CONTINUING EDUCATION
for Physical Therapists

ORTHOPEDIC SPECIAL TESTS: UPPER EXTREMITY

3 CE HOURS

Course Abstract

This course provides learners with state-of-the-art literature on orthopedic special tests for the upper extremity, with attention to the statistics that support and/or dispute the continued relevance of each. It begins with an overview of relevant statistical terminology; touches on medical screening, toolbox questionnaires, and clearing the cervical spine; and examines special tests and related statistics for the shoulder, elbow, and wrist.

NOTE: Links provided within the course material are for informational purposes only. No endorsement of processes or products is intended or implied.

Approvals

To view the states who approve and accept our courses, CLICK HERE.

Target Audience & Prerequisites

PT, PTA, ATC – no prerequisites

Learning Objectives

By the end of this course, learners will:

- ❑ Distinguish between the statistical concepts of sensitivity and specificity
- ❑ Recall elements of medical screening
- ❑ Identify toolbox questionnaires pertaining to the upper extremity
- ❑ Recall elements of clearing the cervical spine
- ❑ Recognize special tests and related statistics for the shoulder, elbow, and wrist
- ❑ Recognize the significance of statistics as they apply to special test scenarios

Timed Topic Outline

I. Statistics: Sensitivity and Specificity (20 minutes)

II. Medical Screening, Toolbox Questionnaires, Cervical Spine and Deep Tendon Reflexes (40 minutes)

III. Special Tests: Shoulder (60 minutes)

IV. Special Tests: Elbow (15 minutes)

V. Special Tests: Wrist (30 minutes)

VI. Conclusion, Additional Resources, References, and Exam (15 minutes)

Delivery Method

Correspondence/internet self-study with a provider-graded multiple choice final exam. *To earn continuing education credit for this course, you must achieve a passing score of 80% on the final exam.*

Cancellation

In the unlikely event that a self-study course is temporarily unavailable, already-enrolled participants will be notified by email. A notification will also be posted on the relevant pages of our website.

Customers who cancel orders within five business days of the order date receive a full refund. Cancellations can be made by phone at (888)564-9098 or email at support@pdhacademy.com.

Accessibility and/or Special Needs Concerns?

Contact customer service by phone at (888)564-9098 or email at support@pdhacademy.com.

Course Author Bio and Disclosure

Dawn T. Gulick, PT, PhD, ATC, CSCS, is a Professor of Physical Therapy at Widener University in Chester Pennsylvania. She has been teaching for over 20 years. Her areas of expertise are orthopedics, sports medicine, modalities, and medical screening. As a clinician, she has owned a private orthopedic/sports medicine practice. She also provides athletic training services from the middle school to elite Olympic/Paralympic level. As a member of the Olympic Sports Medicine Society, Dr. Gulick has provided medical coverage at numerous national and international events. As a scholar, Dr. Gulick is the author of 4 books (Ortho Notes, Screening Notes, Sport Notes, Mobilization Notes), 4 book chapters, and over 50 peer-reviewed publications, and has made over 100 professional and civic presentations. She is the developer of a mobile app called iOrtho+ (Apple, Android, & PC versions), and the owner of a provisional patent.

Dr. Gulick earned a Bachelor of Science in Athletic Training from Lock Haven University (Lock Haven, PA), a Master of Physical Therapy from Emory University (Atlanta, GA), and a Doctorate of Philosophy in Exercise Physiology from Temple University (Philadelphia, PA). She is an AMBUCS scholar and a member of Phi Kappa Phi Honor Society. As a licensed physical therapist, she has direct access authorization. She also is a certified strength and conditioning specialist.

DISCLOSURES: Financial – Dawn T. Gulick sells iOrtho+, a mobile app, through Therapeutic Articulations LLC; receives royalties as an author with F. A. Davis Publishing; and received a stipend as the author of this course. Nonfinancial – No relevant nonfinancial relationship exists.

Welcome to upper extremity examination tests, an evidence-based course designed to provide you with state of the art literature on how to perform and interpret orthopedic examination techniques for the upper extremity.

The physical examination is made up of many elements:

- Client history
- Visual inspection
- **Medical screening**
- Functional skills
- **Questionnaires**
- ROM, MMT, Sensation, DTR's
- Palpation
- **Special tests**

This course will emphasize medical screening, toolbox questionnaires, and special tests.

Client history and visual inspection are components you most likely already know very well. We will touch on them on occasion, with the idea that there may be some particular questions that you might want to ask – or some particular things you might want to look for – but we are not going to spend a great deal of time on them.

We will, however, discuss medical screening, because not everything that causes joint pain is always musculoskeletal. Consider, for example, an individual who presents with anterior hip pain. Pain with motion and tenderness to palpation may imply the problem is musculoskeletal. However, it is important to also consider the possibility that the signs and symptoms may be the result of appendicitis. It is essential to look at the viscera as a potential source of some of this pain, and make the appropriate referrals for the things that are outside our scope of practice.

Functional skills I'm going to leave to you as part of your exam.

We are also going to talk about toolbox questionnaires: they're a resource that's readily available to you that not only helps you discern how much pain someone's in (which is certainly important!), but really helps you focus on function as well. It's one thing if a person reports to you with a pain level

of 9 or 10 out of a scale of 0-10, but it's another if they're also laughing and joking and moving around rather quickly or freely: you look at a situation like that and you say "This doesn't make sense." That's where using toolbox questionnaires to put pain together with respect to function can be very helpful. They can also help you to do serial measurements: doing a test at the time of the examination, and then doing another questionnaire or the same questionnaire two weeks later (or three or four weeks later, or at discharge) helps you to see that serial level of improvement. Finally, they help you to take rote data like range of motion and manual muscle testing and put it into a functional context. By that, I mean if a person gains ten degrees of external rotation over the course of two or three treatments, it is certainly very promising. But the more important consideration is what they can *"do"* with those ten degrees of external rotation – and that's where the toolbox questionnaires come in: by taking that increased motion and telling us how that is related to function.

Range of motion, manual muscle testing, sensation, and palpation are certainly important components of an examination, but will not be a part of this course.

We will spend most of our time discussing the special tests.

All special tests have an inherent problem that I'd like to disclose right from the get-go: standardization of some of these tests can be problematic, because many authors have studied them, and some have proceeded to apply their own personal little tweaks to them. Why is that a problem? Well, particularly in the area of orthopedics, what tends to happen is someone names a test after him/herself, and then somebody else picks up that test, tweaks it slightly, and renames it… and we end up with seventeen tests for the glenoid labrum. That is reality! There are seventeen tests right now for the glenoid labrum… some of them good, and some of them not so good. So which of those tests do you do? And what if you get a positive on one test and a negative on another – now what do you do? To that end, you have to be able to figure out for yourself which of these tests are good and which of these are not good. You'll want to make sure that you have *multiple* tests pointing in the same direction to give you confidence that a *particular* test is valuable to you.

Statistics

As we discuss special tests, we are going to talk about their clinical significance and clinical application: basically, "What do they mean to us?" In order to do that, we need to lead off with a brief tutorial on statistics, focusing on the concepts of *sensitivity* and *specificity*.

If you graduated from school more than ten years ago, these concepts were probably not in your curriculum. That's because we really didn't know a lot about the sensitivity and specificity of many of the orthopedic tests that we were utilizing. But since the early 2000s, this has evolved – and since we have coined the term "evidence-based practice" the use of statistics has basically exploded.

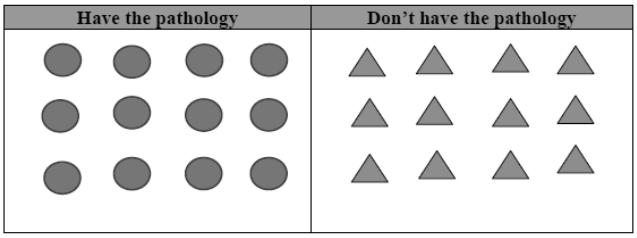
- **Sensitivity = Sen Neg OUT**
  - Test is Negative = Rule pathology OUT
- **Specificity = Sp Pos IN**
  - Test is Positive = Rule pathology IN

For the concept of *sensitivity*, use the acronym '**S-N-O-U-T**'…..**S**ensitivity – **N**egative – rule it **OUT**. When a test is highly sensitive and the results are negative, we can rule out the suspected pathology. In other words, if we have a test that has high sensitivity testing muscle 'A,' and that test is negative, then we can say with confidence that muscle 'A' is not injured. Thus, a test that is highly sensitive is used to rule out the pathology when the test result is negative.

For the concept of *specificity*, use the acronym '**S-P-I-N**'…. **S**pecificity – **P**ositive - rule it **IN**. So when a test that is highly specific is used on muscle 'B,' if that test is positive, then we can say that there's a good chance that muscle 'B' is injured. Now that is not the way you want to necessarily function in the clinic: you don't want to get the results of one test and go running off saying "I know what the problem is; let's start treating you." Ideally, you would like to see a couple of tests that are positive. So to that end, we will also look at clustering tests.

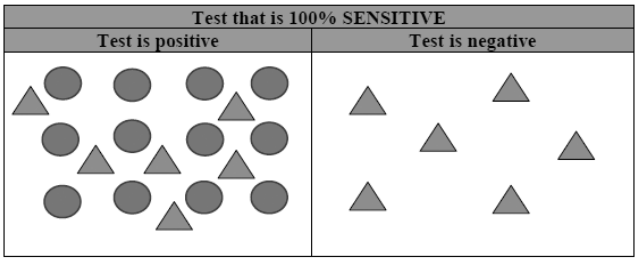
Let's consider this example, published by Cleveland (2007) to depict the application of the sensitivity and specificity.

Here is a situation where we have 12 people with a disease and 12 people without a disease: the ones on the left are red and they have the disease; the ones on the right are green and they do not have the disease.

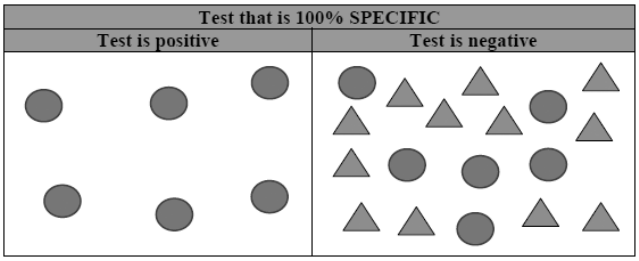


If we explore using a test that is 100% *sensitive*, then that would mean if a person tests negative for that disease, we can rule it out. In the image below, the people on the left tested positive and the people on the right tested negative. As you can see, every single person who tested negative does not have the disease, so it is 100% accurate for sensitivity. Now clearly there

are people on the left that tested positive that don't have the disease, and those would be false positives. But as we go forward in our examination and look at other tests – again, you're not ever going to want to just use one test – we will find things that will help to reassign or recapture those people in the right area.



At the other end of the spectrum, here we see a test that's 100% *specific*: all the people on the left tested positive, all the people on the right tested negative, and every single person who tested positive does in fact have the disease. Again, we have people on the right who tested negative that have the disease, and this test would be a false negative for those people. I'm going to keep stressing this point: as a clinician you will not be making a diagnosis based on one test alone. Instead, your examination process will seek to identify a cluster of signs and symptoms pointing to the correct diagnosis of a given pathology. Following this practice will help you ensure that another test or measure will recapture or reassign the individuals that were false negatives.



Likelihood ratios help to enhance our interpretation of test sensitivity and specificity. A test that has a good negative likelihood ratio would be one that tells us how much the odds of the disease decrease when the test is negative. Conversely, a test that has a solid positive likelihood ratio will tell us how much the odds of the disease increase when the test is positive.

Let's couple these factors together and see what they tell us. If a test for a particular disorder is highly sensitive (over 90%), and also has a negative likelihood ratio that's down around 0.1 or 0.2., this would be a good metric to rule out the disorder. In other words, if the test for muscle 'A' comes back negative on a highly sensitive test with a good negative likelihood ratio, we can pretty confidently say that muscle 'A' is not the problem here.

Likewise, if a test for a particular disorder is highly specific, with a likelihood ratio that's over 5 (it's even better yet when it's in double digits: 10, 11, 15), and the test for muscle 'B' comes back positive – you're in a good position to state that muscle 'B' it is in fact problematic.

Remember, in both instances, you will go on to look at other tests to confirm your initial results, and you'll also consider other tissues, in order to rule them out.

You want to make sure that the results of the tests you chose to implement are complementary, i.e. those tests with high sensitivity are complemented by those that have high specificity in your clinical examination.

Despite their referring to lower extremities, the complementary nature of radiographs and the Ottawa ankle rules serve as a good example. The Ottawa ankle rules detail criteria to discern whether a radiograph is needed, so if a person injures his/her ankle, you would implement the Ottawa Ankle Rules to determine if an x-ray is needed.

Per the Ottawa Ankle Rules, if a person has bone tenderness at the posterior edge of the distal 6 cm of either the medial or the lateral malleolus, that would be positive. (Be sure to palpate the bone and not the joint or muscle. Remember you are looking for the potential of a fracture, not a sprain.) In addition, if the person has difficulty or is unable to weight bear immediately after the injury, and is unable to take four steps in the emergency room or shortly thereafter, then this would also be a positive test.

X-ray series of the ankle is only required if the client presents with any of the following criteria:

- Bone tenderness at posterior edge of the distal 6 cm of the medial or lateral malleolus
- Totally unable to bear weight both immediately after injury & (for 4 steps) in the emergency department

Ottawa Ankle Rules

- Adults:
  - Sensitivity = 95-100%
  - Specificity = 16%
- Children:
  - Sensitivity = 83-100%
  - Specificity = 21-50%

Radiograph

- Sensitivity = 57 - 62%
- Specificity = 88%

Ottawa Ankle Rules

Looking at the metrics, you can see that the Ottawa Ankle Rules are highly sensitive for both adults and for children, but the specificity is extremely poor. So while this test is very good at ruling out the need for a radiograph, it doesn't tell us that there's a fracture. It simply tells us that we need a radiograph if it's positive.

Conveniently, the metrics for a radiograph indicate that they are highly specific.

To recap: in your repertoire, you have the Ottawa Ankle Rules (highly sensitive) and a radiograph (highly specific). So when you couple these two types of tests together, you can arrive at a clinical decision that is strongly supported by the literature: one test rules a pathology out; the other test confirms the diagnosis of the pathology. This is just one of many examples of how you can use the literature to confidently implement clinical decision making.

A final thought: we want test metrics to optimally be > 90%. Greater than 75% may be helpful when clustered with other tests, but metrics around 50-60% are no better than a coin toss… and clearly we don't want to make clinical decisions with a coin toss!

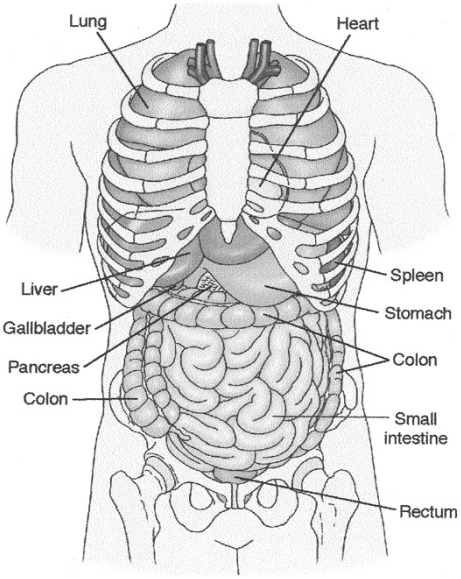
Hopefully this has made the concept of statistics a little bit easier for you, and has helped you see their clinical relevance. Now, on to the meat of the course!

Medical Screening

Let's talk now about medical screening, with attention to staying within our scope of practice. It is essential, when we have a client come to us with an upper extremity problem, we make sure to rule out those conditions that are beyond our scope.

Not all upper extremity pain comes from an upper extremity pathology. As clinicians we need to confirm the "driver" of the pain, and not be fooled into treating the "passenger." Herniated disks are not the only pathology that radiates into the shoulder or down the arm. There are numerous pathologies that produce upper extremity pain. Some of these pathologies may be specific to certain periods of time within the lifespan and others may occur at any time.

We are going to begin with one of the most devastating of all pathologies: cancer. Whenever someone has a diagnosis of cancer in their history, you always have to be concerned about an exacerbation. A client may be in remission for a long period of time and then they present to you in the clinic with pain or some type of problem that might indicate that the cancer has come back. We need to remember: "once a cancer diagnosis, always a cancer diagnosis."



Gulick, OrthoNotes, FA Davis Publishing, 2013

So what are the warning signs of cancer? We use of the word "caution" to help to describe these warning signs.

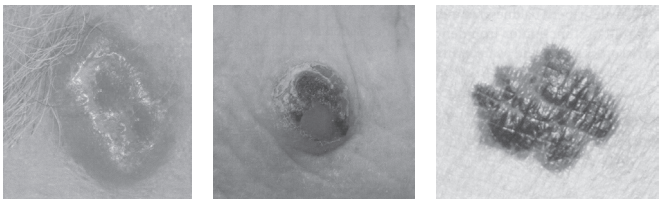
- **C** = Change in bowel & bladder
- **A** = A sore that fails to heal in 6 weeks
- **U** = Unusual bleeding or discharge
- **T** = Thickening/lump (breast or elsewhere)
- **I** = Indigestion or difficulty swallowing
- **O** = Obvious change in wart or mole
  - **A** = Asymmetrical shape
  - **B** = Border irregularities
  - **C** = Color – pigmentation is not uniform
  - **D** = Diameter > 6 mm
  - **E** = Evolution (change in status)
- **N** = Nagging cough, hoarseness, rust colored sputum

For each one of the warning signs, there are many other possible mechanisms for the stated sign or symptom. As a clinician, you need to look for cluster of signs and symptoms that point to a given diagnosis.

For example, "C," a change in the bowel or bladder function, may be the result of a spinal cord injury. A thorough low back examination would be appropriate to rule out mechanical mechanisms for the signs or symptoms before considering cancer. Likewise, when we look at "O," an obvious change in a wart or mole, there are five considerations: an asymmetrical shape, a border that's irregular, pigmentation that's not uniform (multiple color tones), a diameter greater than six millimeters, or a change in status. As for the diameter, I

am not suggesting that you measure all of the warts or moles on your clients. If I told you that six millimeters is the size of a pencil eraser, you get an idea in your head of the size of a lesion that should concern you. If the wart or mole is larger than six millimeters, it may be cause for concern. And then "E," evolution, refers to a change in status over time. If this is the first time you have seen this client, you are going to have to rely on his/her knowledge of the situation. You may have to ask the client if there has been a change in the wart or mole (size, shape, coloration) in the past few weeks or months.

Here is an example of some of the characteristics of the A, B, C, D, E's. When you look at these images, you can see the different criteria for concern: multiple pigmentations, irregular borders, asymmetrical shapes.



Now as a therapist, it doesn't really matter what the labels are on these lesions. You simply need to recognize that elements of the A,B,C,D,E's are present. You need to recognize this is outside of your scope of practice and see to it that the client is referred to the appropriate medical professional.

While skin cancers are among the more obvious referrals, we have the ability to screen for other cancers as well. Maranhao, Maranhao-Filho, Lima, and Vincent (2010) conducted an interesting study that looked at 13 different clinical tests on the detection of unilateral brain tumors. They actually found that the specificity was quite high for a variety of the tests studied. These are the thirteen tests that were explored.

Clinical Tests

- Spasticity of conjugate gaze
- Platysma sign
- Forearm rolling test
- Finger rolling test
- Digit quinti sign
- Souques interosseous sign
- Pronator drifting test
- Mayer sign
- Finger tapping sign
- Digit quinti rolling sign
- Foot tapping test
- Babinski sign
- Chaddock sign

Below are the details for six of the 13 tests reviewed. As you can see from the statistics, all six of the tests have strong specificity and high (+) predictive values (PPV). These are simple maneuvers that could be performed in seconds to assess the likelihood of a unilateral brain tumor.

Clinical Test	Maneuver	Positive Sign
Forearm rolling	Make fists, hold forearms horizontal & roll arms	1 arm orbits around other
Finger rolling	Index fingers pointing towards each other ~ 1 finger length apart; roll fingers	1 finger orbits around other
Souques interosseous sign	Pt raises both UE to 180° of shoulder flexion	Involved fingers ext & abd
Finger tapping	Index finger to thumb IP quickly x 10 sec	> 5 rep difference
Foot tapping	Sit, knee & ankle @ 90°, keep heel on floor & tap foot x 10 sec	> 5 rep difference
Babinski sign	Stimulate lateral plantar surface with blunt object	Extension of great toe

Clinical Test	Sens	Spec	PPV	NPV
Forearm rolling	16%	100%	100%	37%
Finger rolling	41%	93%	92%	44%
Souques interosseous sign	23%	80%	70%	34%
Finger tapping	18%	90%	78%	35%
Foot tapping	23%	93%	87%	37%
Babinski sign	8%	100%	100%	35%

For the forearm rolling test, you make a fist, hold your forearms out in front of you in a horizontal position, and roll the forearms around each other. If one arm orbits around the other in an asymmetrical movement, the test would be positive. Finger rolling is similar. The index fingers are held out in front in a horizontal position about one finger length apart. The client is asked to roll the fingers around each other. Again, a positive test is an asymmetrical motion of one finger orbiting around the other. For finger tapping, the client is asked to take the index finger to thumb and doing a quick tapping motion as many times as possible for ten seconds. A greater than five-rep difference between the right and left hands is a positive test. Foot tapping involves tapping your foot on the floor for ten seconds and looking to see if there is a five-rep difference between the right and left feet. The Babinski is a plantar surface stimulation of the foot. The clinician uses the blunt side of a reflex hammer to stroke the foot. A positive sign would be extension of the great toe.

These are just a few examples, really simple things that can be done to screen for a brain tumor. With that being said, it is important to remember that "when you hear hoof beats, think horses, not zebras." There are a large number of possible diagnoses that are more likely than a brain tumor. The brain tumor is the "zebra" but there are grave consequences to missing this diagnosis.

It is critical to rule this possibility out before moving forward with other possibilities.

When you look at the statistics of these tests, you can see that although the sensitivity is not high, specificity is excellent. Likewise, positive predictive values coupled with the high specificity make these superb diagnostic tests. Should one or more of these tests be positive, a dialogue with the primary care physician would be in order.

In addition to cancer, there are several other medical conditions that should be ruled out before proceeding with a lower extremity examination. When we speak about "red flags" in medical screening, we will define a "red flag" as a sign or symptom that is a strong predictor of pathology. And red flags are going to differ based on the person with who you are working. For example, let's take the symptom of a headache. If you are a middle-aged adult, chances are you have had many headaches over the course of your life span. However, if you are a three year old child, a headache is not typical at all. So a headache may not be a big concern for an adult but it may be a red flag for a three or four year old child. So we have to put signs and symptoms into perspective. The interpretation of red flags has to be client-specific.

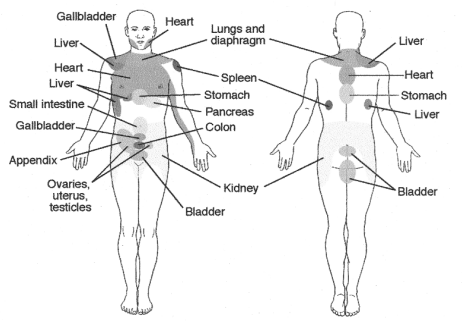
In addition, the heart refers to the left shoulder, and so does the spleen. So we need to make sure that when a client reports left shoulder pain, we rule out cardiac and spleen dysfunction. Is there a family history of cardiac disease, any signs or symptoms of cardiac pathology, or any type of trauma to the thorax that could relate to spleen damage?

What about the right shoulder? The liver and the gallbladder refer to the right shoulder.

What about the mid-scapular region? That is also a cardiac referral area.

The mid-thoracic region can be coming from the stomach; the right lower quadrant from the appendix.

So in these instances, if we are examining clients for a musculoskeletal problem, we should first rule out the possibility of visceral pathology. (The images below depict the locations and potential visceral referral sites of which one should be cognizant.)



Gulick, OrthoNotes, FA Davis Publishing, 2013

While it's beyond the scope of this course to address all the possible pathologies of the liver, gallbladder, etc., we will briefly speak about how you palpate visceral structures to see if you can incriminate them.

