracoacromial ligament.
<b>Drop Arm Test</b>	The patient stands. The shoulder, elbow, and wrist are in the neutral position.	Positioned posterior and somewhat lateral to the patient on the involved side.	The examiner abducts the patient's shoulder to 90° and then asks the patient to slowly lower it to the side in the same arc of movement.	The patient is unable to slowly return the arm to the side, or has severe pain when attempting to do so.	A tear in the rotator cuff complex.
<b>Supraspinatus Test (Empty can)</b>	The patient sits or stands. The shoulders are brought into horizontal scaption. The elbows are extended and the arm is internally rotated (thumbs down).	Positioned anterior to the patient. The patient's forearm is stabilized proximal to each wrist.	The patient is instructed to hold the arms in position as the examiner places a downward force at the wrist.	Weakness or pain	A tear of the supraspinatus tendon or muscle or neuropathy of the suprascapular nerve.

### Biceps Brachii Tendon

<b>Yergason's Test</b>	The patient sits or stands. The glenohumeral joint is in the anatomical position. The elbow is flexed to 90°, with the forearm pronated.	Positioned lateral to the patient on the involved side. The patient's olecranon is stabilized inferiorly and maintained close to the patient's thorax. The patient's forearm is stabilized proximal to the wrist.	The patient flexes and supinates the forearm against resistance while the examiner concurrently moves the glenohumeral joint into external rotation.	Pain and/or snapping in the bicipital groove.	1° Snapping or popping in the bicipital groove indicates a tear or laxity of the transverse humeral ligament. This pathology prevents the ligament from securing the tendon of the long head. 2° Pain with no associated popping in the bicipital groove may be indicative of bicipital tendinitis.
<b>Ludington's Test</b>	The patient sits or stands. The patient clasps both hands and rests them on top of the head. This action relaxes the biceps tendon.	Positioned posterior to the patient. The examiner should bilaterally palpate the bicipital groove.	The patient alternately contracts and relaxes the biceps muscles.	No movement can be palpated in the bicipital groove of the involved side.	A rupture of the long head of biceps tendon.
<b>Speed's Test (Biceps or Straight Arm Test)</b>	The patient sits or stands. The glenohumeral joint is forward flexed to 90°. The elbow is extended with the forearm being fully supinated (palm up).	Positioned lateral to the patient on the involved side. The patient's bicipital groove is palpated. The patient's forearm is stabilized proximal to the wrist.	The patient is instructed to hold the arm in position as the examiner places a downward force at the wrist.	Increased pain or tenderness in the bicipital groove.	Bicipital tendinitis.

Pages 17 – 27 are intentionally not present in this un-registered version.

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