The liver and gallbladder are in the right upper quadrant. They are protected underneath the most inferior aspect of the rib cage. In order to palpate these structures, we need to get the rib cage out of the way. The way to do that is to have the client take a big deep breath, so that the ribcage elevates: now you can press inward and get to the gallbladder and liver.

Liver Palpation

Gulick, iOrtho+ Mobile App, 2016

Murphy Technique

Gulick, iOrtho+ Mobile App, 2016

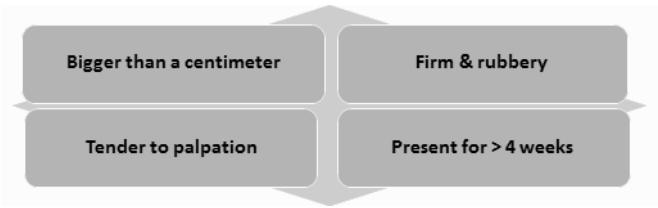
One technique is to come from the left side at the opposite ASIS and move towards the rib cage. The other technique is called the Murphy technique, in which you are on the right and you hook your fingers underneath the rib cage.

The spleen is on the left side in the left upper quadrant. It is found at the mid-axillary line. The clinician can come up from the iliac crest and move proximal towards the rib cage. If the client takes a breath, the ribs will elevate and an enlarged spleen will be revealed.

Spleen Palpation

Gulick, iOrtho+ Mobile App, 2016

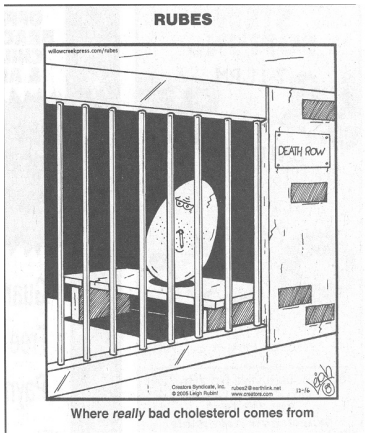
It's also imperative that you look at things like lymph nodes in the area of the upper extremity; the lymph nodes of the neck and certainly the lymph nodes of the axillary region are important as well. Palpating lymph nodes can help us discern if there's an infection or inflammatory process. Even the possibility of breast cancer can present with enlarged lymph nodes and symptoms that mimic thoracic outlet. It is really important in the screening process that when we palpate the lymph nodes we are sensitive to the following criteria:



If you do in fact palpate such an entity, this would be the time to then talk to the client in greater detail about their past medical history and their family history, and perhaps also have a dialogue with the primary care physician.

Finally, as you know, identifying the medications a client is taking is very important. In addition, ascertaining any recent change in medications can yield information about toxicity and/or side effects. Although it is beyond the scope of this course to explore pharmacology in great depth, there are three medications that are both common and can present troublesome side effects.

One such common medication with side effects is a statin. Frequently prescribed for individuals with high cholesterol, statins are drugs that block an enzyme (HMG-CoA reductase) linked to the production of cholesterol in the liver. This inhibits the liver's ability to produce low density lipoproteins (LDL) and results in an increase in the of LDL receptors on the surface of the liver cells. Hence, more cholesterol is removed from the bloodstream in an attempt to reduce a significant cardiovascular risk factor. However, the range of LDL reduction is highly variable (18-55%).



Since cholesterol is not just found in the bloodstream – it is also in cell walls throughout the body – removal of too much cholesterol can impact other systems of the body and produce some adverse responses. The list below represents some of the side effects of statins.

- Loss of muscular coordination
- Trouble talking & enunciating words
- Loss of balance
- Loss of fine motor skills (difficulty writing)
- Trouble swallowing
- Constant fatigue
- Joint & muscle aches & stiffness
- Vertigo & disorientation
- Blinding headaches

In reviewing this list, it is not hard to see that these effects appear in a large number of clients who present for treatment of physical limitations. Onset of these effects after the recent prescription of statins or an increase in the dosage of a statin may warrant a conversation with the prescribing physician.

In spite of the potential concern over side effects, research has also demonstrated some very positive influences of statins on other systems. Statin use has been associated with a 22-55% reduction in various cancer deaths in women and when combined with the anti-diabetes medication, metformin, found a 40% reduction in prostate cancer mortality.

The other two medications are frequently seen in combination: aspirin (ASA) and non-steroidal anti-inflammatories (NSAID). The FDA has issued a "black box warning" for the combination of these two medications.

Many individuals take a daily dose of 81 mg aspirin to reduce the risk of platelet aggregation. Many also take NSAIDs for joint pain, inflammation, osteoarthritis, etc. Given that these two medications compete for the same binding site on a platelet, the timing is ingestion is critical.

ASA works via an irreversible binding of the COX-1 enzyme rendering the platelet permanently unable to aggregate. NSAIDs do the same on a reversible basis with inhibition related to the half-life of the specific

medication - this half-life can range from two to twelve hours. Thus, it is imperative for ASA to be taken at least 30-minutes before or more than eight hours after an NSAID to avoid attenuation of the aggregation effect.

Clearly there is significant value to preventing platelet aggregation. More than two million deep vein thromboses occur in the USA per year. This is third only to coronary artery disease and cerebral vascular accidents. In addition, ASA has been found to have an influence on colon cancer risk. Individuals who have taken a daily aspirin for 20 year have shown a 50% reduction in the risk of colon cancer.

Finally, with regard to medications, the clinician must recognize the overall impact of any medication taken in combination with another. The cytochrome P450 enzymes are essential for the metabolism of numerous medications; this class has more than 50 enzymes, yet six of them are responsible for the metabolism of 90% of drugs. Drug-drug interactions can be serious. Interactions between beta-blockers and anti-depressants, Plavix and Tylenol, and many others can occur. In addition, interactions can occur with non-drug substances such as caffeine and alcohol.

Fortunately there are several resources available to clinicians to identify there interactions. Free mobile apps such as Medscape and Epocrates are available for mobile devices to render access to copious amounts of pharmaceutical information to aid your clients in the recognition and prevention of drug related side effects/ interactions.

Questionnaires

As we discussed previously, toolbox questionnaires can be very helpful in clinical practice because they give you information about many parameters other than just pain. There are numerous questionnaires that are useful.

In looking at the upper extremity, we're going to focus on the Shoulder Pain and Disability Index (SPADI), the Penn Shoulder Score, the Disabilities of the Arm, Shoulder, and Hand (DASH), the Elbow Evaluation, the Patient-Rated Wrist Examination, and Severity of Symptoms and Functional Status in Carpal Tunnel Syndrome.

In the SPADI (http://sapphirept.com/wp-content/forms/Shoulder_Pain_and_Disability_Index_(SPADI).pdf), a pain scale is used, but also a disability scale that looks at functional tasks that are important in everyday life. In this particular case you would have a client rate each area from 0 to 10, then total the question scores, and divide by the number of questions that they answer (they can leave some questions blank, so the denominator may change from client to client). You then multiply by one-hundred: the higher the score, the greater the level of impairment.

Toolbox test

Shoulder Pain & Disability Index (SPADI)

Pain Scale: How severe is your pain? 0 = no pain ——————————10 = worse pain imaginable	
■ At its worst?	
■ When lying on the involved side?	
■ Reaching for something on a high shelf?	
■ Touching the back of your neck?	
■ Pushing with the involved arm?	
Disability Scale: How much difficulty do you have... 0 = no pain ——————————10 = worse pain imaginable	
■ Washing your hair?	
■ Washing your back?	
■ Putting on an undershirt or pullover sweater?	
■ Putting on a shirt that buttons down the front?	
■ Putting on your pants?	
■ Placing an object on a high shelf?	
■ Carrying a heavy object of 10 pounds?	
■ Removing something from your back pocket?	
Pain Scale Score: **Disability Scale Score:**	**Total Score:**

Scoring: Summate the scores & divide by the number of scores possible. If an item is deemed not applicable, no score is calculated. Multiple the total score by 100. The higher the score, the greater the impairment.

Source: From Roach, KE, Buudimanmak, E, Songsirideg, N, Yongsuk, L. (1991). Development of a Shoulder Pain and Disability Index. Arthritis Care and Research. 4(4): 143–149.

Gulick, OrthoNotes, FA Davis Publishing, 2013

The Penn Shoulder Score was developed by Brian Leggin in 1999; he specifically states in his publication that he grants unrestricted use of this questionnaire for client care in clinical practice (http://www.eliterehabsolutions.com/pdfs/PENN%20SHOULDER%20SCORE.pdf).

PENN SHOULDER SCORE Part II: Function: Please circle the number that best describes the level of difficulty you might have performing each activity.	No difficulty	Some difficulty	Much difficulty	Can't do at all	Did not do before injury
1. Reach the small of your back to tuck in your shirt with your hand.	3	2	1	0	X
2. Wash the middle of your back/hook bra.	3	2	1	0	X
3. Perform necessary toileting activities.	3	2	1	0	X
4. Wash the back of opposite shoulder.	3	2	1	0	X
5. Comb hair.	3	2	1	0	X
6. Place hand behind head with elbow held straight out to the side.	3	2	1	0	X
7. Dress self (including put on coat and pull shirt of overhead.	3	2	1	0	X
8. Sleep on affected side.	3	2	1	0	X
9. Open a door with affected side.	3	2	1	0	X
10. Carry a bag of groceries with affected arm.	3	2	1	0	X
11. Carry a briefcase/small suitcase with affected arm.	3	2	1	0	X
12. Place a soup can (1-2 lbs.) on a shelf at shoulder level without bending elbow.	3	2	1	0	X
13. Place a one gallon container (8-10 lbs.) on a shelf at shoulder level without bending elbow.	3	2	1	0	X
14. Reach a shelf above your head without bending your elbow.	3	2	1	0	X
15. Place a soup can (1-2 lbs.) on a shelf overhead without bending your elbow.	3	2	1	0	X
16. Place a one gallon container (8-10 lbs.) on a shelf overhead without bending your elbow.	3	2	1	0	X
17. Perform usual sport/hobby.	3	2	1	0	X
18. Perform household chores (cleaning, laundry, cooking).	3	2	1	0	X
19. Throw overhand/swim/overhead racquet sports (circle all that apply to you)	3	2	1	0	X
20. Work full-time at your regular job.	3	2	1	0	X
SCORING: Total of columns = _____ (a) Number of "X's" x 3 =____(b), 60 – ___(b) = ____ (c) (if no "X's" are circled, function score = total of columns) Function Score = ___(a) ÷ ___(c) = ___ x 60 = _____ of 60					

Gulick, OrthoNotes, FA Davis Publishing, 2013

The DASH consists of 11 questions (http://www.midastouchinstitute.com/mt/wp-content/uploads/2011/03/dash_questionnaire_2010.pdf). You summate the responses, divide by the total responses, subtract 1, multiply by 25, and that gives you a score.

Quick DASH (Disabilities of the Arm, Shoulder, & Hand)

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.	No Difficulty	Mild Difficulty	Moderate Difficulty	Severe Difficulty	Unable
1. Open a tight or new jar	1	2	3	4	5
2. Do heavy household chores (wash walls, floors)	1	2	3	4	5
3. Carry a shopping bag or briefcase	1	2	3	4	5
4. Wash your back	1	2	3	4	5
5. Use a knife to cut food	1	2	3	4	5
6. Recreational activities in which you take some force or impact through your arm, shoulder, or hand (golf, hammering, tennis, etc.)	1	2	3	4	5
	Not At All	**Slightly**	**Moderately**	**Quite A Bit**	**Extremely**
7. During the past week, to what extent has your arm, shoulder, or hand problem interfered with your normal social activities with family, friends, neighbors, or groups?	1	2	3	4	5

Quick DASH (Disabilities of the Arm, Shoulder, & Hand)—*cont'd*

	Not Limited	Slightly Limited	Moderately Limited	Very Limited	Unable
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder, or hand problem?	1	2	3	4	5
Please rate the severity of the following symptoms in the last week.	**None**	**Mild**	**Moderate**	**Severe**	**Extreme**
9. Arm, shoulder, or hand pain	1	2	3	4	5
10. Tingling (pins & needles) in your arm, shoulder, or hand	1	2	3	4	5
	No Difficulty	**Mild Difficulty**	**Moderate Difficulty**	**Severe Difficulty**	**So Difficult, I Can't Sleep**
11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder, or hand?	1	2	3	4	5

Quick DASH Score = [(sum of responses/number of responses) – 1] × 25

A Quick DASH score cannot be calculated if more than 1 item is not answered

Gulick, OrthoNotes, FA Davis Publishing, 2013

The beauty of using these types of questionnaires is the ability to explore the impact of pain on function. For example, if an individual indicates to you that his/her pain level went down from a "7" to a "5", what does that mean? What can he/she do not that he/she could not do before? Using a valid and reliable questionnaire such as the SPADI, Penn Shoulder Score, or the DASH can help the clinician integrate pain and function in both a given period of time and over serial measures.

A helpful toolbox questionnaire for the elbow is the Elbow Evaluation (http://www.drdavidmcallister.com/downloads/evaluations/Elbow%20Eval.pdf. This tool addresses pain, strength, and instability. In the instability section there are a number of questions about functional tasks. Incorporating this into your examinations can be helpful in seeing the big picture of a client.

Toolbox questionnaires for the wrist and hand include the Patient-Rated Wrist Examination (http://www.sportsmedicineofnapavalley.com/pdf/HandWristform.pdf) and the Severity of Symptoms and Functional Status in Carpal Tunnel Syndrome (http://www.drbillgallagher.com/wp-content/uploads/2013/10/Carpal_Tunnel_Syndrome_Questionnaire.pdf).

Patient Rated Wrist Evaluation

Rate the average amount of pain/difficulty you have had in your wrist over the past week by circling the number from 0 (no pain or difficulty) to 10 (the worse pain you have ever experienced or you could not do the task).

PAIN:	
At rest	0 1 2 3 4 5 6 7 8 9 10
When doing a task with repeat wrist movement	0 1 2 3 4 5 6 7 8 9 10
When lifting a heavy object	0 1 2 3 4 5 6 7 8 9 10
When it is at its worst	0 1 2 3 4 5 6 7 8 9 10
How often do you have pain?	0 1 2 3 4 5 6 7 8 9 10
FUNCTION—SPECIFIC ACTIVITIES:	
Turn a door knob using my affected hand	0 1 2 3 4 5 6 7 8 9 10
Cut meat using a knife in my affected hand	0 1 2 3 4 5 6 7 8 9 10
Fasten buttons on my shirt	0 1 2 3 4 5 6 7 8 9 10
Use my affected hand to push up from a chair	0 1 2 3 4 5 6 7 8 9 10
Carry a 10-lb object in my affected hand	0 1 2 3 4 5 6 7 8 9 10
Use bathroom tissue with my affected hand	0 1 2 3 4 5 6 7 8 9 10
FUNCTION—USUAL ACTIVITIES:	
Personal care activities (dressing, washing)	0 1 2 3 4 5 6 7 8 9 10
Household work (cleaning)	0 1 2 3 4 5 6 7 8 9 10
Work (your job or everyday work)	0 1 2 3 4 5 6 7 8 9 10
Recreational activities	0 1 2 3 4 5 6 7 8 9 10

Score:

Pain subscale: /50
Function subscale (total divided by 2): /50
Total PRWE score: /100

Scoring: Each section can be summated individually or the total scores can be calculated & scored as percentages. For either method, the higher the score, the poorer the outcome.

Source: Adapted from Lewis C, Wilk K, Wright, R. The Orthopedic OutcomesTool Box. Virginia: Learn Publications.

Gulick, OrthoNotes, FA Davis Publishing, 2013

Severity of Symptoms & Functional Status in Carpal Tunnel Syndrome

The following questions refer to your symptoms for a typical 24-hr period during the past 2 weeks. Circle 1 answer for each question.

How severe is the hand or wrist pain you have at night? 1. No pain 2. Mild pain 3. Moderate pain 4. Severe pain 5. Very severe pain	How often did hand or wrist pain wake you up during a typical night in the past 2 wks? 1. Never 2. 1 time 3. 2–3 times 4. 4–5 times 5. More than 5 times	Do you typically have pain in your hand or wrist during the daytime? 1. No pain 2. Mild pain 3. Moderate pain 4. Severe pain 5. Very severe pain
How often do you have hand or wrist pain during the daytime? 1. Never 2. 1 time 3. 2–3 times 4. 4–5 times 5. More than 5 times	How long, on average, does an episode of pain last during the daytime? 1. Never have pain 2. Less than 10 min 3. 10–60 min 4. More than 60 min 5. Constantly	Do you have numbness (loss of sensation) in your hand? 1. No numbness 2. Mild numbness 3. Moderate numbness 4. Severe numbness 5. Very severe numbness

(*Continued on following page*)

Severity of Symptoms & Functional Status in Carpal Tunnel Syndrome *(Continued)*

The following questions refer to your symptoms for a typical 24-hr period during the past 2-weeks. Circle 1 answer for each question.

Do you have weakness in your hand or wrist? 1. No weakness 2. Mild weakness 3. Moderate weakness 4. Severe weakness 5. Very severe weakness	Do you have tingling sensation in your hand? 1. No tingling 2. Mild tingling 3. Moderate tingling 4. Severe tingling 5. Very severe tingling	How severe is the numbness or tingling at night? 1. No numbness/tingling 2. Mild numbness/tingling 3. Moderate numbness/tingling 4. Severe numbness/tingling 5. Very severe numbness/tingling
How often did hand numbness or tingling wake you up during a typical night in the past 2 weeks? 1. Never 2. 1 time 3. 2–3 times 4. 4–5 times 5. More than 5 times	Do you have difficulty with the grasping & use of small objects such as keys or pencils? 1. No difficulty 2. Mild difficulty 3. Moderate difficulty 4. Severe difficulty 5. Very severe difficulty	***Scoring***: Summate the scores & divide by 11. The higher the mean score, the more severe the impairment. **Score:**

Source: From Levine, et al., Journal of Bone and Joint Surgery, 75A(11): 1585–1592, 1993.

Gulick, OrthoNotes, FA Davis Publishing, 2013

Clearing the Cervical Spine

There are strong correlations between cervical spine dysfunction and shoulder, elbow and wrist/hand pathology – so before we move onto the special tests for the upper extremity, we need to address ruling out the presence of any pathology from the C-spine.

In order to clear the cervical spine, we should assess range of motion of the spine: flexion/extension, side-bending, and rotation. One might apply a little bit of overpressure, as well as some compression and distraction, to see if you can reproduce any of the client's symptoms.

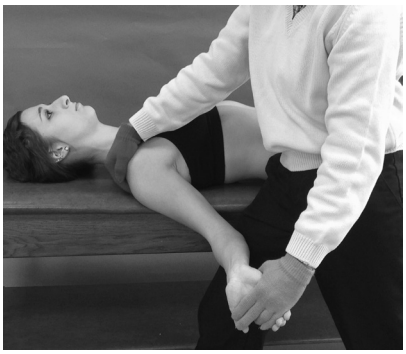
Performance of the upper limb tension tests (also known as neural tension tests), involve assessment of the median, radial, and ulnar nerves.

Median nerve

In supine or sitting with contralateral cervical sidebending and ipsilateral shoulder depressed, move the upper extremity (UE) into shoulder abduction, external rotation (ER), and horizontal abduction with elbow extended, forearm supinated & wrist/fingers extended. Another option some clinicians prefer is to stabilize shoulder/scapula and extend wrist then use amount of elbow extension as the final motion to quantify median nerve tension.

A positive test for median nerve pathology is pain or paresthesia into median nerve distribution of UE, i.e. first two to three digits.

Median Nerve Neural Tension Test



Gulick, iOrtho+, 2016

The data below reveals the high sensitivity and low specificity of the median nerve neural tension test. Thus, the upper limb tension test for the median nerve is very good at ruling out problems with the median nerve; it is not good at making the diagnosis.

Median Nerve

Sensitivity = 94-97%, Specificity = 22%

(+) LR = 1.3, (-) LR = .012

Reliability (Kappa) = 0.76

Combinations: Median nerve, Spurling, Distraction, Ipsilateral c-spine rotation <60 degrees:

- Any 2 (+) tests: Sensitivity = 39%, Specificity = 56%; (+) LR = 0.88
- Any 3 (+) tests: Sensitivity = 39%, Specificity = 94%; (+) LR = 6.1
- All 4 (+) tests: Sensitivity = 24%, Specificity = 99%; (+) LR = 30.3

Radial nerve

In supine or sitting with contralateral cervical sidebending and ipsilateral shoulder depressed, the UE is extended with elbow extended, forearm pronated, wrist flexed, metacarpal phalangeal joints flexed, and interphalangeal joints extended. Another option some clinicians prefer is to stabilize shoulder/scapula and flex the wrist then use amount of elbow extension as the final motion to quantify radial nerve tension.

The test is positive with pain or paresthesia into radial nerve distribution of UE, i.e. posterior aspect of the forearm and hand. Similar to the median nerve testing, radial nerve sensitivity is high while specificity is low such that it serves as a good screening tool.

Radial Nerve Neural Tension Test

Gulick, iOrtho+, 2016

Ulnar Nerve Neural Tension Test

Gulick, iOrtho+, 2016

Radial Nerve

Sensitivity = 72-97%, Specificity = 33%

(+) LR = 1.1, (-) LR = 0.85

Reliability (Kappa) = 0.83

Ulnar nerve

In supine or sitting with ipsilateral shoulder depressed, abduct the shoulder to 90° with ER, flex the elbow, pronate the forearm, extend wrist/fingers in an attempt to place the palm of the hand on the ipsilateral ear. Another option some clinicians prefer is to stabilize shoulder/scapula and extend the wrist, then use the amount of elbow flexion as the final motion to quantify ulnar nerve tension.

The test is positive with pain or paresthesia into ulnar nerve distribution of UE, i.e. digits 4th and 5th.

The problem with ulnar nerve testing is that we don't have any data on sensitivity and specificity – there's essentially nothing out there. A part of that is consistent with what is seen clinically, i.e. a lot of people with no reports of UE dysfunction present with a positive ulnar nerve tension test.

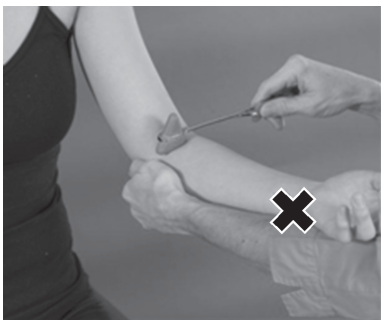
Perhaps the fact that the nerve runs very superficial in many areas and is torqued around the medial aspect of the elbow lends itself to being scarred down or having some difficulty gliding. Nonetheless, just because a test is positive doesn't mean there necessarily needs to be an intervention.

Deep Tendon Reflexes (DTR)

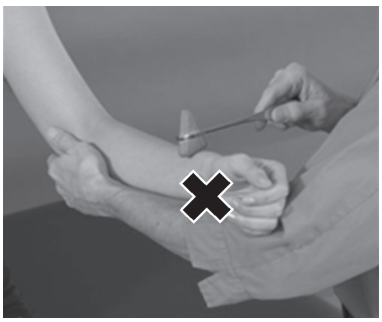
DTRs are a brisk muscle contraction in response to a sudden stretch generated by a reflex hammer tapping the tendon insertion. DTRs assess the central nervous system as well as the peripheral nervous system at the segmental level of innervation. Hyperactive reflexes may indicate pathology above the level of the reflex arc. Hypoactive reflexes may be the result of muscle, nerve, nerve root, or spinal cord damage.

The biceps, brachioradialis, and triceps assess C5-6, C5-6, and C6-8, respectively. The performance of these reflexes is as follows:

Biceps DTR

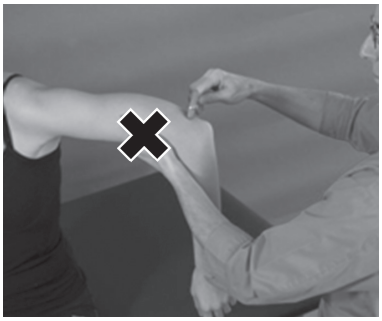


Brachioradialis DTR



Gulick, iOrtho+, 2016

Triceps DTR



Gulick, iOrtho+, 2016

The grading of the DTRs is displayed below. Overall, UE reflexes can be good diagnostic tools for the detection of neurological lesions. Data published by Teitelbaum et al (2002) stated that when DTRs are used for the detection of unilateral cerebral lesions the statistics are as follows: Sensitivity = 68.9%; Specificity = 87.5%; (+) LR = 5.5; (-) LR = 0.36; (+) PV = 86.1%; (-) PV = 71.4%.

Grading DTRs

0 = areflexia/absent

1 = hyporeflexia/diminished

2 = average/normal

3 = hyperreflexia/exaggerated

4 = clonus

Overall UE DTR Statistics:

Sensitivity = 3-24%, Specificity = 95-100

(+) LR = 0.8-10.0, (-) LR = 0.91-40

Special Tests

Once the viscera, c-spine, and potential issues with neural tension tests are ruled out, you can begin to examine the UE.

You are strongly encouraged to not only examine the involved joint but also the joint proximal and distal. The presence of numerous biarticulate muscles lend themselves to the potential for injury. A thorough evaluation includes posture, ROM (osteokinematics and arthrokinematics), strength, sensation, deep tendon reflexes, and functional activities.

SHOULDER

Whenever we talk about the shoulder, we should begin with a visual inspection of the shoulder and the scapula. To this end, Burkhart, Morgan and Kibler (2003) coined the term "sick scapula," which stands for scapular malpositioning, inferior medial scapular winging, coracoid tenderness, and scapular dyskinesis.

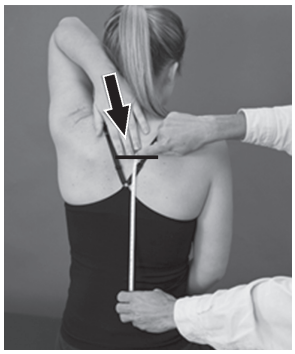
Gulick, iOrtho+, 2016

Basically what we're looking at here are scapulas that are not symmetrical: you can see in these pictures how the right scapula is malpositioned, and is much more rotated than the left. It's also winging a lot more than the left scapula when the arms are abducted. When you press on the coracoid there is noted tenderness, and then when you actually look at the movement, you can see how that right scapula really wings out. The images above are consistent with a sick scapula, and the client would probably benefit tremendously from scapular stabilization activities.

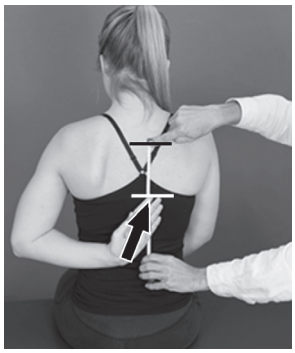
Another technique used to get an overall picture of shoulder and scapular movement is a technique known as "rotational lack." The technique involves the two steps depicted below.

The first step is to reach over the top as far down the back as far as possible. Step two, is to reach up the back as far as possible. A tape measure is used to measure the difference between these two points. Measurements should be compared bilaterally. The combination of these two movements incorporates all shoulder motions (step 1 - flexion, abduction, ER; step 2 – extension, adduction, IR).

Rotational Lack 1



Rotational Lack 2

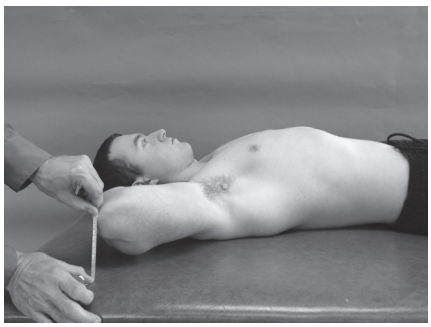


Gulick, iOrtho+, 2016

Other muscle lengths that may be valuable to check include the pectoralis major (sternal and clavicular portions) and pectoralis minor.

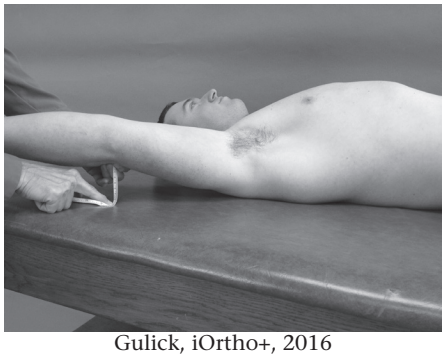
If you look at the clavicular portion of the pectoralis major, you want to see how far the arm is elevated off of the mat and should be compared bilaterally. The test position is one in which the fingers are interlaced behind the head and you drop the elbows down. The measure is from the olecranon process down to the table and should be compared bilaterally.

Clavicular Test



Gulick, iOrtho+, 2016

Sternal Test



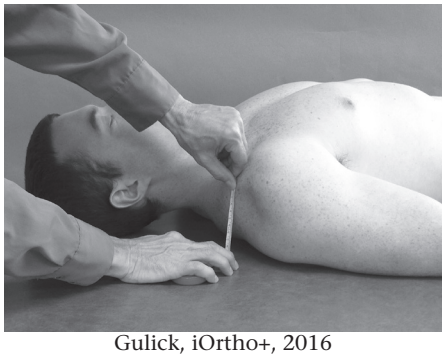
Gulick, iOrtho+, 2016

When you examine the sternal version, the test position is the superman pose. In supine, with the arms overhead at about 130° of elevation and the shoulders in external rotation, a measurement is taken from the lateral epicondyle to the table. In this standardized form, the reliability of this test is 81-84%.

For the pectoralis minor, in the supine position, we measure the height of the acromion from the table – and of course bilateral comparison is important.

Clearly the pectoralis minor are muscles that are frequently very tight. Everything we do in our life is in front of us and so we're constantly lifting and pushing with our pecs and this produces a significant imbalance between our anterior and posterior musculature that can lead to kyphotic postures that are often problematic. Anterior angulation of the glenoid fossa alters the position of the humerus. Getting a picture of what those pecs look like when we're examining the shoulder, and identifying any asymmetries, can be very helpful. (There tend to be asymmetries more in the right handed people than in left handed. Much of our world is very right handed so people that are left handed are pretty much forced to be ambidextrous but it's very easy to be extremely right hand dominant in our world. So we may see some noted discrepancies when comparing the sides.)

Pectoralis Minor Test



Gulick, iOrtho+, 2016

Rotator cuff

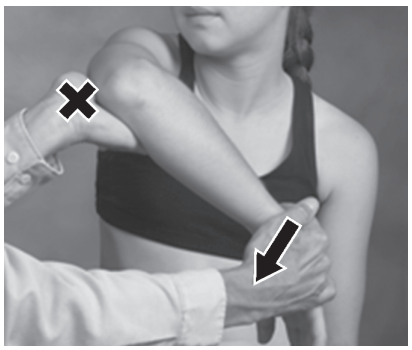
First we're going to look at some information on the predictor values, and then we'll talk about each of the rotator cuff muscles.

This is a perfect example of how the clustering of tests can enhance clinical decision making. The predictor signs of rotator cuff injury include 1) supraspinatus weakness, 2) external rotation weakness, and 3) positive impingement test. Any one sign in a client over 70 years of age has a 76% chance of a rotator cuff tear. Any two signs in a client under 60 years of age has a 64% chance of a rotator cuff injury. Any two signs in a client over 60 years of age has a 98% chance, and any three signs at any age has a 98% chance, of a rotator cuff tear. When correlating the signs with age, it gives you a perspective of the potential for a problem with the rotator cuff.

Supraspinatus Weakness

External Rotation Weakness

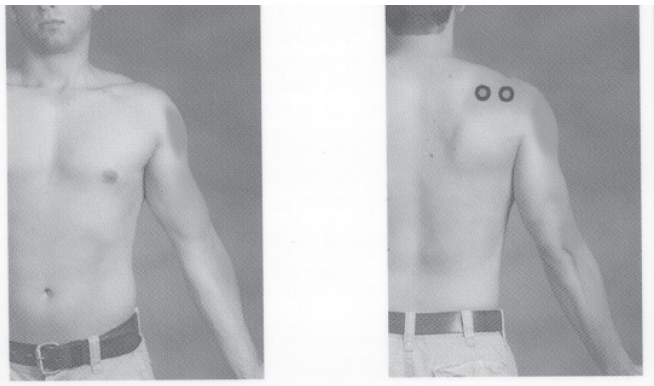
Positive Impingement Test



Gulick, iOrtho+, 2016

Supraspinatus

We move on to the supraspinatus, and begin by taking a look at the referral pattern. Based on the work of Simon and Travell, the circled dots represent the location at which the trigger points tend to be located. The red splay is an indication of where the supraspinatus tends to refer.



Gulick, OrthoNotes, FA Davis Publishing, 2013

There are several supraspinatus tests in the literature, some of them better than others. Clinical practice does not afford the time to perform more than a couple of tests per structure, and it simply does not make sense to do tests without ample literature to support them. Thus, the tests presented in this course include the Full Can, Empty Can, Lateral Jobe, and external rotation (ER) Lag sign.

In the Full Can, you're going to bring the arm up to 30 to 45 degrees of elevation in the plane of the scapula (scaption). The differentiating characteristic of the Full Can is that the arm is in external rotation, i.e. the thumb is facing up. The clinician then resists UE elevation in this position.

Full Can Test

Gulick, iOrtho+, 2016

The two unique features of the statistics for this test are the differentiation of weakness versus pain for a positive test, and the ability to distinction between full-thickness and partial-thickness tears.

The Full Can test is a better test for ruling out the diagnosis of supraspinatus injury when pain is the

positive criteria (as evidenced by the statistics). It makes sense when you consider of all the things that are incriminated in this test position: you are actually compressing the subacromial bursa, activating the biceps, stressing the transverse humeral ligament that holds down the biceps, and tractioning the labrum via the attachment to the biceps. When a plethora of tissues are incriminated by virtue of doing this test, it is understandable that it's not a great diagnostic tool.

Full Can - Overall

Sensitivity = 66-86%, Specificity = 57-74,
(+) LR = 1.83-2.96, (-) LR = 0.25-0.53

Full thickness tear (weakness):
Sensitivity = 68.4%, Specificity = 35.7%

Full thickness tear (pain):
Sensitivity = 65%, Specificity = 30.8%

Partial thickness tear (weakness):
Sensitivity = 70%, Specificity = 7.1%

Partial thickness tear (pain):
Sensitivity = 70%, Specificity = 7.1%

Subacromial Bursitis

Weakness:
Sensitivity = 73%, Specificity = 46 – 50%

Pain:
Sensitivity = 25 - 65%, Specificity = 37 - 66%

(+) PV = 8.8%, (-) PV = 87.4%

The Empty Can, also known as the Jobe's Test, starts in the same position, the plane of the scapula at 30 to 45 degrees of elevation. However, in the Empty Can test the thumb is rotated downwards so the arm is in internal rotation. Again, sensitivity is much higher than specificity, whether it be full or partial thickness or pain or weakness as the positive criteria. Thus both the Empty Can and the Full Can are better as screening tools than as diagnostic tools.

Empty Can Test

Gulick, iOrtho+, 2016

Empty Can - Overall

Sensitivity = 66-86%, Specificity = 57-74
(+) LR = 1.83-2.96, (-) LR = 0.25-0.53

Full thickness tear (weakness):
Sensitivity = 68.4%, Specificity = 35.7%

Full thickness tear (pain):
Sensitivity = 65%, Specificity = 30.8%

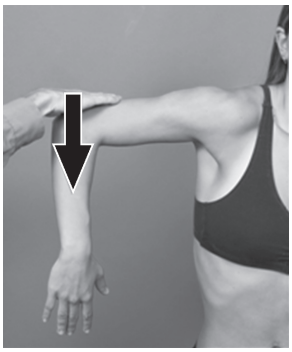
Partial thickness tear (weakness):
Sensitivity = 70%, Specificity = 7.1%

Partial thickness tear (pain):

Sensitivity = 70%, Specificity = 7.1%

So what tests are available as strong diagnostic indicators of a supraspinatus tear? The Lateral Jobe is a test that fulfills this criteria. For this test, the client is in sitting or standing position and abducts the UE to 90° with IR and 90° of elbow flexion. Thus, the fingers should be pointing inferior and thumb medial. The clinician applies a downward resistance to the distal humerus. This position puts the supraspinatus in a direct line of pull for the proximal and distal attachments.

Lateral Jobe Test



Gulick, iOrtho+, 2016

Lateral Jobe Test

Sensitivity = 81%, Specificity = 89%
(+) PV = 91%, (-) PV = 77%

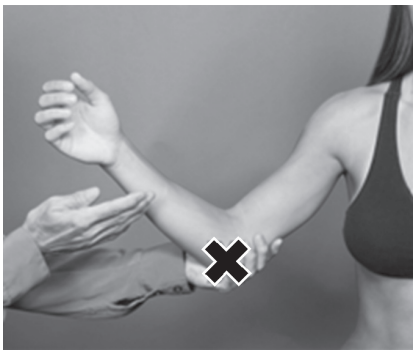
Note, this can be a difficult position to assume for an individual with a supraspinatus tear. One must realize an important fact about all of the orthopedic tests we are discussing: if you cannot get into the test position, then you can't render an interpretation of it. In other words, if the standard position is altered, it is inappropriate to say that the test is either positive or negative.

However, with that caveat in mind, the metrics of the Lateral Jobe Test are rather good for both ruling in and ruling out the supraspinatus.

Another test is the ER Lag Sign. Here you can see that you will passively place the person in an elevated posture so they're in approximately 90 degrees of flexion and about 20 degrees of scaption. While supporting the elbow, move the client into a position

of just a few degrees shy of full ER. Once there, instruct the client to hold that position. Release the forearm and note if the client lags into internal rotation. Failure to maintain the position of ER is a positive test. This test is highly specific and thus serves as a strong diagnostic tool.

ER Lag Sign



Gulick, iOrtho+, 2016

ER Lag Sign

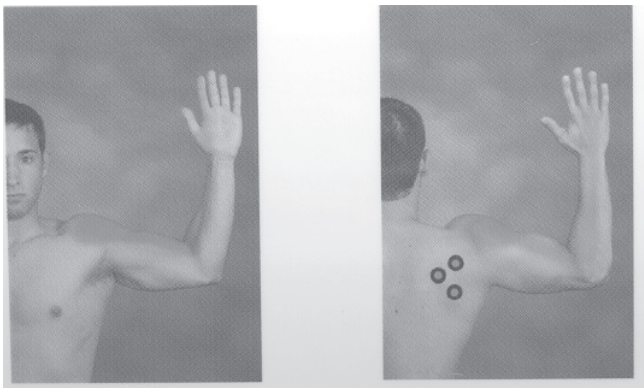
Sensitivity = 45-70%, Specificity = 91-100%

(+) LR = 5.00, (-) LR = 0.30-0.60

To recap: regarding the supraspinatus, although there are about several tests in the literature, we've prioritized four: two, the Full Can and the Empty Can, are good screening tools and two, the Lateral Jobe and the ER Lag, are good diagnostic tools.

Infraspinatus

Here is the referral pattern of the infraspinatus muscle.



Gulick, OrthoNotes, FA Davis Publishing, 2013

The tests purported to incriminate the infraspinatus, an ER of the shoulder, are the dropping sign, the drop sign, and again the ER Lag. (It can be a little confusing because some of these names are rather similar.)

For the dropping sign the client is seated, the elbow is flexed to 90°, the shoulder at the side (0° of abduction) and 45° of ER. The clinician resists ER. A positive test is dropping into IR.

Dropping Sign

Gulick, iOrtho+, 2016

Dropping Sign

Sensitivity = 20-100%, Specificity = 69-100%

(+) LR = 1.5-3.2, (-) LR = 0.0-0.79

(+) PV = 10.1-69.1%, (-) PV = 70.5-87.7%

The statistics for this test are highly variable. Some of that can be attributed to the amount of ER for the test position as well as the amount of resistance that is applied to "break" the position of ER.

The drop sign starts by abducting the shoulder to 90 degrees and then just positioning there in full ER. The client is asked to hold this position. This has been deemed a good diagnostic test due to the high specificity.

Drop Sign

Gulick, iOrtho+, 2016

Drop Sign

Sensitivity = 6-50%, Specificity = 100%

(+) PV = 100%, (-) PV = 32%

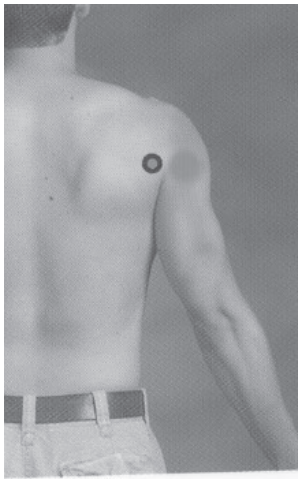
Again, you already saw the ER Lag. This test can also be used for the infraspinatus because both the infraspinatus and the supraspinatus are external rotators.

So we have three tests for the infraspinatus that are all decent diagnostic tools. Although you don't have to do all three, doing at least two of them would help you to appreciate whether or not the infraspinatus is injured. If one of the two tests selected is the ER Lag, then you probably need to do a third: since the ER Lag also

implicates the supraspinatus, it would need to be ruled out. (Do you remember the best supraspinatus tests to rule it out? Hint: one is done with the thumb pointing up and the other with the thumb pointing down.)

Teres minor

The teres minor muscle comes off the axillary border of the scapula just below the infraspinatus and above the teres major. The teres minor refers to the posterior lateral shoulder.

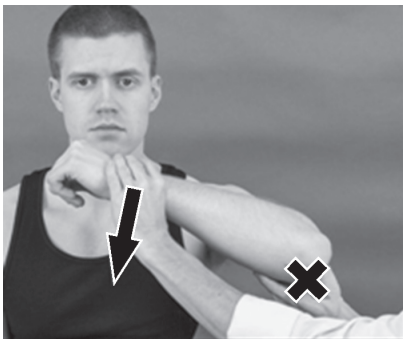


Gulick, OrthoNotes, FA Davis Publishing, 2013

The test for the teres minor is called the Hornblower test. There are two methods to perform this test. These come from the interpretation of what type of horn is being mimicked.

The first test is like blowing a trumpet. The client is asked to move the hand up towards the face and hold the position. In this position of external rotation, the clinician may apply a little over pressure if you wish into the internal rotation. In resisting the movement to maintain the position, the client recruits the teres minor muscle.

Hornblower Test 1



Gulick, iOrtho+, 2016

Hornblower Test 2

Gulick, iOrtho+, 2016

In the second version of this test, the shoulder is flexed to 90 degrees in ER with 90 degrees of elbow flexion. The position is meant to simulate the pulling of a rope for a truck horn.

A positive test for technique #1 is the inability to bring the hand to the mouth without abducting the shoulder and a positive test for technique #2 is inability to maintain shoulder ER.

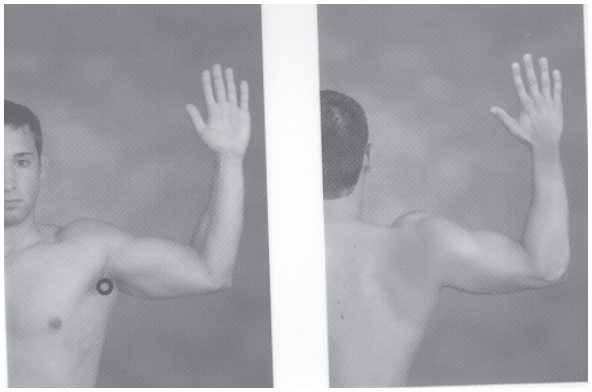
The hornblower tests serve as good screening tools for teres minor injuries, but the literature has also used the tests to predict surgical success. A positive test in the presence of stage-2, stage-3, or stage-4 fatty degeneration indicates repairs have a 50% chance of re-rupture. A positive test in the presence of stage-1 or less fatty degeneration indicates repairs have a 10% chance of re-rupture.

Hornblower Test

Sensitivity = 92-100%, Specificity = 30-93%
(+) LR = 14.29, (-) LR = 0

Subscapularis

The subscapularis comes from the underside of the scapula and goes through the axilla. The referral pattern is consistent with the anatomic course of the muscle.



Gulick, OrthoNotes, FA Davis Publishing, 2013

There are several tests for the subscapularis, five of which are fairly well researched: IR lag sign, lift-off test, belly-press, belly-off, and the bear hug. When you look at these tests, what you're going to see are some consistencies or common features. Since the subscapularis is the only rotator cuff responsible for IR, obviously all tests are intended to use IR to incriminate the muscle. Some of them are isometric and some of them are concentric/eccentric. Each one gives us slightly different information.

For the IR lag sign, the clinician stands behind the seated client and places the affected arm behind the back. The clinician controls the client's arm at the elbow and wrist to place the arm in ~20-30° of extension. The client is told to hold the arm in that position as clinician releases the wrist contact (maintain elbow contact). The test is positive if the forearm drops towards the back, i.e. into ER. A partial tear may only result in a slight lag (5°), while the larger the lag the larger the tear.

IR Lag Sign

Gulick, iOrtho+, 2016

The lift-off test is also performed in the seated position, with the hand of the involved shoulder in the curve of the lumbar spine. The client is asked to lift the hand off the back and maintain IR against resistance. A positive test is the reproduction of pain and/or weakness or the inability to lift hand off back. This test has been identified as one that is best for detecting larger tears (>75%).

Lift-off Test

Gulick, iOrtho+, 2016

It is worth noting that both the IR lag and the lift-off tests require the client to assume a challenging position. As mentioned previously, if the position cannot be assumed, you can't render a decision on the test.

Fortunately, there are other options for testing the subscapularis. Both the belly press and belly off test use resisted IR with the hand of the involved shoulder on the belly.

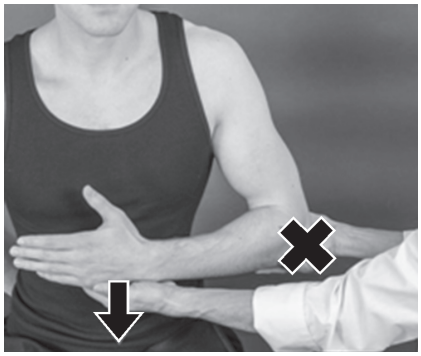
The test position for the belly press is very simple: have the client seated with hand on the belly and ask him/her to press the hand into the belly. Reproduction of pain and/or inability to IR is a positive test. Inability to perform IR may result in substitution with shoulder extension or wrist flexion. Stabilizing the elbow may help prevent this, or at least cue the clinician into the compensatory motion. The belly press test has been reported to require tears >50% to be positive.

Belly Press Test

Gulick, iOrtho+, 2016

The belly off test assumes the same position as the belly press test, but in this test the clinician tries to pull the client's hand off of the belly. Reproduction of pain and/or inability to IR is a positive test (and the same concerns are present for substitution of the testing task).

Belly Off Test

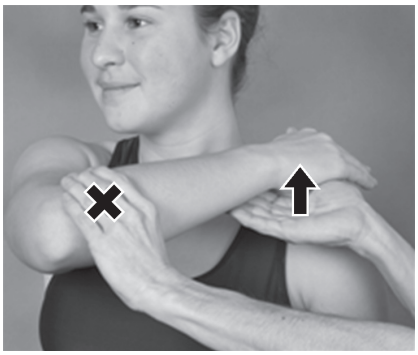


Gulick, iOrtho+, 2016

The bear hug is the newest of the subscapularis tests. This test involves sitting with the palm of the hand (involved shoulder) on the opposite shoulder (elbow in front of body). The elbow is elevated to 90° to assess the lower subscapularis fibers and positioned at 45°

of elevation to assess the upper subscapularis fibers. In the respective position, the clinician resists IR by attempting to pull the hand off the shoulder.

Bear Hug Test



Gulick, iOrtho+, 2016

This is the only subscapularis test that differentiates the upper and lower fibers. Does that really matter to a clinician? Unless you're a surgeon, it probably does not make a difference, but it may be helpful in developing therapeutic exercise programs.

As for test interpretation, inability to hold the hand against the opposite shoulder or weakness >20% of contralateral UE would be considered positive. This test is capable of detecting tears as small as 30%.

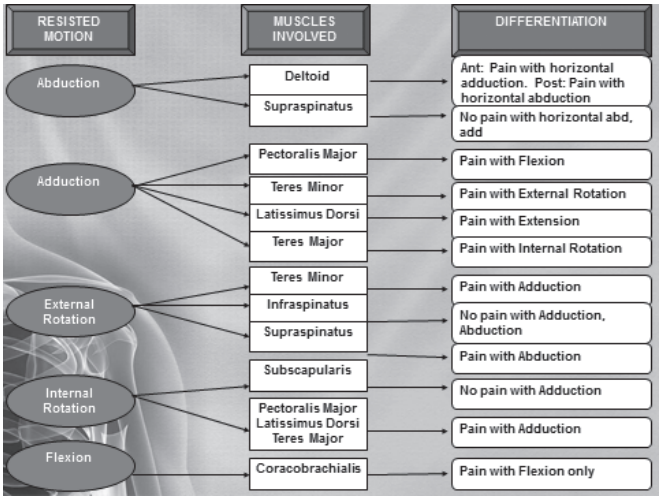
To summarize the subscapularis tests, there are two in which the involved hand is placed on the lumbar spine. One test involves an isometric contraction (IR lag) and the other a concentric contraction (lift off). There are also two tests that place the involved hand on the belly. One test is concentrically active (belly press) and the other is an eccentric motion (belly off). Finally, there is the bear hug, which places the involved hand on the opposite shoulder and IR is resisted at 90 and 45 degrees of elevation.

Subscapularis Tests	Full Thickness		Partial Thickness	
	Sensitivity	Specificity	Sensitivity	Specificity
IR Lag	98%	94%	54%	96%
Lift-off	89%	98-100%	18%	98-100%
Belly press#	88%	97%	29%	98%
Belly-off	90%	66%	66%	66%
Bear hug*	88%	91%	53%	92%

= capable of detecting tears of 50%
* = capable of detecting tears of 30%

The metrics for these five tests are summarized above for both full thickness and partial thickness tears. In addition, approximately 24% of supraspinatus tears also involve a tear of the subscapularis tendon due to the congruent attachment at the anterosuperior edge of the humerus.

The chart below summarizes the muscular actions and assists in the differential diagnosis of the shoulder:

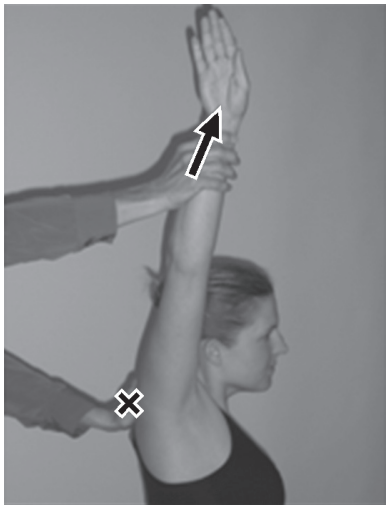


Impingement

When addressing impingement tests, the preface is there are not many good ones. The Neer, Hawkins-Kennedy, and Yocum tests are the most recognized of the impingement tests.

The Neer test involves elevating the arm in internal rotation. The internally rotated position is important to create the impingement of several structures. Pain or reproduction of the symptoms when the arm is in this elevated/IR position constitutes a positive test.

Neer Test



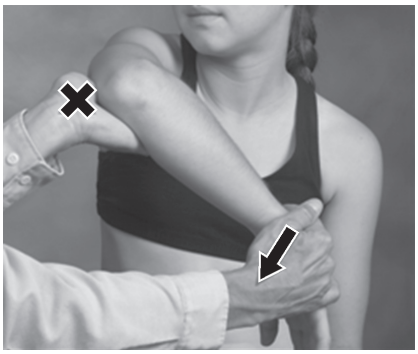
Gulick, iOrtho+, 2016

Unfortunately the statistics for this test are poor. Part of the problem is this test incriminates a variety of structures, i.e. rotator cuff, labrum, subacromial bursa.

The Hawkins-Kennedy test involves elevating the arm up to 90 degrees and then horizontally abducting and internally rotating to endrange. This position is an attempt to torque the supraspinatus (wringing it out like a twisted towel) and close down the subacromial space.

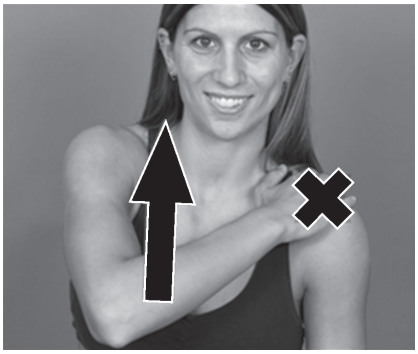
However, the same problem of incriminating multiple structures is present with this test, as was the issue with the Neer Test.

Hawkins-Kennedy Test



Gulick, iOrtho+, 2016

Yocum Test



Gulick, iOrtho+, 2016

Finally, the start position of the Yocum test is very similar to the bear hug test. The client is sitting or standing with the hand of the involved shoulder on the contralateral shoulder. Thus the arm is elevated, adducted and internally rotated. The client is then asked to raise the elbow to a position in front of the face.

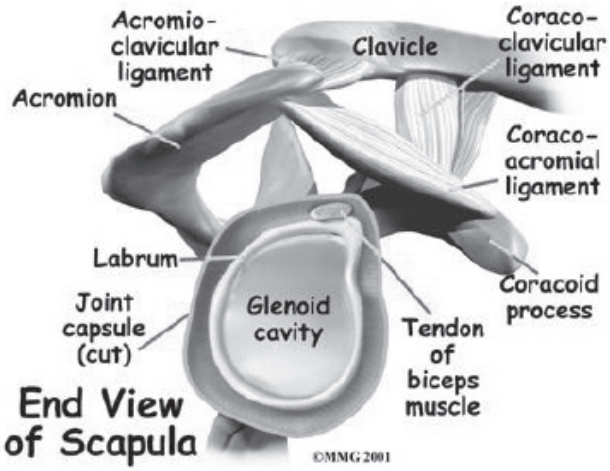
The end position for the Yocum test is very similar to the end position of the Hawkins-Kennedy test. Thus the statistics are very similar also.

So there are three tests for impingement but none of them are good diagnostic tools.

Impingement Tests	Sensitivity	Specificity
Neer Test	78%	58%
Hawkins-Kennedy Test	74%	57%
Yocum Test	70-80%	36-92%

Labrum

Let's move onto the labrum.



There are more than 17 tests for the labrum; this course will prioritize seven: Anterior Slide, Crank, Kim, Biceps Load, Biceps Load II, Pain Provocation, and Dynamic Labral Shear Tests. These are all meant to incriminate the labrum via compression or tractioning the tissue via the attachment to the biceps. So let's look at how that's done.

- Crank Test
- Kim Test
- Jerk Test
- Compression Rotation Test
- Pain Provocation Test
- Biceps Load Test
- Biceps Load II Test
- O'Brien (Active Compression) Test
- Clunk Test
- Anterior Slide Test
- Resisted Supination ER Test
- Dynamic Labral Shear Test
- Upper Cut Test
- Hawkins-Kennedy Test
- SLAP Prehension Test
- Speed Test
- Yergason Test

The Anterior Slide, also known as the Kibler test, is performed in a seated position with hands on hips and thumbs pointing posteriorly. The clinician places one hand on top of the affected shoulder to stabilize the scapula. The other hand is placed on the olecranon to apply a forward and superior force along the shaft of the humerus. The result is an anterior slide of the humeral head. A positive test is pain over front of shoulder joint line or a click.

Anterior Slide Test

Gulick, iOrtho+, 2016

A summary of the statistics for all the labral tests below reveal that this is a good diagnostic test.

The Crank test takes the arm overhead to 160° with the elbow flexed to 90°. A compression force is administered down the humerus while performing a scouring motion of IR/ER. This scouring maneuver is used to assess the cartilage of other joints in the body, i.e. hip (Scour Test) and knee (Apley Test). The intent is to capture the labrum to identify a lesion. Pain along the joint line and/or clicking would be considered a positive test.

Crank Test

Gulick, OrthoNotes, FA Davis Publishing, 2013

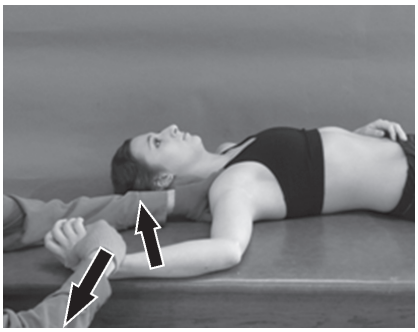
The Kim test applies a similar load through the humerus while the scapula is stabilized and the elbow is flexed to 90 degrees. However, for the Kim test, the UE is only elevated to approximately 90 degrees in the plane of the scapula. In some versions of the Kim test, clinicians have been reported to move the humerus up and down +/- 45 degrees while applying a downward and backward force through the humerus, i.e. range of examination is 45 to 135 degrees. A positive test would be sudden onset of posterior shoulder pain or clicking with or without a clunk. (Some clinicians take the liberty of adding the scouring maneuver to the Kim test, but that is not part of the standardized technique.)

Kim Test

Gulick, iOrtho+, 2016

The biceps load test first appeared in the literature in 2001and later was revised to the biceps load II test. It incriminates the labrum via the attachment of the biceps tendon. The test is performed in supine with the shoulder in 90 degrees of abduction and 90 degrees of elbow flexion. The clinician loads the biceps by resisting the combination of elbow flexion and supination.

Biceps Load I



Gulick, iOrtho+, 2016

The difference in the biceps load II test is simply the starting position. The biceps load II starts at 120 degrees of shoulder abduction (still 90 degrees of elbow flexion). A positive test for both versions of the biceps load test is a reproduction of pain as the biceps pulls on the labrum.

Biceps Load II

Gulick, iOrtho+, 2016

These tests are unique in that the statistics reveal them to be both good diagnostic and good screening tools.

The pain provocation test, also known as the Mimori test, implicates the biceps by taking it into a position of passive insufficiency. Thus, in supine with the UE placed in a 90/90 position, a traction force is applied to the biceps by passively taking the forearm into maximal pronation and elbow extension. So the motion is the opposite of the biceps load test. However, a positive interpretation is the same, i.e. a reproduction of pain as the biceps pulls on the labrum.

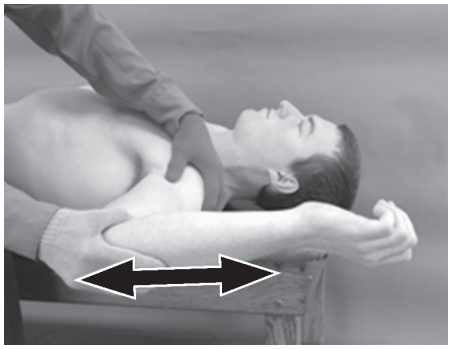
Pain Provocation Test

Gulick, iOrtho+, 2016

Unfortunately the sensitivity is quite variable for this test. It is possible that a person's increased flexibility may not effectively traction the biceps with just elbow extension and forearm pronation. I have personally modified this test by having the client move to the edge of the plinth so the shoulder can be extended over the side and increase the tension on the biceps.

The dynamic labral shear test is best performed in supine with the humerus off the plinth in 90 degrees of abduction and full ER. The humerus should be free to move. This test can be done in the sitting position, but the scapula needs to be supported and the clinician would then need to work against gravity to move the client's arm. The clinician places one hand on the acromion and the other hand engulfing the olecranon of the flexed elbow. The humerus is passively abd/adducted to impart a shearing force to the labrum. A palpable click is a positive test.

Dynamic Shear Test



Gulick, iOrtho+, 2016

Following is a chart summarizing the statistics for the seven labral tests presented. It provides the opportunity to compare the efficacy of the tests at a glance. Clearly one would not elect to perform all seven, let alone 17 tests. This chart allows you to strategically select two or three tests to confidently examine the labrum and render a decision on the clinical result.

Labral Tests	Sensitivity	Specificity	(+) Likelihood Ratio	(-) Likelihood Ratio
Anterior slide	8-78%	70-91%	0.5-9.7	0.2-1.1
Crank	9-91%	56-100%	0.8-13	0.1-2
Kim	80-82%	86-94%	13.3	0.2
Biceps load	78-91%	97%	26-30	0.1
Biceps load II	78-91%	82-97%	26-30	0.1
Pain provocation	17-100%	90%	10	0
Dynamic labral shear	72-86%	98%	31.57	Not tested

Acromioclavicular (AC) Joint

The AC tests are a conglomeration of four tests that serve as an excellent example of the value of clustering test results.

The AC shear is a simple test that been around for quite some time: the literature dates back to the early 1980s on this test. The technique entails "smushing" the AC joint together to create a shearing force. Hence, the clinician interlaces his/her fingers and places the heel of one hand on the front of the AC joint and the heel of the other hand on the back of the AC joint. Now the AC joint is surrounded and the clinician squeezes his/her hands together. A positive test would be pain or excessive movement at the AC joint. Given the small amount of motion, to confirm the concept of "excessive movement," a bilateral comparison should be performed.

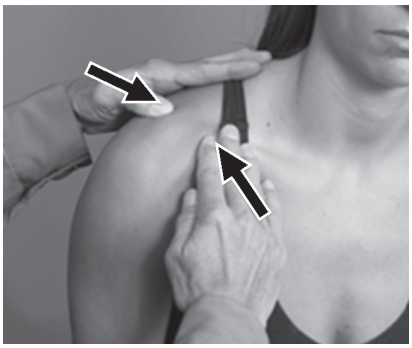
AC Shear Test

Gulick, OrthoNotes, FA Davis Publishing, 2013

The Paxinos sign is a more precise version of the AC shear test. For this test we are palpating the posterior acromion and the lateral aspect of the clavicle. If the clinician places his/her thumb of one hand over the posterior acromion and index or long finger of the other hand over the lateral aspect of the clavicle, a compression force will shear the AC joint. It is very interesting to note that although the palpation is very precise, the specificity of this test is not better than the

AC shear. Perhaps the inability to generate as much force with this test fails to create enough shear to be diagnostic.

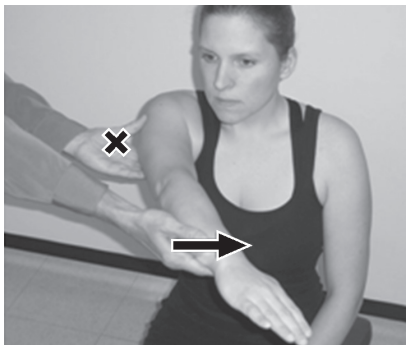
Paxinos Test



Gulick, iOrtho+, 2016

The Cross-body Adduction test involves bringing the arm across the body into horizontal adduction in a position of IR. This test was discussed in the literature in 1999. A positive test is pain at the AC joint. However, this maneuver may also incriminate the labrum, bursa, and/or rotator cuff.

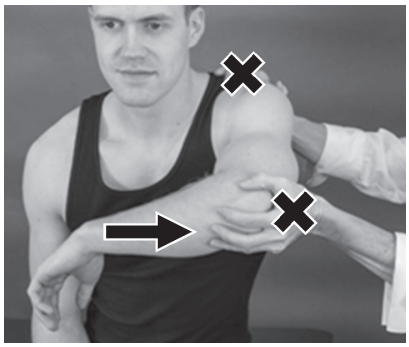
Cross Body Adduction Test



Gulick, iOrtho+, 2016

The AC resisted test is the fourth AC test we will discuss. In a seated position with the shoulder flexed to 90°, maximal IR, and 90° of elbow flexion, the client is asked to horizontally abduct the arm against resistance. A positive test is pain at the AC joint.

AC Resisted Test



Gulick, iOrtho+, 2016

In 2004, a study by Chronopoulus, Kim, Park et al looked at putting these tests for the AC joint into clusters. The chart below summarizes their work. As you can see, if one of the three tests studied (AC shear, cross-body adduction, & AC resisted test) were positive, you have a 74% chance of accurately diagnosing an AC injury. If two or more of the tests are positive, you can see that the specificity increases to 89% and (+) likelihood ratio increased to 7.4. Furthermore, if three or more of the tests are positive, specificity increases again to 97% and the (+) likelihood ratio to 8.3. This makes the clustering of these tests very strong diagnostic predictors for AC joint pathology.

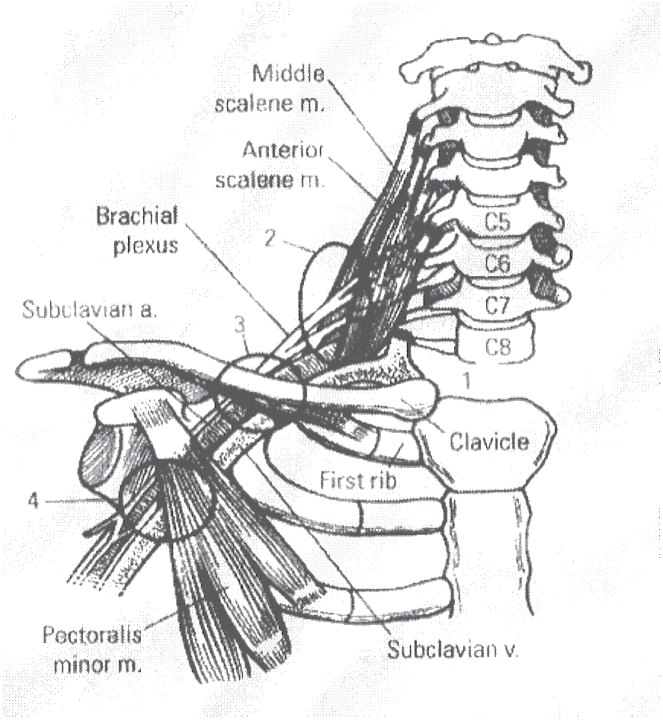
Diagnostic Utility of 3 AC Tests
AC Shear, Cross-body Adduction & AC Resisted Test

	Sensitivity	Specificity	(+) LR	(-) LR	(+) PV	(-) PV
≥1 (+) test	0%	74%	0.0	1.4	0.17	1.00
≥2 (+) tests	81%	89%	7.4	0.2	0.28	0.99
=3 (+) tests	25%	97%	8.3	0.8	0.31	0.96

Thoracic Outlet Syndrome (TOS)

Last but not least for the shoulder are the thoracic outlet tests.

There are four areas that are potentially problematic: thoracic inlet, scalene triangle, coracopectoral loop, and pectoralis minor loop. The structures that are compressed in these zones are the subclavian artery, subclavian vein, and brachial plexus.



When one discusses thoracic outlet syndrome (TOS) and the tests used to diagnosis it, some inherent problems surface. Historically, thoracic outlet tests have only looked at circulation, i.e. used the radial

pulse as the indicator of a positive or negative test. If the pulse diminished or was absent in the test position it was deemed positive. However, vascular compression is significantly less common (only 4-6% of TOS diagnoses) than neural compression. Some researchers (Lindgre, 2010; Plews & Delinger, 1998) have begun to look at pain and paresthesias as the barometer for a positive test.

Although there are numerous thoracic outlet tests, five of them will be reviewed in this course. These are the five that have the most research done on them and identify the specific location of the thoracic outlet compressed. Some also differentiate pulse from paresthesias.

There is also one common feature worth sharing as we embark on discussing these five tests: remember the head always follows the direction of the thumb, i.e. "the rule of the thumb." Take notice of this as we compare the various test positions. It will help you remember the details with ease.

The Adson test involves first supporting the arm and taking the radial pulse. In a seated position, move the UE into abduction, extension, and ER. Next, rotate the head toward involved side. The thumb is facing ipsilaterally, so you're going to rotate ipsilaterally. Take a deep breath to engage the scalene muscles and hold it. A positive test is the reproduction of symptoms or an absent or diminished pulse.

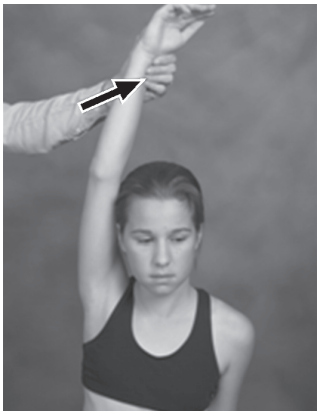
Adson Test

Gulick, OrthoNotes, FA Davis Publishing, 2013

Sensitivity is 32-87%, and specificity ranges between 74-100%

Wright test, AKA hyperabduction test, also begins by taking the radial pulse. Once you get the pulse, you bring the arm up overhead, and have the person take a big, deep breath. Note, there is no head rotation in this test (consistent with the "rule of the thumb" – thumb is directly overhead so the head stays in neutral with no rotation). Care should be taken to bring the arm overhead with ER to avoid the possibility of creating impingement (see Neer test). The Wright test incriminates the tissues at the coracopectoralis minor loop. When pulse is the diagnostic characteristic, sensitivity is 70% and specificity is 53%. However, when pain is the characteristic, sensitivity is 90% and specificity is 29%. In both cases, Wright test is a better screening tool than a diagnostic tool.

Wright Test



Gulick, OrthoNotes, FA Davis Publishing, 2013

Begin by taking the radial pulse for the Allen test. In seating, move the UE into 90° of shoulder abduction with 90° of elbow flexion. Turn the head away (thumb is facing contralateral), take a deep breath and hold it. The Allen test is used to detect tissue compressed by the pectoralis minor muscle. At this time, there are no statistics for sensitivity of this test and specificity is poor (18-43%).

Allen Test

Gulick, OrthoNotes, FA Davis Publishing, 2013

In contrast, the military press test, also known as the Eden test, detects tissue compressed at the costoclavicular region (between 1st rib and clavicle). In this test the radial pulses are obtained bilaterally. In either sitting or standing, the shoulders are retracted into extension and abduction with the neck in extension (exaggerated military posture). Like the Allen test, there is no literature on sensitivity and specificity is 53-100%.

Military Press Test

Gulick, OrthoNotes, FA Davis Publishing, 2013

The Roos test, also known as the EAST (Elevated Arms Stress Test), looks like you are performing a party dance, but it has some of the best statistics of the TOS tests. In sitting with the UE's at 90° of shoulder abduction, ER, and elbow flexion, the client is instructed to open and close his/her hands for 3-minutes. A positive test is paresthesias of the hands, heaviness of the hands, and/or a slowing of the flexion/extension task. The Roos test has been reported to have a sensitivity of 82-84% and a specificity of 30-100%.

Roos Test

Gulick, OrthoNotes, FA Davis Publishing, 2013

Generally, the statistics on the TOS tests are not very good: the Adson test is the only decent diagnostic test, and Wright and Roos are the better screening tests. However, Lindgre (2010) examined the influence of clustering TOS tests and these results are displayed below.

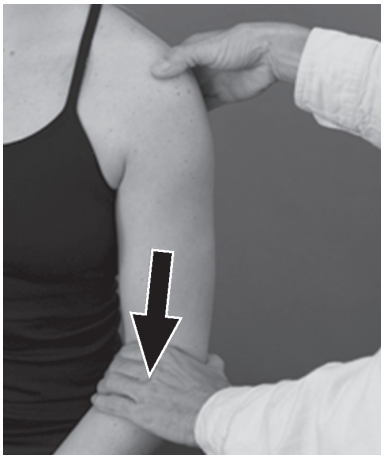
Clustering of TOS Tests	Sensitivity	Specificity
Adson + Wright Pulse	54%	94%
Adson + Wright Pain	72-79%	76-88%
Adson + Roos	72%	82%
Wright (pain) + Roos	83%	47%

Miscellaneous Tests

There are a few miscellaneous tests for the shoulder.

The sulcus sign is used to assess instability. This is done with a long arm distraction. Scapular control is best obtained in supine but the test can be done in sitting. The arm is placed at the side, the clinician grasps the client's forearm proximal to the elbow, and pulls the arm distally. A positive test is an increased distance from inferior acromion to humeral head when compared to the contralateral shoulder.

Sulcus Test



Gulick, OrthoNotes, FA Davis Publishing, 2013

Although sensitivity is poor (17%), specificity is 93%. However, to obtain a positive test, the quantity of the "space" has been defined as a full finger of displacement and a separation of more than 25% of the diameter of the humeral head.

Speeds test is a well-known test that involves elevating the arm 75-90° in the sagittal plane with the elbow extended and forearm supinated. The clinician then resists the upward motion. Although it is a simple test, it incriminates a lot of different tissues: biceps, transverse humeral ligament, labrum, and supraspinatus.

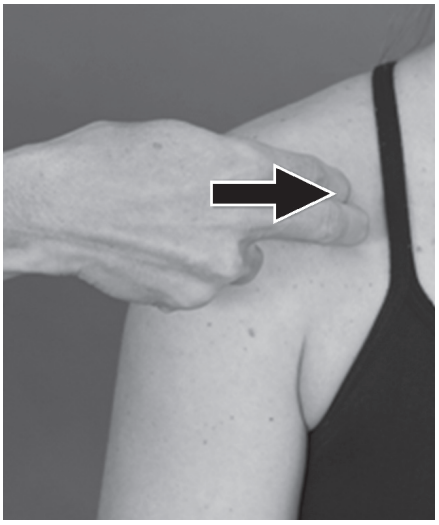
Speeds Test

Gulick, iOrtho+, 2016

A positive test for pain could be biceps tendonitis (sensitivity = 9-100%, specificity = 14-87%), while a sense of instability may be a labral problem (sensitivity =9-100%, specificity = 38-79%). It is recommended that the clinician ask the client to be very precise ("place one finger on the location it hurts most") about the location of the pain with this test. The clinician can then use his/her knowledge of anatomy to determine the structure that may be involved.

The coracoid pain test is the most simple test known to orthopedics. The clinician palpates from medial to lateral across the clavicle, finds the AC joint, moves inferior to land on the coracoid, and pushes on the coracoid process. Pain is considered a positive finding.

Coracoid Test



Gulick, iOrtho+, 2016

In 2010, Carbone et al. identified the coracoid pain test as being a test for adhesive capsulitis. We know that the coracohumeral ligament attaches to the coracoid process. We also know that the pectoralis minor attaches to the coracoid process. We know that the sensitivity (96%) and specificity (87-89%) of this test are amazingly high for such a simplistic thing, poking on the coracoid. Yet when Carbone et al (2010) studied 1196 people, they found only 2% false positives.

Interestingly, palpation of the coracoid was identified by Homsi, Bordalo-Rodrigues, da Silva, and Stump (2006) as a strong indicator of adhesive capsulitis. They looked at ultrasounds of the coracohumeral ligament of 306 people who had painful shoulders. In addition to thickening of the inferior fold of the capsule and a tightening of the subscapularis, they found 300 of the people had shortening of the coracohumeral ligament. Furthermore, they had a dramatic increase in shoulder external rotation when the coracohumeral ligament was released.

Studies like this have strongly influenced the way that I practice. Perhaps we don't always need complex or sophisticated tests. Looking at the transverse humeral ligament for adhesive capsulitis can be very valuable.

Not only do I want to then do some inferior glides to enhance movement into the inferior capsule and posterior glides to center of the humeral head, but I now include instrument-assisted strumming of the coracohumeral ligament to increase ER.

ELBOW

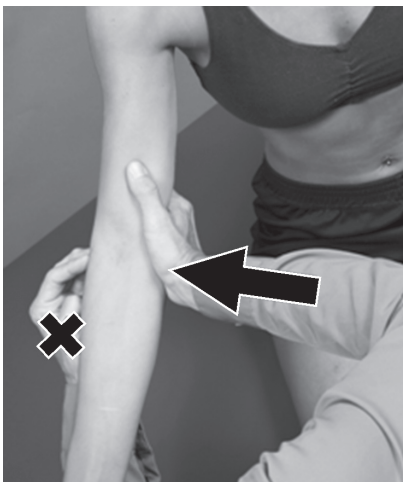
We move on now to the elbow. Quite frankly, there is limited data on sensitivity and specificity for the elbow tests – and there aren't as many tests for the elbow as there are for the shoulder either.

As we look at the tests for the elbow, we are going to compartmentalize them into medial and lateral. We will include muscle, tendon, ligament, and nerve tests. However, just like in the shoulder examination, the clinician should rule out the cervical spine and perform neural tension tests prior to assessing the elbow.

Lateral

Turning to the lateral aspects of the elbow, the lateral collateral ligament is assessed via a Varus Stress. This is accomplished through three points of contact. With the elbow slightly flexed and the humerus stabilized proximal to elbow (point 1), the forearm is grasped distally (point 2), and a varus force (point 3) is applied. Testing can also be done in prone to enhance the stabilization of the arm. A positive test is pain or joint gapping/instability as compared to the contralateral elbow.

Varus Stress Test



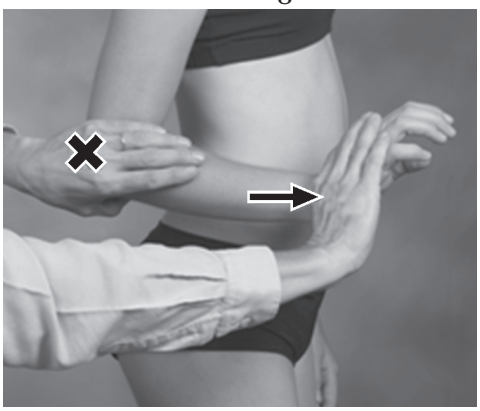
Gulick, iOrtho+, 2016

There is no data regarding sensitivity or specificity for this test.

The Cozen Sign and Mill tests are used to assess for lateral epicondylitis: the Cozen sign resists muscle activation, while the Mill test places the same tissues on stretch. The tissues involved include the wrist/finger extensors and forearm supinators.

For the Cozen sign, the UE is relaxed at the side with the elbow flexed to 90 degrees and the forearm pronated. The clinician resists supination and wrist extension. A positive test is pain at the lateral epicondyle or proximal musculotendinous junction of wrist extensors. The muscles most commonly involved in lateral epicondylitis are the extensor carpal radialis longus and brevis. The Cozen sign incriminates these muscles.

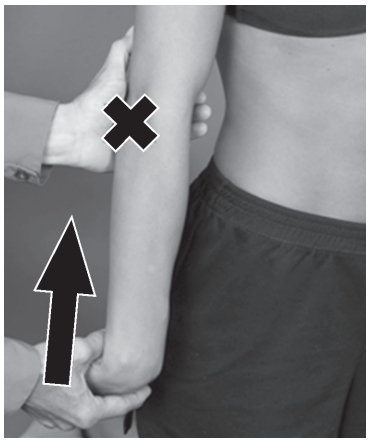
Cozen Sign



Gulick, OrthoNotes, FA Davis Publishing, 2013

Likewise, the Mill test attempts to reproduce the lateral epicondyle pain via elongation of the tissue. The UE is relaxed at the side with the elbow fully extended. The wrist is passively stretched into wrist flexion and forearm pronation.

Mill Test

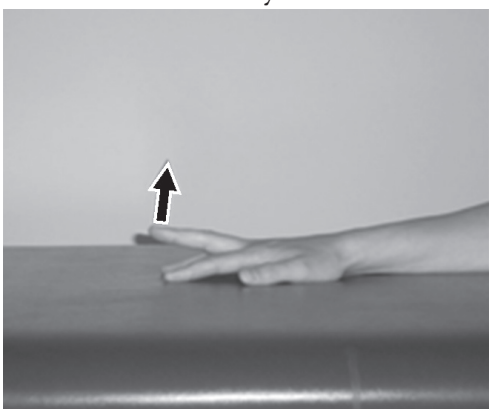


Gulick, iOrtho+, 2016

There is no data regarding sensitivity or specificity for either of these tests.

In isolating the extensor digitorum muscle, the Maudsley test can be used. The extensor digitorum is commonly involved in lateral epicondylitis/epicondylosis. To activate this muscle you would ask the client to extend the third digit. If that fails to produce pain, resistance can be applied to increase the muscle activation and possibly identify a more minor degree of pathology.

Maudsley Test



Gulick, iOrtho+, 2016

There are not any statistics for the Maudsley test.

Medial

The medial collateral ligament of the elbow is assessed with a valgus stress to the elbow. Again we will use three points of contact. With the elbow slightly flexed and the humerus stabilized proximal to the elbow (point 1), the forearm is grasped distally (point 2), and a valgus force is imparted to the joint line (point 3). Pain along the collateral ligament or joint gapping/instability is a positive test.

Valgus Stress Test

Gulick, iOrtho+, 2016

Like the varus stress test, there is no information on sensitivity or specificity for this test.

The Moving Valgus test also challenges the medial collateral ligament. This test was reported by O'Driscoll et al in 2002. The testing position requires the arm to be brought up into 90° of abduction, full ER, and full elbow flexion. A valgus force is applied to the elbow as it is quickly extended. If this produces pain in what is known as the "shear angle," the test is positive. The "shear angle" is the midrange of elbow flexion between 120° & 70° of motion.

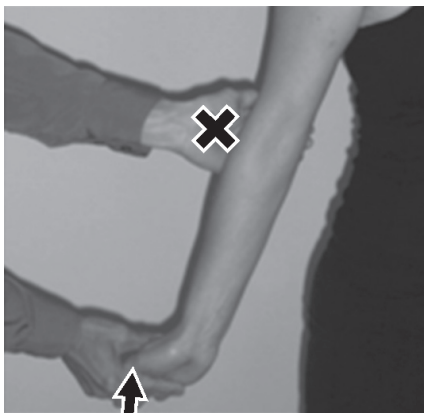
Moving Valgus Test

Gulick, OrthoNotes, FA Davis Publishing, 2013

Sensitivity is 100%, meaning that if there is no indication of pain or discomfort within the shear angle, then you can confidently rule out that medial collateral ligament as being a problem. Specificity is also pretty high (75%), meaning it is a good indicator of a problem with the medial collateral ligament.

To assess the musculature off the medial epicondyle, i.e. wrist/finger flexors and forearm pronators, we can perform maneuvers that are the exact opposite of the Cozen sign and Mill test. (Although there are no formal names for these tests, the clinical application of resisting and stretching these tissues makes sense.) The arm is placed at the side with 90 degrees of elbow flexion and the forearm supinated. Whether we resist forearm pronation with wrist/finger flexion or we passively extend the wrist/fingers with forearm supination (all to end range), we are incriminating the muscles originating from the medial epicondyle.

Medial Condyle Passive Stretch



Gulick, iOrtho+, 2016

Obviously, since no one has claimed these tests, there is no statistical data to report.

The pronator teres test is used to assess for compression neuropathy of the median nerve at the elbow. The clinician grasps the client's hand in a hand-shake position, i.e. elbow flexed, forearm half-way pronated, wrist neutral. Resistance is then applied to the pronators via the clinician's attempt to supinate the client's forearm. Tenderness over the pronator teres muscle or pain &/or numbness into the first three fingers and palm would be a positive test. Weakness may also be present with flexion/abduction of the thumb.

Pronator Teres Test

Gulick, iOrtho+, 2016

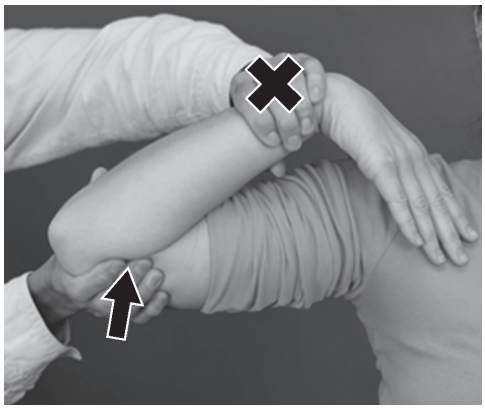
The other neural test at the elbow is the ulnar nerve. The tests that compress the ulnar can be divided into three components: the flexion test, the compression test, and the pressure flexion test. In the interest of keeping this simplistic, the nerve compression tests simply put pressure around the distal upper arm in an attempt to compress the ulnar nerve on the medial aspect of the upper arm and/or torque the ulnar nerve around the corner of a flexed elbow.

The flexion test alone is just a portion of the ulnar ULTT – it simply tensions the ulnar nerve around the flexed elbow. The client would be asked to maintain end range elbow flexion for 30-60 seconds.

The compression test applies pressure to the ulnar nerve just proximal to the elbow as it becomes more superficial. Squeezing the distal humerus with emphasis on the fleshy tissue on the medial side will compress the ulnar nerve.

The flexion-compression test just adds these two components together. When the client is sitting with elbow maximally flexed, the clinician will apply and maintain firm pressure just proximal to the cubital tunnel for 30 to 60 seconds. A positive test would be reproduction of neurologic symptoms along the ulnar nerve distribution – 4th and 5th digits.

Flexion-Compression Test



Gulick, iOrtho+, 2016

From the metrics below, one can see that it is often not necessary to hold for 60 seconds.

Flexion-Compression Test

- 30 second hold:
  Sensitivity = 91%, Specificity = 97%
- 60 second hold:
  Sensitivity = 89-98%, Specificity = 95-98%

And that wraps up the elbow. Once again, there are not a whole lot of tests, and there is even less literature to support their use. Nonetheless, if one knows anatomy and the actions of the muscles, the performance of the various tests discussed here becomes rather intuitive.

WRIST

Moving on to the wrist and hand, there are a few more tests than those discussed for the elbow, but unfortunately, again, great statistics are simply not available: the wrist and hand test are clearly not as well-researched joints.

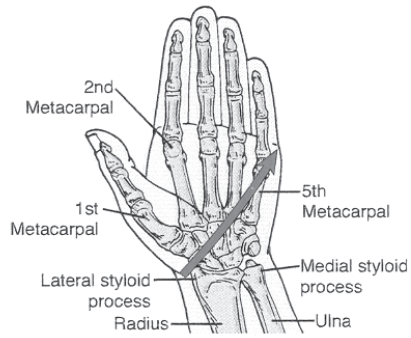
Prior to discussing the special tests for the wrist and hand, one test or measurement technique that we should review is that of edema assessment. This can be done via figure-eight measurements or volumetry.

The tables and images below depict the steps of the figure-eight method for both palmar/volar and dorsal edema.

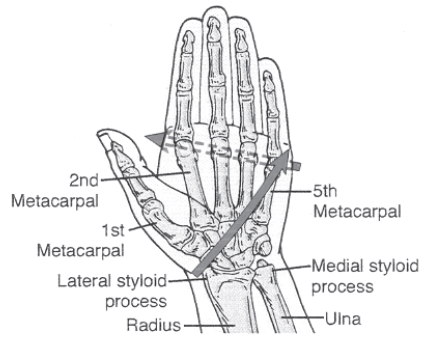
Palmar/Volar	Dorsal
• Place the tape measure at the distal aspect of the medial styloid process	• Place the tape measure at the distal aspect of the medial styloid process
• Go lateral across the palm of hand to the 2nd MCP joint	• Go lateral across the back of the hand to the 2nd MCP joint
• Go over the knuckles to the 5th MCP joint	• Go over the palmar aspect of the MCP joints to the 5th MCP joint
• Go across the palm to the lateral styloid process	• Go across the back of the hand to the lateral styloid process
• Go around the back of the wrist to the medial styloid process	• Go around the front of the wrist to the medial styloid process
• Read the tape measure at the point of overlap	• Read the tape measure at the point of overlap

Method to Assess Hand Edema (Palmar Surface)

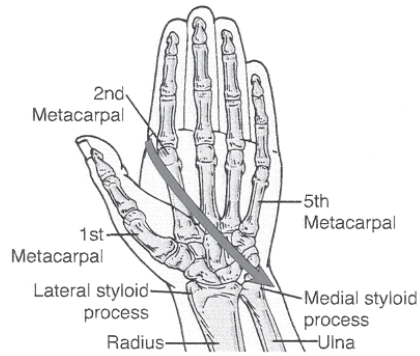
- 1—Start distal to the lateral styloid process; go medial across the palm of the hand to the 5th MCP joint



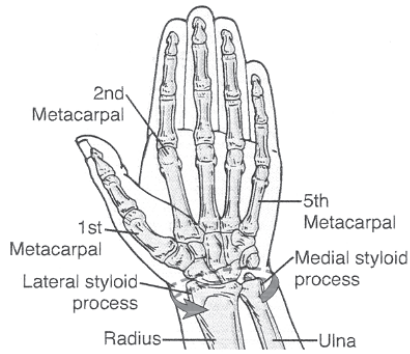
- 2—Over the knuckles to the 2nd MCP joint



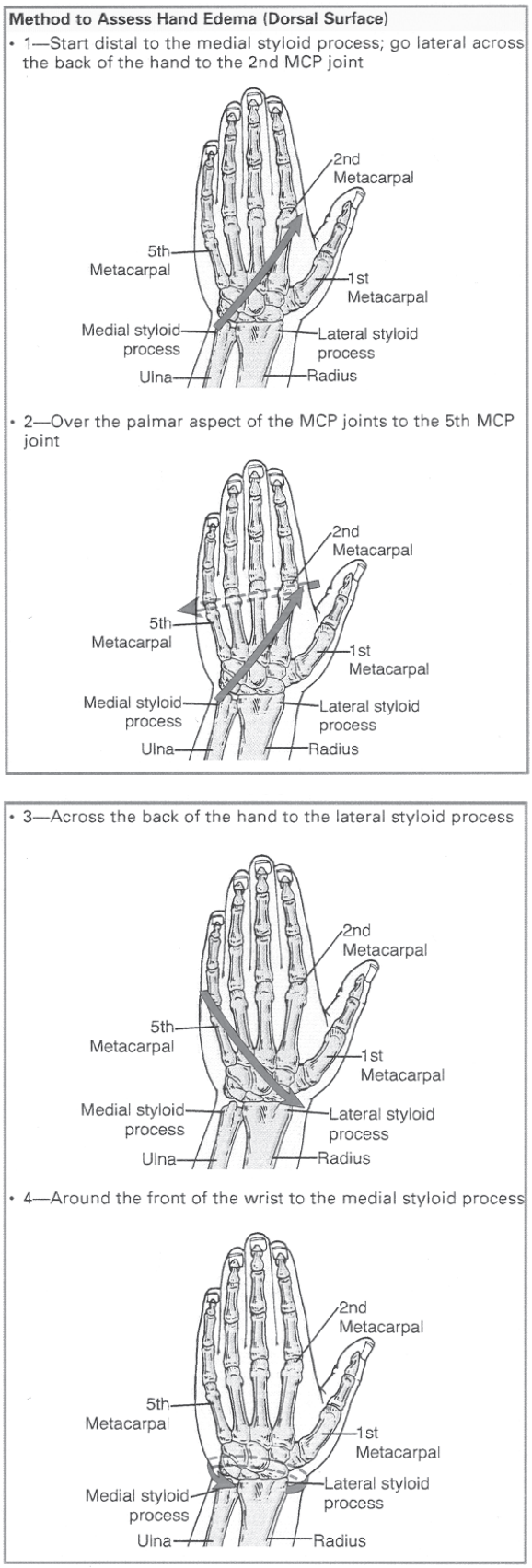
- 3—Across the palm to the medial styloid process



- 4—Around the back of the wrist to the lateral styloid process



Inter-rater reliability = 0.99
Intra-rater reliability = 0.99



Gulick, OrthoNotes, FA Davis Publishing, 2013

Volumetry is another way that you can measure edema. This allows you to assess the entire hand and/or wrist.

Just like the specific steps of the figure-eight measurements, it is important to standardize the measurement process to obtain consistent values. You have to make sure the client always puts his/her hand down to the same and appropriate level. To assist, the plexiglass chamber has a horizontal pin that may be placed at various levels (the pin placement should allow for adequate submersion of the involved structure). The clinician can direct the client to place the pin between the web space of the 3rd and 4th digits, the fingertips to the floor of the chamber, or the knuckles to the floor of the chamber. Any of these are acceptable as long as the procedure is consistent.

Gulick, iOrtho+, 2016

As far as the special tests for the wrist, we are going to divide them into several categories: fractures, instability, carpal tunnel, triangular fibrocartilage, tenosynovitis, neural, and vascular.

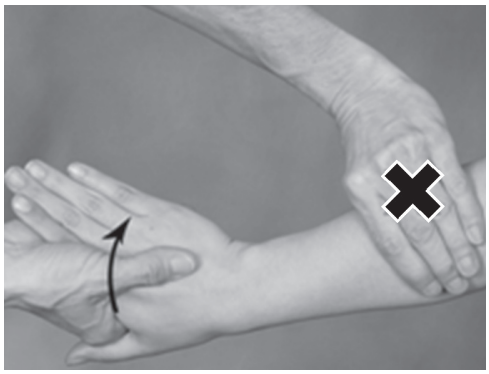
Fractures

The most important pathology to identify in the wrist and hand is a fracture, and the scaphoid bone accounts for 70% of all carpal fractures. Thus, one should assume the scaphoid is fractured until proven otherwise.

The mechanism of injury is a fall on an outstretched hand (FOOSH) with forceful wrist extension with radial deviation; proximal fractures have a worse prognosis than distal fractures because of blood supply to the scaphoid. While plain films frequently do not show the fracture, there are two tests used for the assessment of the scaphoid bone. They are the clamp and axial load tests.

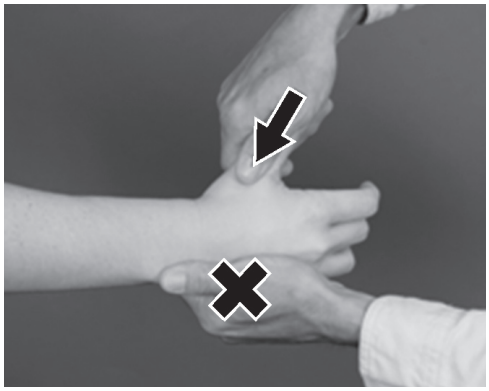
The clamp technique is used to assess the scaphoid, and places the forearm in pronation and the wrist in extension. A longitudinal load is applied through a "handshake" like position such that ulnar deviation can be facilitated.

Clamp Sign



Gulick, OrthoNotes, FA Davis Publishing, 2013

Axial Load Test



Gulick, iOrtho+, 2016

The axial load test is performed with the client sitting and the UE supported on the table. The clinician passively abducts and extensions the MCP joint of the thumb. An axial load is then applied to the 1st CMC joint.

Both tests would be deemed positive if there is pain in the anatomic snuffbox, i.e. location of the scaphoid.

Clamp Sign
Sensitivity = 52-100%, Specificity = 34-100%
(+) LR = 1.52, (-) LR = 0

Axial Load Test
Sensitivity = 89%, Specificity = 98%
(+) LR = 49, (-) LR = 0.02

The statistics for clamp sign are highly variable, perhaps because it is very similar to a test for the triangular fibrocartilage. Being able to distinguish which of those is involved really comes down to where the client reports the pain. So with the clamp sign we would be expecting to see pain at the base of the first metacarpal, whereas when we are testing the triangular fibrocartilage, we would expect to find it just distal to the ulnar styloid.

The statistics for the axial load test are much better.

Instability

The goal of the Murphy test is assessing for a lunate dislocation. Under normal circumstances when one views the hand in the position of a fist, the third MCP will be slightly higher than the second and fourth MCP (see image). However, if the lunate bone is dislocated, the third metacarpal will slide proximal and the third MCP will be level with the second and fourth MCP.

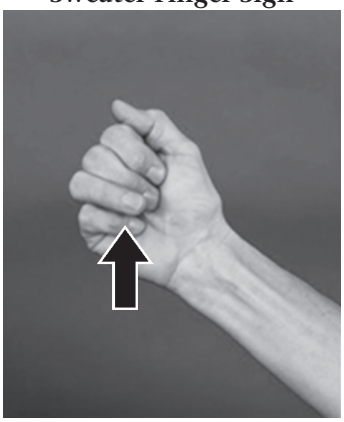
Murphy Test

Gulick, iOrtho+, 2016

There is no statistical data for this test.

The sweater finger sign indicates a rupture of flexor digitorum profundus (FDP). This muscle is attached proximally to the upper anterior and medial surfaces of the ulna, and fans out into four tendons (digits 2-5) to attach to the palmar side of the distal phalanx. The clinician instructs the client to make a fist. If in doing so, the distal interphalangeal (DIP) joint fails to flex, the suspicion is that the FDP is torn.

Sweater Finger Sign



Gulick, iOrtho+, 2016

There is no statistical data for this test.

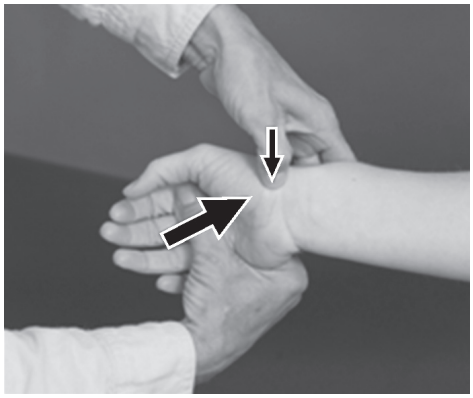
The ligaments of the wrist that provide stability include the scapholunate (deemed the ACL of the wrist), the lunotriquetral (not very commonly injured), and collateral ligaments.

As far as these two structures are concerned, the mechanism of injury is different. The scapholunate is potentially injured in wrist flexion, radial deviation, and supination, whereas the lunotriquetral occurs in wrist extension, radial deviation, and pronation. Once these ligaments are injured it is really tough to get any kind of stability in weight-bearing through the injured hand. So this is considered a surgical intervention if the client's activities involve a considerable amount of UE weight bearing.

The clinical tests used to assess the magnitude of the instability are the Watson test (scaphoid shift maneuver) for the scapholunate and the Fovea or Shearing sign for the lunotriquetral.

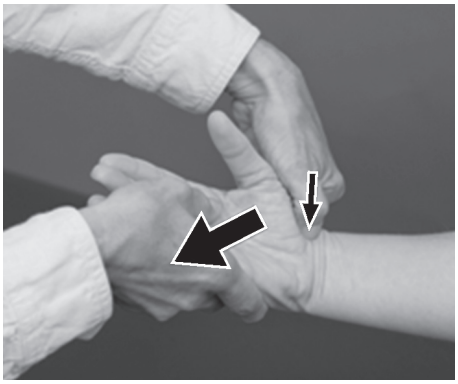
For the Watson test, the clinician places his/her thumb over the palmar aspect of the distal pole of the scaphoid and wraps his/her fingers around the distal radius for stabilization. Constant pressure is maintained with the examining thumb as the wrist is moved from a position of extension/ulnar deviation (Watson Test 1) to one of flexion/radial deviation (Watson Test 2), and back again. This movement pattern is similar to the wrist motions of the PNF diagonal 1. A positive test is dorsal wrist pain, or a clunk/shift may indicate instability of the scapholunate ligament.

Watson Test 1



Gulick, iOrtho+, 2016

Watson Test 2



Gulick, iOrtho+, 2016

Watson Test

Sensitivity = 69%, Specificity = 64-68%

(+) LR = 2.03, (-) LR = 0.47

As you can see from the statistics, this is not a strong test for either diagnosis or screening purposes, but there are no other tests for this ligament.

The Fovea sign assesses foveal disruptions of the distal radio-ulnar ligament and ulno-triquetral ligament. To perform this test, the elbow is placed in 90° of flexion, forearm and wrist in neutral and the clinician presses his/her thumb into the soft spot between the pisiform and ulnar styloid. Remember, you are assessing the distal radio-ulnar ligament and ulno-triquetral ligament, but if you go too proximal you could be on the triangular fibrocartilage. Thus, you want to make sure your palpation is precise. A positive test is defined as "exquisite pain."

Fovea Sign

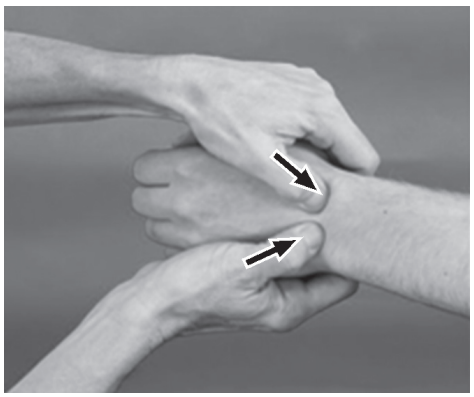
Sensitivity = 95.2%, Specificity = 86.5%

(+) LR = 1.69-7.1, (-) LR = 0.06-0.56

Despite the potential for error, sensitivity and specificity are excellent for this test.

Lunotriquetral shear (Reagan) test is used to assess the integrity of the lunotriquetral ligament. The client is in a seated position with the elbow flexed and forearm in neutral; the clinician places one thumb on the lunate and one 1 thumb on triquetrum. A shear force is applied by alternating pressure between the two contacts. The presence of pain, laxity, or crepitis is a positive test.

Reagan Test



Gulick, iOrtho+, 2016

Reagan Test

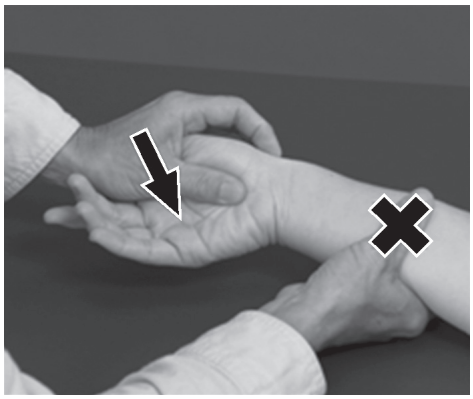
Sensitivity = 66-95.2%, Specificity = 64-87%

(+) LR = 1.69-7.1, (-) LR = 0.06-0.56

Varus and valgus stressing of the wrist and fingers is the same as any other collateral ligament testing. With the wrist or finger in neutral, the proximal radius/ulna is stabilized. A varus stress is used to incriminate the radial collateral ligament and a valgus stress for the ulnar collateral ligament. A positive test is joint line

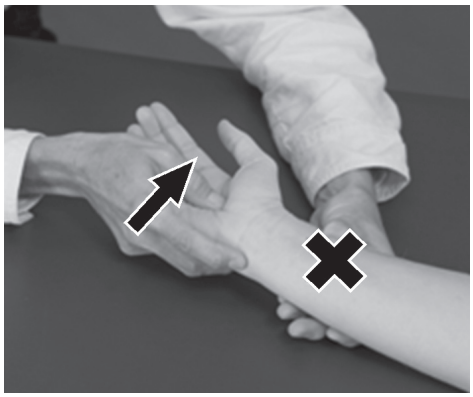
pain, gapping, or instability but one should compare bilaterally. Although varus/valgus testing is common for collateral ligaments, there are no statistics for these tests.

Wrist Varus Test



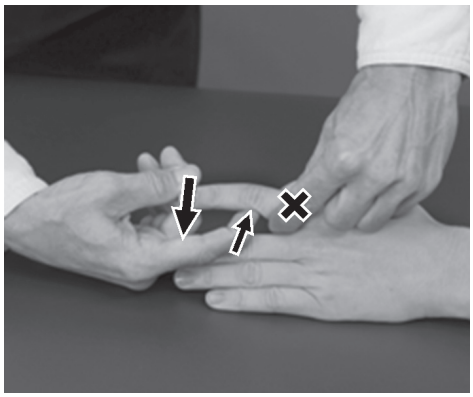
Gulick, iOrtho+, 2016

Wrist Valgus Test



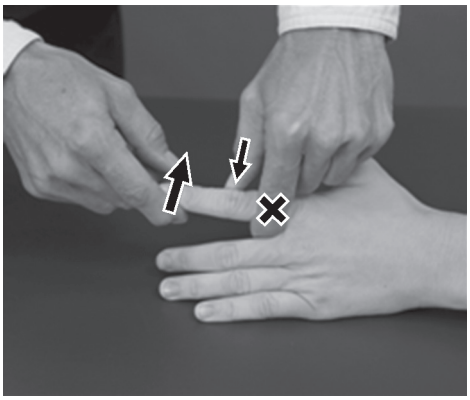
Gulick, iOrtho+, 2016

Finger Varus Test



Gulick, iOrtho+, 2016

Finger Valgus Test



Gulick, iOrtho+, 2016

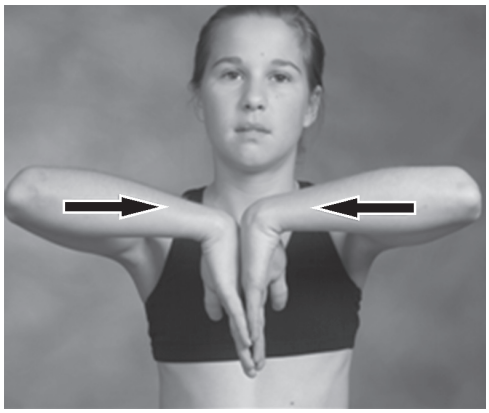
Carpal Tunnel

There are a number of tests used for the assessment of carpal tunnel syndrome.

The Phalen and reverse Phalen tests aim to compress the median nerve in the carpal tunnel with endrange flexion or extension, respectively. For the Phalen test, the client puts the back of both hands together with his/her arms elevated at the level of the shoulder. I like to remember the **Ph**alen Test by "**F**ingers-**F**alling." In contrast, the **R**everse Phalen is "fingers **R**ising." Thus the palms of the hands are pressed together with the arms at the level of the shoulders. A positive test is numbness or tingling into the median nerve distribution, i.e. palmar surface of digits 1, 2, and 3.

As you can see from the chart below, sensitivity and specificity span a very wide range. Likewise, the likelihood ratios are not very strong. Thus, the Phalen and reverse Phalen tests are not very valuable clinical tests by themselves. However, additional tests done with Phalen/reverse Phalen can be helpful (see clustering data below).

Phalen Test



Gulick, OrthoNotes, FA Davis Publishing, 2013

Reverse Phalen Test

Gulick, OrthoNotes, FA Davis Publishing, 2013

Phalen		Reverse Phalen
34 – 77%	Sensitivity	42 – 88%
40 – 100%	Specificity	35 – 93%
0.60 – 9.88	(+) LR	0.60
0.09 – 3.12	(-) LR	1.66

The Flick Maneuver is an interesting test. It does exactly that: flicks the wrist. Where most tests look to reproduce the symptoms, this test is positive when the symptoms (paresthesias into the median nerve distribution) subside as a result of the repeated flicking maneuver of the wrist.

Flick Maneuver

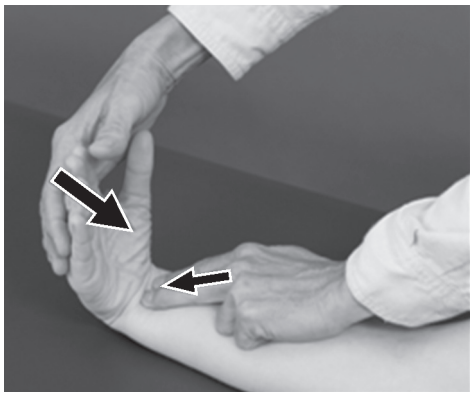
Gulick, OrthoNotes, FA Davis Publishing, 2013

Flick Maneuver
Sensitivity = 37-90%, Specificity = 30-92%
(+) LR = 1.3-23, (-) LR = 0.3-0.9

Again, sensitivity and specificity have a wide range; I tend to think that this may be due to the interpretation of the magnitude of the symptom relief being highly variable.

The carpal tunnel compression test simply involves positioning the wrist in at least 60 degrees of flexion and maintaining the position for 30 seconds. This position is essentially the same as a Phalen test without addressing the position of the shoulder.

Carpal Compression Test



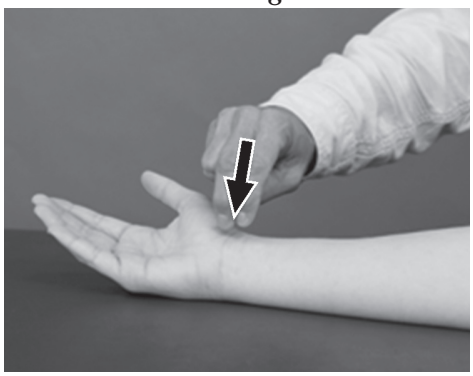
Gulick, iOrtho+, 2016

Thus, it is not a surprise to learn the statistics are almost exactly the same as the Phalen test.

The Tinel sign is being discussed here in the wrist section because of its ability to incriminate the median nerve; however, the Tinel sign can be performed at numerous locations of the body, i.e. elbow, shoulder, ankle. The test attempts to reproduce paresthesias by tapping on a superficial nerve.

The statistics for this test in isolation are not very good. Given the superficial anatomic location of the median nerve, it is not surprising to obtain a large number of false positives for this test. Unfortunately, the poor reliability may be attributed to the interpretation of the magnitude of the paresthesias produced.

Tinel Sign



Gulick, iOrtho+, 2016

Tinel Sign
Sensitivity = 23-90%, Specificity = 55-100%
(+) LR = 0.90-6.8, (-) LR = 0.12-1.10
Reliability = 0.35-0.81

When assessing the results of a test, it is always helpful when you have a contralateral structure to which you can compare. Obviously it is always desirable to obtain positive results from at least two tests for a given tissue to provide some reassurance of the diagnosis. Notwithstanding the less than stellar statistical data for the individual tests, there is really not much improvement in the clustering of carpal tunnel tests.

The chart below displays the statistical result when various combinations of carpal tunnel tests are performed.

CTS Tests	Sensitivity	Specificity
Flick & Phalen	49%	62%
Flick & Tinel	46%	68%
Phalen & Tinel	41%	72%

Triangular Fibrocartilage Complex

The triangular fibrocartilage complex (TFCC) is a cartilaginous tissue that occupies the gap between the ulna and the proximal row of carpals. It transmits an axial load between the carpals and the ulna, as well as provides stability to the ulna. The TFCC is composed of an articular disk, meniscus, and several ligaments (ulnolunate, ulnotriquetral, volar and dorsal radioulnar, and ulnar collateral). Compression of this tissue via a FOOSH can result in tears. The TFCC blood supply comes from three sources: ulnar artery and palmar and dorsal branches of the interosseous artery. However, these three arteries only supply 15-20% of the peripheral aspect of the TFCC; the central region and the radial attachment are avascular. Thus, the very poor healing properties can result in significantly longer healing times.

There are three TFCC tests: load test, press test, and GRIT. All of the tests utilize compression and/or ulnar deviation to "trap" the cartilage.

The TFCC load test begins with the wrist in ulnar deviation. A longitudinal load is then applied through the 5th metacarpal bone to the TFCC. A positive test is pain at the TFCC. Please remember, this position is similar to the clamp test for the scaphoid. Thus, being very distinct about the location of the pain could be important in distinguishing TFCC (ulnar joint line) pain from scaphoid (anatomic snuffbox) pain.

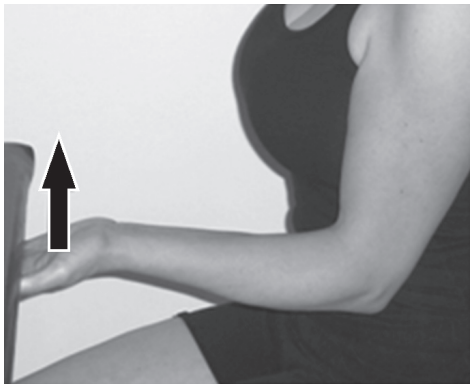
TFCC Load Test

Gulick, OrthoNotes, FA Davis Publishing, 2013

The TFCC press test has been reported to be performed in two different ways. Those two techniques are identified as Press Test 1 and Press Test 2.

The first technique involves pressing the hand on the underside of a table or any immoveable object. The client presses up like he/she is attempting to lift the table. This isometric contraction creates a load on the TFCC and can reproduce the client's pain.

Press Test 1



Gulick, iOrtho+, 2016

The second technique uses the UE's to press up from a chair. The closed chain position on the UE results in loading of the TFCC.

Press Test 2

Gulick, iOrtho+, 2016

The statistical data for the load and press tests report a value for sensitivity (100%) but no value for specificity. Thus, these tests appear to be excellent screening tools but we really don't know how much stock to place in them for diagnostic purposes.

Another test that indirectly assesses and incriminates the TFCC is the GRIT test – GRIT stands for Gipping Rotatory Impaction Test. Under normal circumstances, the act of gripping is accompanied by wrist extension and ulnar deviation; this combination of motions results in compression of the TFCC. Thus testing maximal grip strength can shed light on the health of the TFCC.

Typically, we would expect to see that supination and pronation grip strength are equitable (ratio 1:1).

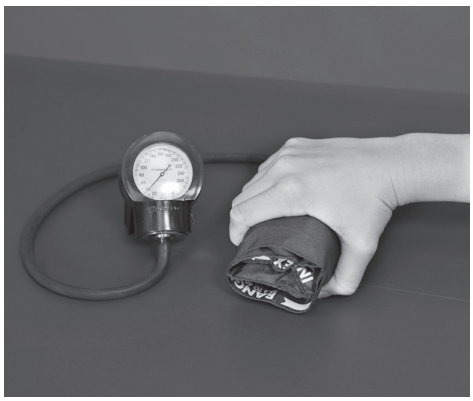
LaStayo and Weiss (2001) and DeSmet (2005) looked at the GRIT with the idea that we may see a difference in supination vs pronation grip. To test these conditions, the elbow is supported in extension (Espana-Romero et al (2010) reported that grip strength has the highest validity and reliability in elbow extension). A hand-held dynamometer is placed in the client's hand. Grip strength is then assessed in both forearm pronation and supination. If the supinated grip is markedly greater than the pronated grip (ratio > 1), an impaction of the TFCC is suggested.

GRIT Impaction:
- Supination strength
- Pronation strength

Pearl:
s**UP**ination = up on top
pr**ON**ation = on bottom

If you don't have a hand-held dynamometer, you can very easily do this with a blood pressure cuff. You can pump up the blood pressure cuff to approximately 20 millimeters of mercury, squeeze the cuff, and read the measurement. You then do the math, i.e. calculate the delta = measurement minus your starting value of 20.

BP in Pronation



Gulick, iOrtho+, 2016

BP in Supination

Gulick, iOrtho+, 2016

Note: chronic compression between the ulnar head and the TFCC results in ulnar impaction syndrome and can lead to degenerative tearing of the TFCC and chondromalacia of the lunate, triquetrum, and distal ulnar head.

Tenosynovitis

The Finkelstein test is used to assess the extensor pollicis brevis and abductor pollicis longus tendons for DeQuervain's tenosynovitis syndrome. It does so by putting the thumb inside the palm, wrapping the fingers around it, and moving into ulnar deviation. A positive test is pain in the tendons surrounding the anatomic snuffbox.

Statistical data definitely supports my clinical experience. I have found this test to produce a significant number of false positives; however, when the test is negative, it has a high statistical probability of ruling out DeQuervain's syndrome. In addition, one will often find the extensor pollicis brevis and abductor pollicis longus tendons to have palpable crepitis.

Finkelstein Test

Gulick, OrthoNotes, FA Davis Publishing, 2013

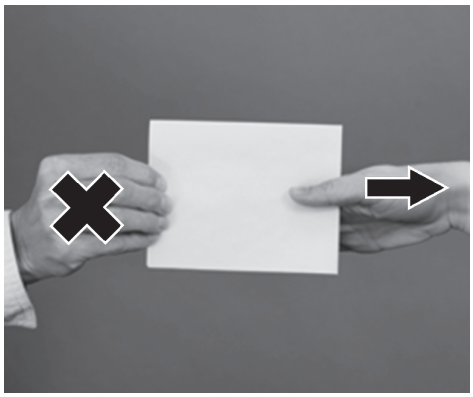
Finkelstein Test
Sensitivity = 81-100%, Specificity = 50-100%

(+) LR = 1.62, (-) LR = 0.38

Neural Tests

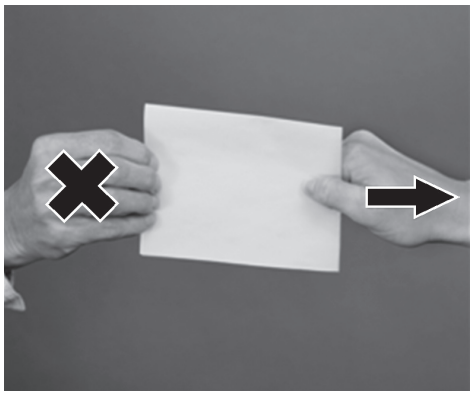
Besides the neural tension tests we discussed earlier, there are three tests that can be used to further test neural integrity of the wrist and hand. The Froment sign, Wartenberg test, and Egawa sign all assess the ulnar nerve.

Froment Test - Normal



Gulick, iOrtho+, 2016

Froment Test (+) Test

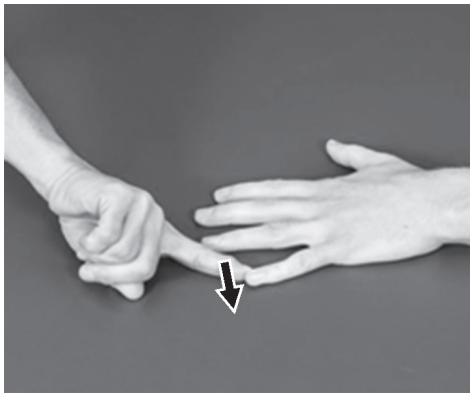


Gulick, iOrtho+, 2016

The Froment sign asks the client to hold a piece of paper between the thumb and index finger. The clinician then tries to tug the paper away. A positive test is when the client flexes the thumb distal interphalangeal (DIP) joint via the flexor pollicus longus (FPL). This occurs if the adductor pollicis muscle is impaired by an ulnar nerve problem. Hyperextension of the metacarpal phalangeal (MCP) joint may also occur as a form of compensation (AKA the Jeanne's sign).

The Wartenberg test is performed with the UE relaxed in a supported position. The clinician resists 5th digit adduction. If weakness is significantly greater on the involved side than the uninvolved side, the test would be considered positive.

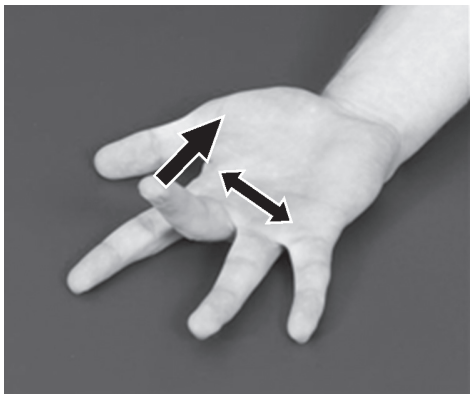
Wartenberg Test



Gulick, iOrtho+, 2016

Egawa sign assesses the ulnar nerve via the interossei muscle. The client flexes the 3rd digit and alternately performs radial and ulnar deviation of that digit. Inability to perform radial and ulnar deviation in the flexed position is a positive test.

Egawa Sign



Gulick, iOrtho+, 2016

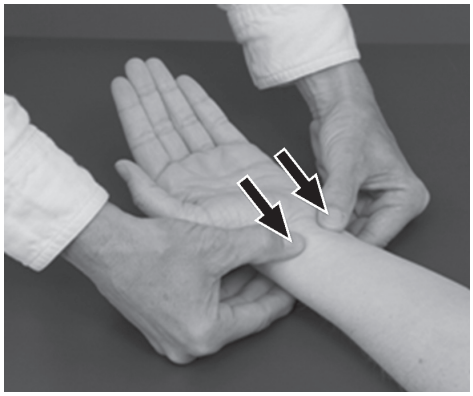
None of these tests have any statistical data associated with them; they are simply using basic anatomic knowledge of the innervation of specific muscles to determine if there is pathology.

Vascular Test

We previously discussed the Allen test for TOS, but there is also an Allen test to gage the vascularization of the hand.

The Allen test for the wrist begins with the hand supported but relaxed in supination. The clinician compresses both radial and ulnar arteries at the wrist and then instructs the client to clench the hand repeatedly to flush the blood out. With the client's hand open, the clinician releases pressure on the radial artery and counts the number of seconds it takes for the blood flow to be restored. The test is then repeated with the ulnar artery. If that fill time is more than 2 seconds, there would be concern about the blood flow to the hand.

Allen Test for the Wrist



Gulick, iOrtho+, 2016

There is no data regarding sensitivity or specificity for this test.

Manipulation Tests

There are also a number of tests that you can do that assess manual dexterity of the hand. It is really beyond the scope of this course to discuss all of these possibilities, but we will mention a few.

The Minnesota Rate of Manipulation looks at five gross motor tasks: placing, turning, displacing, and one hand and two-handed tasks.

The Purdue Pegboard takes five fine motor tasks and looks at performance with the right hand, left hand, bilaterally, and assembling.

The Moberg test looks at picking up things like bolts, screws and coins.

There is also the Simulated ADL, which looks at nineteen subtests performing tasks like buttoning, zipping, typing, utilizing a phone, and more.

You can use any of these to assess the hand dexterity of a client, and there are standardized norms for all of them which can help you discern how the client compared to 'normal.'

Conclusion

We have reviewed a plethora of clinical tests that can be very valuable in your clinical decision making. It is unfortunate that data does not exist for all clinical tests. However, that just reinforces the need for multiple signs, symptoms, and/or positive tests confirming or eliminating a given pathology.

With that thought in mind, you are challenged with the following self-reflective questions:

- What drew you to this course, and/or what needs does it address for you?
- Are you currently using statistics to determine which special tests you use?
- Do you anticipate that your practices will change as a result of information presented in this course?
- Are there additional tests you think are worthy of being included in your client examination?
- Is your decision to include other tests based on the literature or your personal experiences?
- Will you be incorporating additional special tests into your practice as a result of this course?

Space is provided for you to answer. (These answers need not be submitted - they are for your personal use.)

Additional Resources

As disclosed in the details of this course, the author of this home study course is the author of OrthoNotes (F.A. Davis Publishing, 2013) and the developer of iOrtho+ Mobile App.

In addition to the images, descriptions, and statistical data provided in this course, iOrtho+ has high quality videos for each of the more than 350 orthopedic tests.

iOrtho+ is available for all Apple and Android devices, including tablets. Imagine all this information with you at all times. In addition, iOrtho+ can be accessed on your computer (PC and MAC). So whatever device(s) you own, iOrtho+ is available for a one-time fee of only $14.99. There are no annual fees or membership dues, and iOrtho+ is updated several times a year to keep you current with the newest literature.

Simply go to www.iortho.xyz to enter your email, select a password, click register, and make your purchase. If you would like to see a video on iOrtho+ please go to https://www.youtube.com/watch?v=GuCD11B7giA.

Questions on course content or iOrtho+ may be sent to info@iortho.xyz.

Reference List

- Adson AW, Coffey JR. Cervical rib: a method of anterior approach for relief of symptoms by division of the scalenus anticus, Annals Surgery 1927;85:839-857
- Ahn D. Hand Elevation: A new test for carpal tunnel syndrome. Annuals of Plastic Surgery. 2001;46:120-124
- Alexander RD, Catalano LW, Barron OA, Glickel SZ. The extensor pollicis brevis entrapment test in the treatment of deQuervain's disease. Journal Hand Surgery. 2002;27:813-816
- Allen AW. Peripheral vascular disease. Archives Surgery. 1940;40(2):161-162
- Allen EV: Thromboangiitis obliterans: Methods of diagnosis of chronic occlusive arterial lesions distal to the wrist with illustrative cases, American Journal Medicine Science 1929; 178:237-244
- Alqunaee M, Galvin R, Fahey T. Diagnostic accuracy of clinical tests for subacromial impingement syndrome: A systematic review & meta-analysis. Archive of Physical Medicine & Rehabilitation. 2012;93:229-236
- Amatya P, Shah D, Gupta N, Bhatta NK. Clinical and ultrasonographic measurement of liver size in normal children. Indian Journal of Pediatrics. 2014 May;81(5):441-445
- Amirfeyz B, Gozzard C, Leslie IJ. Hand elevation test for assessment of carpal tunnel syndrome. Journal of Hand Surgery. 2005;30B(4):361-364
- Andrews JR, Gillogly S: Physical examination of the shoulder in throwing athletes. In Zarins B, Andrews JR, Carson WG, editors: Injuries to the throwing arm, Phila, 1985, WB Saunders
- Arguisuelas Martinez MD, Lopez Cubas C, Lluch Girbes E. Ulnar nerve neurodynamic test: Study of the normal sensory response in asymptomatic individuals. JOSPT. 2014;44(6):450-456
- Awan R, Smith J, Boon AJ. Measuring shoulder internal rotation range of motion: A comparison of 3 techniques. Archives Physical Medicine Rehabilitation. 2002;83:1229-1234
- Axe MJ: Acromioclavicular joint injuries in the athlete, Sports Medicine Arthroscopy Reviews 2000;8:182-191
- Babinski J, Froment J. Les signes objectifs de la paralysie de l'adducteur du pouse. Revue Neurol (Paris). 1918;1:484
- Bak K, Sorensen AKB, Jorgensen U, Nygaard M, Krarup AL, Thune C, Sloth C, Pedersen ST. The value of clinical tests in acute full-thickness tears of the supraspinatus tendon: Does subacromial lidocaine injection help in clinical diagnosis? Arthroscopy. 2010;26(6);734-742
- Barkun AN, Camus M, Green L, Meagher T, Coupal L, DeStempel J, Grover SA. The bedside assessment of splenic enlargement. American Journal of Medicine. 1991 Nov;91(5):512-518
- Barth JRH, Burkhart SS, DeBeer JF. Bear-Hug Test: A new & sensitive test for diagnosing a subscapular tear. Arthroscopy: Journal of Arthroscopy & Related Surgery. October 2006;22(10):1076-1084
- Batteson R, Hammond A, Burke F, Sinha S. The de Quervain's screening tool: Validity and reliability of a measure to support clinical diagnosis and management. Musculoskeletal Care. 2008;6(3):168-180
- Benzon HT, Cheng SC, Avram MJ, Molloy RE. Sign of complete sympathetic blockade: sweat test or sympathogalvanic response? Anesthesia and analgesia. 1985; 64(4): 415-419
- Blacker GJ , et al. Journal Hand Surgery. 1991;16-A:967-974.
- Booher JM, Thibodeau GA: Athletic injury assessment, St Louis, 1989, C.V. Mosby.
- Borstad JD. Resting position variables at the shoulder: Evidence to support a posture-improvement association. Physical Therapy. 2006;86:549-557
- Bradshaw DY, Shefner JM. Ulnar neuropathy at the elbow. Neurology Clinics. Aug 1999;17(3):447-61
- Bratton RL, Whiteside, JW, Hovan MJ, Engle RL, Edwards FD. Diagnosis & Treatment of Lyme Disease. Mayo Clinic. 2008 May: 566-571
- Bruske J, Bednarski M, Grzelee H, Zyluk A. The usefulness of Phalen Test & the Hoffman-Tinel sign in the diagnosis of carpal tunnel syndrome. Acta Orthopaedica Belgica. 2002;68(2):141-150
- Buchberger DJ: Introduction of a new physical examination procedure for the differentiation of acromioclavicular joint lesions & subacromial impingement, Journal Manipulative Physiological Therapeutics 1999;22:316-321
- Burkhart SS, Morgan CD, Kibler WB: The disabled throwing shoulder: spectrum of pathology, part three: the SICK scapula, scapular dyskinesia, the kinetic chain, and rehabilitation, Arthroscopy. 2003;19:641-661.

- Burkhart SS, Morgan CD, Kibler WB: The disabled throwing shoulder: spectrum of pathology, part two: evaluation & treatment of SLAP lesions in throwers, Arthroscopy 2003;19:531-539
- Butler, DS. Mobilisation of the Nervous System. Singapore: Churchill Livingstone, 1991
- Calis M, Akgun K, Birtane M, Karacan I, Calis H, Tuzun F. Diagnostic values of clinical diagnostic tests in subacromial impingement syndrome. Annuals of Rheumatic Disease. 2000;59(1):44-47
- Callahan AD: Sensibility testing. In Hunter J, Schneider LH, Mackin EJ, Callahan AD (eds): Rehabilitation of the hand: surgery and therapy, St Louis, 1990, C.V. Mosby.
- Carbone S, Gumina S, Vestri AR, Postacchini R. Coracoid pain test: a new clinical sign of shoulder adhesive capsulitis. International Orthopedics. 2010;34(3):385-388
- Chao S, Thomas S, Yucha D, Kelly JD, Driban J, Swanik K. An electromyographic assessment of the bear hug: an examination for the evaluation of the subscapularis muscle. Arthroscopy. 2008;24(11):1265-1270
- Chronopoulus E, Kim TK, Park HB et al: Diagnostic value of physical tests for isolated chronic acromioclavicular lesions, HB American Journal Sports Medicine 2004;32(3):655-661
- Clark HD, McCann PD: Acromioclavicular joint injuries, Orthopedic Clinics North America. 2000;31:177-187
- Cleland J, Orthopaedic Clinical Examination: An Evidence-Based Approach for Physical Therapists. Saunders Elsevier, Phila. 2007
- Coppieters M, Stappaerts K, Janssens K. Reliability & detecting onset of pain & submaximal pain during neural provocation testing of the upper quadrant. Physiologic Research International. 2002;7:34-42
- Coppieters MW, Stappaerts KH, Everaert DG, Staes FF. Addition of test components during neurodynamic testing: effect of ROM & sensory responses. Journal of Orthopedics & Sports Physical Therapy. 2001;31:226-237
- Corso G. Impingement Relief Test: An Adjunctive Procedure to Traditional Assessment of Shoulder Impingement Syndrome. Journal of Orthopedics & Sports Physical Therapy. 1995;22(5):183-192.
- Davies GJ, Gould JA, Larson RL: Functional examination of the shoulder girdle, Physical Therapy Sports Medicine 1981;9:82-104
- De Smet L. Magnetic resonance imaging for diagnosing lesions of the triangular fibrocartilage complex. Acta Orthop Belg. 2005;71(4):396-398.
- deKrom MC, Knipschild PG, Kester AD, Spaans F. Efficacy of provocative tests for diagnosis of carpal tunnel syndrome. Lancet. 1990;335(8686):393-395
- Depietropaolo DL, Powers JH, Gill JM, Foy FJ. Diagnosis of Lyme Disease. American Family Physician. 2005;72(2):297-304
- Donatelli RA, Wooden MJ editors: Orthopaedic Physical Therapy, ed 4, St Louis, 2010, Churchill Livingston.
- Donta ST. Issues in the Diagnosis & Treatment of Lyme Disease. Open Neurology Journal. 2012;6:140-145
- Durkan JA. The carpal compression test: an instrumented device for diagnosing carpal tunnel syndrome. Orthopedic Review. 1994;23:522-525
- Dutton M: Orthopedic examination, evaluation & intervention, New York, 2004 McGraw Hill
- Ebinger N, Magosch P, Lichtenberg S, Habermeyer P. A new SLAP test: the supine flexion resistance test. Arthroscopy. 2008:24:500-505
- Edwards TB, Bostick RD, Greene CC, Baratta RV, Drez D. Inter-observer and intra-observer reliability of the measurement of shoulder internal rotation by vertebral level. Journal of Shoulder & Elbow Surgery. 2002; 11:40-42.
- El Miedany Y, Ashour S, Youssef S, et al. Clinical diagnosis of carpal tunnel syndrome: old tests-new concepts. Joint Bone & Spine. 2008;75:451-457
- Ellman H, Harris E, Kay SP: Early degenerative joint disease simulating impingement syndrome: Arthroscopic findings, Arthroscopy. 1992; 8:482-487
- Feindel W, J Stratford J. Cubital tunnel compression in tardy ulnar palsy. Canadian Medical Association Journal. Mar 1 1958;78(5):351-353
- Fertl E, Wober C, Zeithofer J. The serial use of 2 provocative tests in the clinical diagnosis of carpal tunnel syndrome. Acta Neurology Scandanavia. 1998;98:328-332
- Finkelstein H: Stenosing tendovaginitis at the radial styloid process, Journal Bone Joint Surgery 1930;12:509
- Fodor D, Poanta L, Felea I, Rednic S, Bolosiu H. Shoulder impingement syndrome: Correlations between clinical tests & ultrasonographic findings. Orthopedics, Traumatology, Rehabilitation. 2009;11(2):120-126
- Foreman TA, Foreman SK, Rose NE. Clinical approach to diagnosing wrist pain. American Family Physician. 2005;72(9):1753-1758
- Fowler EM, Horsley IG, Rolf CG. Clinical & arthroscopic findings in recreationally active patients. Sports Medicine, Arthroscopy, Rehabilitation, Therapy, & Technology. 2010;2:1-8
- Garmer DA, Jones A, McHorse KJ. The ulnar nerve bias upper limb neurodynamic tension test: An investigation of responses in asymptomatic subjects. APTA Conference Abstract, Cincinnati OH 2002
- Gasharrini G. et al. Celiac Disease: What's new about it? Digestive Diseases. 2008;26:121-127
- Gates TJ. Screening for Cancer. American Family Physician. 2014;90(9):625-631
- Gendelman O, Itzhaki D, Makarov S, Bennun M, Amital H. A randomized double-blind placebo-controlled study adding high dose vitamin D to analgesic regimens in patients with musculoskeletal pain. Lupus. 2015;24(4-5):483-489
- Gengo FM , et al. Effects of Ibuprofen on the Magnitude & Duration of Aspirin's Inhibition of Platelet Aggregation. Clinical Pharmacology. 2008;48:117-122
- George SZ, Beneciuk JM, Bialosky JE, Lentz TA, Zeppieri Jr G, Pei Q, & Wu SS. Development of a Review-of-System Screening Tool for Orthopedic Physical Therapists: Results from the Optimal Screening for Prediction of Referral & Outcome Cohort. JOSPT. 2015;45(7):512-526.
- Gerber C, Krushell RJ: Isolated ruptures of the tendon of the subscapularis muscle, Journal Bone Joint Surgery British 1991;73:389-394
- Gill HS, El Rassi G, Bahk MS, et al. Physical Examination for partial tears of the biceps tendon. American Journal of Sports Medicine. 2007;35:1334-1340
- Gillard J, Perez-Cousin M, Hachulla E, Remy J, Hurtevent JF, Vinckier L, Thevenon A, Duquesnoy B. Diagnosing thoracic outlet syndrome: contribution of provocative tests, ultrasonography, electrophysiology, and helical computed tomography in 48 patients. Joint Bone Spine. 2001 Oct; 68(5): 416-424

- Gillard J, Perez-Cousin M, Hachulla E, Remy J, Hurtevent JF, Vinckier L, Thevenon A, Duquesnoy B. Diagnosing thoracic outlet syndrome: contribution of provocative tests, ultrasonography, electrophysiology, and helical computed tomography in 48 patients. Joint Bone Spine. 2001 Oct; 68(5): 416-424
- Gillooly JJ, Chidambaram R, Mok D. The lateral Jobe test: A more reliable method of diagnosing rotator cuff tears. International Journal of Shoulder Surgery. 2010;4(2):41-43
- Godfried MH, Briet E. Physical diagnosis: percussion and palpation of the spleen. Nederlands tijdschrift voor geneeskunde 2000 Jan 29; 144(5): 216-219
- Goldman SB, Brininger TL, Schrader JW, Koceja DM. A review of clinical tests & signs for the assessment of ulnar neuropathy. Journal of Hand Therapy. 2009;22:209-220
- Gonzalez del Pinto, et al. Value of the carpal compression test in the diagnosis of carpal tunnel syndrome. Journal Hand Surgery British. 1997;22:38-41
- Greis PE, Kuhn JE, Schultheis J et al: Validation of the lift-off sign test & analysis of subscapularis activity during maximal internal rotation, American Journal Sports Medicine 1996;24:589-593
- Guanche CA, Jones DC. Clinical testing for tears of the glenoid labrum. Arthroscopy. 2003;19(5):517-523
- Gulick DT, Borger A, McNamee L. Rotational Lack: A Functional Approach to Assess Shoulder Mobility, PPTA Annual Conference, Seven Springs Mountain, October 2005
- Gulick DT. OrthoNotes, FA Davis, Phila. 2013.
- Gulick DT. Screening Notes, FA Davis, Phila. 2006
- Gunnarsson LG, Amilon A, Hellstrand P, Leissner P, Philipson L. The diagnosis of carpal tunnel syndrome; sensitivity & specificity of some clinical & electrophysiological tests. Journal Hand Surgery. 1997;22:34-37
- Halperin JJ, Baker P, Wormser GP. Common Misconceptions about Lyme Disease. American Journal of Medicine. 2013;126(3):264e1-264e7
- Hansen P, Mickelsen P, Robinson L. Clinical utility of the flick maneuver in diagnosing carpal tunnel syndrome. American Journal of Physical Medicine & Rehabilitation. 2004;83:363-367
- Hartz CR, Linscheid CL, Gramse RR, Daube JR. The pronator teres syndrome: compressive neuropathy of the median nerve. The Journal of Bone and Joint Surgery (American) 1981;63(6): 885-890
- Hawkins RJ, Kennedy JC: Impingement syndrome in athletics, American Journal Sports Medicine 1980;8:151-163
- Hayes K, Walton JR, Szomor ZR, Murrell GA. Reliability of five methods for assessing shoulder range of motion. Australian Journal Physiotherapy. 2001;47(4):289-294
- Hegedus EJ, Cook C, Lewis J, Wright A, Park J-Y. Combing orthopedic special tests to improve diagnostic pathology. Physical Therapy in Sport. 2015;16:87-92
- Heller L, Ring H, Costeff H, Solzi P. Evaluation of Tinel's & Phalen's signs in diagnosis of the carpal tunnel syndrome. European Neurology. 1986;25(1):40-42
- Hertel R, Ballmer FT, Lambert SM et al: Lag signs in the diagnosis of rotator cuff rupture, Journal of Shoulder Elbow Surgery. 1996;5:307-313
- Hodges A. A-Z of Plastic Surgery. Oxford University Press. 2008
- Hoffman R. National Comprehensive Cancer Network (NCCN). 2015
- Hoving JL, Buchbinder R, Green S, Forbes A, Bellamy N, Brand C, Buchanan R, Hall S, Patrick M, Ryan P, Stockman A. How reliably do rheumatologists measure shoulder movement? Annals Rheumatology & Disease. 2002; 61: 612-616.
- Howard M, Lee C, Dellon AL. Documentation of brachial plexus compression utilizing provocative neurosensory & muscle testing. Journal Reconstructive Microsurgery. 2003;19(5):303-312
- Inman VT, Saunders SJB, Abbott LC. Observations on the function of the shoulder joint. Clinical Orthopedics. 1996;330:3-12
- Itoi E, Kido T, Sano A, Urayama M, Sato K. Which is more useful, the full can test or the empty can test in detecting the torn supraspinatus tendon. American Journal of Sports Medicine. 1999;27(1):65-68
- Jarvis MA, Jarvis CL, Jones PRM, Spyt TJ. Reliability of Allen's test in selection of patients for radial artery harvest. Society of Thoracic Surgeons. 2000;70:1362-1365
- Johnson CD. ABC of the Upper GI Track: Upper Abdominal Pain: Gall Bladder, British Medical Journal. 2001;323;1170-1173
- Johnson RP, Carrera GP: Chronic capitolunate instability, J Bone Joint Surg Am. 1986; 68:1164-1176
- Joshi R, Singh A, Jajoo N, Kalantri SP. Accuracy and reliability of palpation and percussion for detecting hepatomegaly: a rural hospital-based study. Indian Journal of Gastroenterology. 2004 Sept-Oct;23(5):171-174
- Katz J, Larson M, Sabra A, et al. The carpal tunnel syndrome: diagnosis utility of the history & physical examination findings. Annals International Medicine. 1990;112:321-327
- Kaul MP, Pagel KJ, Wheatley MJ, Dryden JD.. Carpal compression test & pressure provocation test in veterans with median-distribution paresthesias. Muscle Nerve. 2001;24:107-111
- Kelly SM, Brittle N. The value of physical tests for subacromial impingement syndrome: A study of diagnostic accuracy. Clinical Rehabilitation. 2010;24:149-158
- Keneally M. The upper limb tension test. In: Proceedings, Manipulative Therapists Association of Australia, 4th biennial conference, Brisbane, 1985
- Kibler WB, Sciascia AD, Hester P, Dome D, Jacobs C. Clinical utility of traditional and new tests in the diagnosis of biceps tendon injuries and superior labrum anterior and posterior lesions in the shoulder. American Journal of Sports Medicine. 2009;37(9):1840-1847
- Kibler WB. Specificity & sensitivity of the anterior slide test in throwing athletes with superior glenoid labral tears, Arthroscopy 1995;11:296-300
- Kim SH, Ha KI, Ahn JH, Kim SH, Choi HJ. Biceps load test II: a clinical test for SLAP lesions of the shoulder, Arthroscopy 2001;17(2):160-164
- Kim SH, Ha KI, Han KY: Biceps load test: a clinical test for superior labrum anterior & posterior lesions in shoulder with recurrent anterior dislocations, American Journal Sports Medicine. 1999;27:300-303
- Kim SH, Park JS, Jeong WK et al: The Kim test: a novel test for posteroinferior labral lesion of the shoulder - a comparison to the jerk test, American Journal Sports Medicine 2005;33:1188-1191
- Kleinrensink GJ, Stoeckart R, Mulder PGH, Hock GVD, Broek TH, Vleeming A, Snijders CJ. Upper limb tension tests as tools in the diagnosis of nerve & plexus lesions: Anatomical & biomechanical aspects. Clinical Biomechanics. 2000;15:9-14.

- Konin JG, Wiksten DL, Isear JA, Brader H. Special tests for orthopedic examination. 3rd ed. Thorofare, NJ: SLACK incorporated; 2006.
- Krendel DA, Jobsis M, Gaskell Jr PC, & Sanders DB. The flick sign in carpal tunnel syndrome. Journal Neurology Neurosurgery Psychiatry. 1986 February; 49(2): 220-221
- Kuhlman KA, Hennessey WJ. Sensitivity & specificity of carpal tunnel syndrome signs. American Journal of Physical Medicine & Rehabilitation. 1997;76:451-457
- LaJoie AS, McCabe SJ, Thomas B, Edgell SE. Determining the sensitivity & specificity of common diagnostic tests for carpal tunnel syndrome using latent class analysis. Plastic Reconstructive Surgery. 2005;116:502-507
- Lan LB. The scaphoid shift test. The Journal of Hand Surgery. 1993;18A(2):366-368
- LaStayo P, Howell J. Clinical provocative tests used in evaluating wrist pain: a descriptive study. Journal Hand Therapy. 1995;8:10-17
- LaStayo P, Weiss S. The GRIT: a quantitative measure of ulnar impaction syndrome. Journal Hand Therapy. 2001; 14(3):173-179.
- Lauder TD, et al. Predicting electrodiagnostic outcome in patients with upper-limb symptoms: Are history & physical examination helpful? Archives of Physical Medicine & Rehabilitation. 2000;81:436-441
- Lauder TD, et al. Predicting electrodiagnostic outcome in patients with upper-limb symptoms: Are history & physical examination helpful? Archives of Physical Medicine & Rehabilitation. 2000;81:436-441
- Leard J, Breglio L, Fraga L, Ellrod N, Nadler L, Yasso M, Fay E, Ryan K, Pellecchia GL. Reliability & concurrent validity of the figure-of-eight method of measuring hand size in patients with hand pathology. JOSPT. 2004;24:335-340
- Lee AD, Agarwal S, Sadhu D. Doppler Adson's test: predictor of outcome of surgery in non-specific thoracic outlet syndrome. World Journal of Surgery. 2006;30(3):291-292
- Lester B, et al. Press test for office diagnosis of triangular fibrocartilage complex tears of the wrist. Annals Plastic Surgery. 1995;35:41-45
- Lewis CL, Sahrmann SA. Acetabular labral tears. Physical Therapy. 2006;86(1):110-121
- Lindgre K-A. Thoracic outlet. International Musculoskeletal Medicine. 2010;32(1):17-24
- Litaker D, Pioro M, El Bilbeisi H, et al. Returning to the bedside: using history & physical examination to identify rotator cuff tears. Journal of American Geriatric Society. 2000;48:1633-1637
- Liu SH, Henry MH, Nuccion SL: A prospective evaluation of a new physical examination in predicting glenoid labral tears, American Journal Sports Medicine 1996;24:721-725
- Lyons AR, Tomlinson JE. Clinical diagnosis of tears of the rotator cuff. Journal of Bone & Joint Surgery. 1992;74-B(3):414-415
- Lyons RP, Green A: Subscapularis tendon tears, Journal American Academy Orthopedic Surgery 2005;13:353-363
- MacDermid JC, Kramer JF, Woodbury MG, et al. Interrater reliability of pinch & grip strength measurements in patients with cumulative trauma disorders. Journal of Hand Therapy. 1994;7:10-14
- MacDonald PB, Clark P, Sutherland K: An analysis of the diagnostic accuracy of the Hawkins & Neer subacromial impingement signs, Journal Shoulder Elbow Surgery 2000;9(4):299-301
- Magee D. Orthopedic Physical Assessment. 5th ed. Philadelphia, PA: WB Saunders Company; 2008.
- Manske RC, Jones SM, Bryan TL, et al. Intrarater & interrater reliability of upper extremity muscle length testing & a comparison of upper extremity muscle length in normal males & college baseball pitchers. JOSPT. 2006;36(1):A83
- Manvell JJ, Manvell N, Snodgrass SJ, Reid SA. Improving the radial nerve neurodynamic test: An observation of tension of the radial, median, & ulnar nerves during upper limb positioning. Manual Therapy. 2015
- Maranhao ET, Maranhao-Filho P, Lima MA, Vincent MB. Can Clinical Tests Detect Early Signs of Monohemispheric Brain Tumors? Journal of Neurologic Physical Therapy. 2010;34(3):145-149
- Martin, S. Against the grain: An overview of celiac disease. American Academy of Nurse Practitioners. July 2007:243-250
- Marx RG, Bombardier C, Wright JC. What do we know about the reliability & validity of physical examination tests used to examine the upper extremity? Journal of Hand Surgery. 1999;24A:185-193
- McClellan DL, Swash M. Longitudinal sliding of the median nerve during movements of the upper limb. J Neurol Neurosurgery Psychiatry, 1976;39:566-569
- McClusky CM: Classification & diagnosis of glenohumeral instability in athletes, Sports Medicine Arthroscopic Reviews 2000;8:158-169
- McFarland EG, Kim TK, Savino RM. Clinical assessment of three common tests for superior labral anterior-posterior lesions. American Journal of Sports Medicine. 2002;30(6):810-815
- McFarland EG, Tanaka MJ, Garzon-Muvdi J, Jia X, Petersen SA. Clinical & imaging assessment for superior labrum anterior & posterior lesions. Current Sports Medicine Reports. 2009;8(5):234-239
- Michener LA, Walsworth MK, Doukas WC, Murphy KP. Reliability & diagnostic accuracy of 5 physical examination tests & combination of tests for subacromial impingement. Archives of Physical Medicine & Rehabilitation. 2009;90(11):1898-1903
- Miller CA, Forrester GA, Lewis JS. The validity of the lag signs in diagnosing full-thickness tears of the rotator cuff: a preliminary investigation. Archives Physical Medicine Rehabilitation. 2008;89(6):1162-1168
- Miller RG. The cubital tunnel syndrome: diagnosis & precise localization. Annals Neurology. Jul 1979;6(1):56-59
- Mimori K, Muneta T, Nakagawa T, Shinomiya K. A new pain provocation test for superior labral tears of the shoulder. American Journal Sports Medicine. 1999;27:137-142
- Moldaver J: Tinel sign: Its characteristics & significance, Journal Bone Joint Surgery American 1978;60:412-414
- Morris HH, Peters BH. Pronator syndrome: clinical and electrophysiological features in seven cases. Journal of Neurology, Neurosurgery, and Psychiatry. 1976;39(5): 461-464.
- Murell GAC. How to treat shoulder dysfunction. Australian Doctor. 2004;17:23-30
- Murrell GA, Walton JR. Diagnosis of rotator cuff tears. Lancet. 2001;357:769 & 1452
- Myers TH, Zemanovic JR, Andrews JR. The resisted supination external rotation test. American Journal of Sports Medicine. 2005;33(9): 1315-1320
- Nakagawa S, Yoneda M, Hayashida K, Obata M, Fukushima S, Miyazaki Y. Forced shoulder abduction & elbow flexion test: a new simple clinical test to detect superior labral injury in the throwing shoulder. Arthroscopy. 2005; 21:1290-1295

- Neer CS, Welsh RP. The shoulder in sports, Orthopedic Clinics North America. 1977;8:583-591
- Novak CB, Lee GW, Mackinnon SE, Lay L. Provocation testing for cubital tunnel syndrome. Journal Hand Surgery American. 1994;19:817-820.
- Obrien SJ, Pagnani M, Fealy S, McGlynn S, Wilson J. The active compression test: A new & effective test for diagnosing labral tears & acromioclavicular joint abnormality. American Journal of Sports Medicine. 1998;26:610-614
- O'Connell DG et al. Special Tests of the Cardiopulmonary, Vascular & GI Systems, 2011
- O'Driscoll SW, Lawton RM, Smith AM: The "moving valgus stress test" for medial collateral ligament tears of the elbow, American Journal Sports Medicine 2005;33:231-239
- Oh JH, Kim JY, Kim WS, et al. The evaluation of various physical examinations for the diagnosis of type II superior labrum anterior & posterior lesion. American Journal of Sports Medicine. 2008;36:353-359
- O'Riain S: Shrivel test: A new and simple test of nerve function in the hand, Br Med J. 1973; 3:615-616
- Ostor AJ, Richards CA, Prevost AT, Hazleman BL, Speed CA. Interrater reproducibility of clinical tests for rotator cuff lesions. Annals Rheumatic Disease. 2004;63:1288-1292
- Pandya NK, Colton A, Webner D, Sennett B, Huffman GR, Physical Examination and Magnetic Resonance Imaging in the Diagnosis of Superior Labrum Anterior-Posterior Lesions of the Shoulder: A Sensitivity Analysis. Arthroscopy. 2008:24(3):311-317
- Parentis MA, Glousman RE, Mohr KS, et al. An evaluation of the provocative tests for superior labral anterior posterior lesions. American Journal of Sports Medicine. 2006;34:265-268
- Parentis MA, Mohr KJ, ElAttrache NS. Disorders of the superior labrum: review & treatment guidelines. Clinical Orthopedics Related Research. 2002:77-87
- Park HB, Yokota A, Gill HS, El Rassi G, McFarland EG. Diagnostic accuracy of clinical tests for the different degrees of subacromial impingement syndrome. Journal of Bone & Joint Surgery. 2005;87-A(7):1446-1455
- Petersen SA: Arthritis and arthroplasty. In Hawkins RJ, Misamore GW, editors: Shoulder injuries in the athlete, New York, 1996, Churchill Livingstone.
- Plews MC, Delinger M. The false-positive rate of thoracic outlet syndrome shoulder maneuvers in healthy patients. Academy Emergency Medicine. 1998;5(4):337-342
- Posner J. Compressive ulnar neuropathies at the elbow: I. Etiology & diagnosis. Journal American Academy Orthopedic Surgery.1998; 6: 282-288
- Post M, Cohen J. Impingement syndrome: a review of late stage II & early stage III lesions. Clinical Orthopedics. 1986;207:127-132
- Powell JM, Lloyd GJ, Rintoul RF. New clinical test for fracture of the scaphoid. Canadian Journal Surgery. 1988;31:237-238
- Powell JW, Huijbregts PA. Concurrent Criterion-Related Validity of Acromioclavicular Joint Physical Examination Tests: A Systematic Review. The Journal of Manual & Manipulative Therapy. 2006;14(2):E19 - E29
- Pryse-Phillips WE. Validation of a diagnostic sign in carpal tunnel syndrome. Journal Neurology Neurosurgery Psychiatry. 1984 Aug;47(8):870-872
- Rayan GM, Jensen C. Thoracic outlet syndrome: provocative examination maneuvers in a typical population. Journal of Shoulder & Elbow Surgery. 1995;4(2):113-117
- Reese NB, Bandy WD. Joint Range of Motion & Muscle Length Testing. Philadelphia: Saunders, 2002
- Regan WD, Morrey BF: The physical examination of the elbow. In Morrey BF, editor: The elbow & its disorders, Philadelphia, 1993, WB Saunders.
- Reiman MP, Manske RC. Functional Testing in Human Performance. Champaign, IL: Human Kinetics, 2009

Reese NB, Bandy WD. Joint Range of Motion & Muscle Length Testing. Philadelphia: Saunders, 2002

- Rigsby R, Sitler M, Kelly JD. Subscapularis tendon integrity: an examination of shoulder index tests. Journal of Athletic Training. 2010;45(4):404-406
- Roos DB. Historical perspectives & anatomical considerations. Thoracic outlet syndrome. Seminars Thoracic Cardiovascular Surgery. 1996;8:183-189
- Scheibel M, Magosch P, Pritsch M, Lichtenberg S. The belly-off sign: A new clinical diagnostic sign for subscapularis lesions. Arthroscopy. 2005;21(10):1229-1235
- Shaffer BS: Painful conditions of the acromioclavicular joint, Journal American Academy Orthopedic Surgery 1999;7:176-188
- Shenenberger DW. Cutaneous Malignant Melanoma: A Primary Care Perspective. American Family Physician. 2012;85(2):161-168
- Shin AY, Battaglia MJ, Bishop AT: Lunotriquetral instability: diagnosis and treatment, J Am Acad Orthop Surg 2000;8:170-179
- Silva L, Andreu JL, Munoz P, et al. Accuracy of physical examination in subacromial impingement syndrome. Rheumatology (Oxford). 2008;47:679-683
- Stetson WB, Templin K. The crank test, the O'Brien test, & routine magnetic resonance imaging scans in the diagnosis of labral tears. American Journal of Sports Medicine. 2002;30(6):806-809
- Stromberg WB, McFarlane RM, Bell JL, et al: Injury of the median and ulnar nerves: 150 Cases with an evaluation of Moberg ninhydrin test, J Bone Joint Surg Am. 1961;43:717-730.
- Szabo RM, Slater RR. Diagnostic testing in carpal tunnel syndrome. Journal of Hand Surgery. 2000;25(1):184
- Taleisnik J: Carpal instability, Journal Bone Joint Surgery American. 1988; 70:1262-1268
- Tamayo SG, Rickman LS, Mathews WC, et al. Examiner dependence on physical diagnostic tests for the detection of splenomegaly: A prospective study with multiple observers. Journal of general internal medicine 1993 Feb; 8(2): 69-75
- Tay SC, Tomita K, Berger RA. The ulnar fovea sign for defining ulnar wrist pain: an analysis of sensitivity and specificity. Journal Hand Surgery American. 2007 Apr;32(4):438-44
- Teitelbaum JS, Eliasziw M, Garner M. Tests of Motor Function in Patients Suspected of having Mild Unilateral Cerebral Lesions. Canadian Journal of Neurological Science. 2002;29:337-344
- Tennet DT, Beach WR, Meyers JF. Clinical sports medicine update: A review of the special tests associated with shoulder examination. American Journal of Sports Medicine. 2003;31:154-160
- Tetro AM, Evanoff BA, Hollstien SB, Gelberman RH. A new provocation test for carpal tunnel syndrome. Assessment of wrist flexion & nerve compression. Journal Bone & Joint Surgery. 1998;80:493-498
- Ticker JB, Warner JJ: Single-tendon tears of the rotator cuff: Evaluation & treatment of subscapularis tears, Orthopedic Clinical North American 1997;28:99-116

- Tokish JM, Decker MJ, Ellis HB, Torry MR, Hawkins RJ. The belly-press test for the physical examination of the subscapularis muscle: electromyographic validation & comparison to the lift-off test. Journal of Shoulder & Elbow Surgery. 2003;12(5):427-430
- Tubiana R, Thomiene JM, Mackin E: Examination of the hand and wrist, St Louis, 1996, C.V. Mosby.
- Urbano FL, Carroll MB. Murphy's sign of cholecystitis. Hospital Physician. 2000;11:51-52, 70
- Valadic AL, Jobe CM, Pink MM et al: Anatomy of provocative tests for impingement syndrome of the shoulder, Journal Shoulder Elbow Surgery 2000;9:36-46
- Vasudevan TM, van Rij AM, Nukada H, Taylor PK. Skin wrinkling for the assessment of sympathetic function in the limbs. Australian & New Zealand Journal of Surgery. 2000;70(1):57-59
- Waeckerle JF. A prospective study identifying the sensitivity of radiographic findings & the efficacy of clinical findings in carpal navicular fractures. Annals Emergency Medicine. 1987;16:733-737.
- Wainner RS, Fritz JM, Irrgang JJ, Delitto A, Allison S, Boninger ML. Development of a clinical prediction rule for the diagnosis of carpal tunnel syndrome. Archives Physical Medicine Rehabilitation. 2005;86:609-618
- Wainner RS, Fritz JM, Irrgang JJ, et al. Reliability & diagnostic accuracy of the clinical examination & patient self-report measures for cervical radiculopathy. Spine 2003;28:52-62
- Walch G, Boulahia A, Calderone S et al: The dropping & hornblower signs in evaluating rotator cuff tears, Journal Bone Joint Surgery British 1998;80:624-628
- Walsworth M, Mills III J, Michener L. Diagnosing suprascapular neuropathy in patients with shoulder dysfunction: A report of 5 cases. Journal of the American Physical Therapy Association. 2004;84:359-372
- Walsworth, MK, Doukas WC, Murphy KP, Mielcarek BJ, Michener LA. Reliability & Diagnostic Accuracy of History and Physical Examination for Diagnosing Glenoid Labral Tears. American Journal Sports Medicine. 2008; 36(1):162-168
- Walton J, Mahajan S, Paxinos A, et al. Diagnostic value of tests for acromioclavicular joint pain. Journal of Bone & Joint Surgery. 2004;86-A:807-812
- Wartenberg R. A sign of ulnar palsy. Journal American Medical Association. 1939;112:1688
- Watson HK, Ashmead D, Makhlouf MV: Examination of the scaphoid, Journal Hand Surgery American 1988;13:657-660
- Watson HK, Ballet FL: The SLAC wrist: scapulolunate advanced collapse pattern of degenerative arthritis, Journal Hand Surgery American 1984;9:358-365
- Wertsch JJ, Melvin J. Median nerve anatomy and entrapment syndromes: a review. Archives of Physical Medicine and Rehabilitation. 1982;63(12):623-627
- Wilk KE, Reinold MM, Dugas JR, Arrigo CA, Moser MW, Andrews JR. Current concepts in the recognition & treatment of superior labral (SLAP) lesions. Journal of Orthopedic & Sports Physical Therapy. 2005;35:273-291
- Wolf EM, Agrawal V. Transdeltoid palpation (the rent sign) in the diagnosis of rotator cuff tears. Journal of Shoulder & Elbow Surgery. 2001; 10(5):470-473
- Wood VJC, Sabick MB, Pfeiffer RP, Kuhlman SM, Christensen JH, Curtin MJ. Glenohumeral muscle activation during provocative tests designed to diagnose superior labrum anterior-posterior lesions. American Journal of Sports Medicine. 2011;39(12):2670-2678
- Wright IS: The neurovascular syndrome produced by hyperabduction of the arms, American Heart Journal. 1945; 29:1-19
- Wright WF, Riedel DJ, Talwani R, & Gilliam BL. Diagnosis & Management of Lyme Disease. American Family Physician. 2012;85(11):1086-1093.
- Yokoyama H, et al. Influence of Non-steroidal Anti-inflammatory Drugs on Antiplatelet Effect of Aspirin. Journal of Clinical Pharmacy & Therapeutics. 2013;38:12-15
- Young D, Papp S, Giachino A. Physical examination of the wrist. Hand Clinics. 2010;26(1):21-36
- Young DK, Giachino A. Clinical examination of scaphoid fractures. Physician & Sports Medicine. 2009;37(1):97-105
- Zoli M, Magalotti D, Grimaldi M, Gueli C, Marchesini G, Pisi E. Physical examination of the liver: it is still worth it? American Journal of Gastroenterology. 1995 Sept:90(9):1428-1432

ORTHOPEDIC SPECIAL TESTS: UPPER EXTREMITY
(3 CE Hours)
FINAL EXAM

1. **We're using a test that is_____. If a person tests negative for that disease, we can rule it out.**
   a. < 75% sensitive
   b. < 75% specific
   c. > 90% sensitive
   d. > 90% specific

2. **When using a test to confirm a diagnosis, you should look for statistical data such as: _____.**
   a. Sensitivity > 90% & (+) likelihood ratio > 5
   b. Sensitivity > 90% & (-) likelihood ratio < 0.1
   c. Specificity > 90% & (+) likelihood ratio > 5
   d. Specificity > 90% & (-) likelihood ratio < 0.1

3. **When considering an obvious change in a wart or mole, which of the following is NOT of concern?**
   a. Asymmetrical shape
   b. Border irregularities
   c. Color – pigmentation is uniform
   d. Diameter > 6 mm

4. **Considering pain referral patterns, if a client reports left shoulder pain, we should rule out _____ dysfunction.**
   a. appendix and liver
   b. cardiac and spleen
   c. gall bladder and spleen
   d. liver and gall bladder

5. **In the toolbox questionnaire for the shoulder known as the _____, a pain scale is used, but also a disability scale that looks at functional tasks that are important in everyday life.**
   a. CTSAR
   b. PRWET
   c. SHADA
   d. SPADI

6. **As part of the process of clearing the C-spine, we can test the radial, median, and ulnar nerves. The problem with _____ is that we don't have any data on sensitivity and specificity.**
   a. median nerve testing
   b. radial nerve testing
   c. ulnar nerve testing
   d. all of the above

7. **With Sensitivity = 81%, Specificity = 89%, the metrics of the _____ test are rather good for both ruling in and ruling out the supraspinatus.**
   a. empty can
   b. ER lag sign
   c. full can
   d. lateral Jobe

8. **The statistics for the _____ for the infraspinatus are highly variable (Sensitivity = 20-100%, Specificity = 69-100%). Some of that can be attributed to the amount of ER for the test position as well as the amount of resistance that is applied to "break" the position of ER.**
   a. dropping sign
   b. drop sign
   c. ER Lag test
   d. lateral Jobe test

9. **It is worth noting that _____ tests require the client to assume a challenging position.**
   a. both the Belly-press and the Lift-off
   b. both the IR Lag and the Lift-off
   c. neither the IR Lag nor the Lift-off
   d. neither the Belly-press nor the Lift-off

10. **Which of the following is NOT a labral test?**
    a. Anterior Slide
    b. Biceps Load Test
    c. Crank Test
    d. Yocum Test

11. **A conglomeration of four tests for the _____ serve as an excellent example of the value of clustering test results: if three or more of the tests are positive, specificity is 97% and the (+) likelihood ratio is 8.3.**
    b. acromioclavicular (AC) joint
    c. infraspinatus
    d. sternoclavicular (SC) joint
    a. subacromial bursa

12. **In the _____ test, which incriminates the tissues at the coracopectoralis minor loop: when pulse is the diagnostic characteristic, sensitivity is 70% and specificity is 53%; however, when pain is the characteristic, sensitivity is 90% and specificity is 29%.**
    a. Adson
    b. Allen
    c. Military Press
    d. Wright

13. **_____ is used to assess shoulder instability.**
    a. Coracoid Pain
    b. Speeds
    c. Sulcus Sign
    d. Wright

14. **The _____ test challenges the medial collateral ligament. Sensitivity is 100%, meaning that if there is no indication of pain or discomfort within the shear angle, you can confidently rule out the medial collateral ligament as being a problem.**
    a. Cozen Sign
    b. Moving Valgus
    c. Pronator Teres
    d. Valgus Stress

15. **The Fovea sign test assesses foveal disruptions of the distal radio-ulnar ligament and ulno-triquetral ligament. _____ are excellent for this test.**
    a. Sensitivity (69.4%) and specificity (69.1%)
    b. Sensitivity (52.7%) and specificity (34.8%)
    c. Sensitivity (95.2%) and specificity (86.5%)
    d. Sensitivity (72.6% and specificity (64%)

16. **Based on the data below for carpal tunnel tests, which two tests are the best diagnostic combination?**

	Sensitivity	Specificity
Flick & Phalen	**49**	**62**
Flick & Tinel	**46**	**68**
Phalen & Tinel	**41**	**72**

    a. Flick & Phalen
    b. Flick & Tinel
    c. Phalen & Tinel
    d. None – all are below 50%.

17. **Tests that assess for fractures of the wrist and hand include _____.**
    a. Clamp and Axial Load
    b. Cozen Sign and Mill
    c. Moving Valgus and Pronator Teres
    d. Phalen and Flick Maneuver

18. **Special tests for the shoulder include: _____.**
    a. Lateral Jobe, Dropping Sign, and Hornblower
    b. Moving Valgus, Mill, and Flexion-Compression
    c. Murphy, Watson, and Phalen
    d. Neer, Crank, and Maudsley

19. **Special tests for the elbow include: _____.**
    a. Lateral Jobe, Dropping Sign, and Hornblower
    b. Moving Valgus, Mill, and Flexion-Compression
    c. Murphy, Watson, and Phalen
    d. Neer, Crank, and Maudsley

20. **Special tests for the wrist include: _____.**
    a. Lateral Jobe, Dropping Sign, and Hornblower
    b. Moving Valgus, Mill, and Flexion-Compression
    c. Murphy, Watson, and Phalen
    d. Neer, Crank, and Maudsley

ANSWER SHEET

First Name: _____ Last Name: _____ Date: _____

Address: _____ City: _____

State: _____ ZIP: _____ Country _____

Phone: _____ Email: _____

License/certification # and issuing state/organization _____

Clinical Fellow: Supervisor name and license/certification # _____

Graduate Student: University name and expected graduation date _____

** See instructions on the cover page to submit your exams and pay for your course.

By submitting this final exam for grading, I hereby certify that I have spent the required time to study this course material and that I have personally completed each module/session of instruction.

Orthopedic Special Tests: Upper Extremity
Final Exam

1. Ⓐ Ⓑ Ⓒ Ⓓ	5. Ⓐ Ⓑ Ⓒ Ⓓ	9. Ⓐ Ⓑ Ⓒ Ⓓ	13. Ⓐ Ⓑ Ⓒ Ⓓ	17. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ	6. Ⓐ Ⓑ Ⓒ Ⓓ	10. Ⓐ Ⓑ Ⓒ Ⓓ	14. Ⓐ Ⓑ Ⓒ Ⓓ	18. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ	7. Ⓐ Ⓑ Ⓒ Ⓓ	11. Ⓐ Ⓑ Ⓒ Ⓓ	15. Ⓐ Ⓑ Ⓒ Ⓓ	19. Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ	8. Ⓐ Ⓑ Ⓒ Ⓓ	12. Ⓐ Ⓑ Ⓒ Ⓓ	16. Ⓐ Ⓑ Ⓒ Ⓓ	20. Ⓐ Ⓑ Ⓒ Ⓓ

Accessibility and/or special needs concerns?
Contact customer service by phone at (888) 564-9098
or email at support@pdhacademy.com.

Refund and general policies are available online at https://pdhtherapy.com/policies/

ORTHOPEDIC SPECIAL TESTS: UPPER EXTREMITY

(3 CE HOURS)

COURSE EVALUATION

Learner Name: _____

	Disagree				Agree	
Orientation was thorough and clear	1	2	3	4	5	
Instructional personnel disclosures were readily available and clearly stated	1	2	3	4	5	
Learning objectives were clearly stated	1	2	3	4	5	
Completion requirements were clearly stated	1	2	3	4	5	
Content was well-organized	1	2	3	4	5	
Content was at or above entry-level knowledge	1	2	3	4	5	
Content was substantiated through use of references, footnotes, etc.	1	2	3	4	5	
Content reflected stated learning objectives	1	2	3	4	5	
Exam assessed stated learning objectives	1	2	3	4	5	
Exam was graded promptly	1	2	3	4	5	
Satisfied with learning experience	1	2	3	4	5	
Satisfied with customer service (if applicable)	1	2	3	4	5	n/a

What suggestions do you have to improve this program, if any?

_____

_____

What educational needs do you currently have?

_____

_____

What other courses or topics are of interest to you?

_____