Examination And Assessment For The Upper Extremity:
Part 2
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Today's course is Examination and Assessment for the Upper Extremity: Part 2. Our presenter today is Valeri Calhoun. She is an occupational therapist and certified hand therapist with over 35 years of experience in a variety of settings. For the last 12 years, she has focused solely on the pediatric and adolescent hand population. She received a BS in OT from Indiana University and an MS in Community Health from the University of Kansas. She has been a certified hand therapist since 1994. In her current position, she developed and implemented new pediatric hand therapy program for St. Louis Children's Hospital. In addition to working in clinical settings, her experience includes over 15 years teaching at the graduate level for occupational therapy programs in the Midwest. She has provided professional presentations and lectures both nationally and internationally for therapists on a variety of therapy topics. Lastly, she participated for seven years as faculty of the CHT test prep course for ASHT.

Welcome, Valeri, so happy to have you back.

Thank you very much. I hope everybody can hear me, and welcome to part two of Examination and Assessment for the Upper Extremity. Just to tell you a little bit about it, the first part was about two weeks ago, and I know it's in the library on the videos and we talked about the subjective components and the screening assessments for the upper extremity. Today, we're going to talk a little bit more about some specific measurements and then end up with how to synopsize all of the information. Our learning outcomes for today is, as a result of this course, you will be able to: define two guidelines when screening for upper extremity motion. You'll be able to list two tests of dexterity to use for the upper extremity population, you'll be able to list two tests of sensibility for use on the hand or upper extremity patient and you'll be able to list one outcome tool specific to the upper extremity population.
So in a real quick review of the first part of this course, we talked about the purpose of an examination and evaluation for the upper extremity patient. And I wanted to review those. That is to establish base lines for where you’re starting with your treatment. You’re going to determine components that you want to address during treatment in order to establish your treatment plan. You need to be able to determine what limitations there are for that individual. You need to be able to establish treatment goals based on your evaluation. You need to be able to determine treatment results and outcomes and the efficacy of your treatment as long, you need to make sure that you're making a difference and making a change with your treatment and not just maintaining. Examination methods that we use need to be accurate. They need to be standardized and reliable. They need to be reproducible. And not just reproducible from you from one test to the other but also from one therapist to another because in most of our busy clinics, it's not always the same therapist who gets to see and evaluate a patient. Or possibly, that patient is going to a doctor that also has a therapist involved with them. So we want to make sure that we're using reproducible methods during our assessment. It needs to be valid. And most importantly, it needs to be meaningful to your outcome and your goals for treatment.

So today, we’re gonna start to talk and continue the talk on objective measurements. The two objective measurements that we addressed last time were edema and wound care or the wound assessment and now we're gonna proceed with range of motion. So I, in my clinic, basically try to follow the ASHT recommendations for range of motion assessments. And I know that if I do that, that I’m being consistent with the other therapists that I'm working with that are taking those same measurements. So ASHT's recommendations for range of motion of the upper extremity is that zero is neutral. If you have hyperextension at any joint, you should use a plus before that number. And if you have an extension deficit that can't get to zero, then you should use a minus before that number. You should write your measurements as extension over flexion. You should measure volar or dorsal for fingers and wrist. Now there are exceptions to
this, and that is if you have a very edematous joint, say the PIP joint is very enlarged, or
if you have wounds that would prohibit this, you can measure lateral. There was
actually a study in the Journal of Physical Therapy by Hamilton and Lachenbruch that
show that there is equal reliability between lateral or dorsal, not the two of them
together. But if you measure lateral consistently, it’s reliable. And if you measure
dorsally consistently, it’s reliable. What I instruct, like the other therapists that I’m
talking to in our clinic, is that if you’re going to make an exception and do a lateral
measurement, then indicate that on your note so that when I go back and reassess that
same patient, I’ll know that I need to measure the same location. So when you’re
looking at range of motion, there’s a couple different ways we can look at range of
motion. And I think in therapy we focus a lot on motion. And the reason is that the
amount of motion that a joint has directly relates to function. There are multiple studies
out there that describe how much motion is required in the wrist to be able to complete
all of your daily activities, or how much motion is required in the elbow to be able to
complete certain jobs or daily activities. So I encourage you to go out and find some of
those articles for what is required motion and then what is normal motion.

So when we’re looking at motion, the first thing I typically look at is active range of
motion, so I wanna see how that person is moving. And basically, active range of
motion is the muscle’s ability to move a joint. And there are several things that can
affect a person’s active range of motion. There are variations from person to person
and what is considered normal. So I actually, over the years, have kind of shied away
from using textbook normals for range of motion. What I tend to do is possibly use the
other side, or I use more of what is required for function because normal range of
motion, very few people have. They may have hyperextensibility at many joints. They
may have limited motion but they’re getting everything done. Another thing that’s very
important to understand, and probably I point it out because I do work with the
younger population, is that about the age of seven or eight and down, I can’t rely on
active range of motion measurements as my guideline very easily. Because if you ask a
young child to move their joint as far as they can, they may move it all of the way, they may not. They may move it down and then not hold it, so it's very, very challenging to try to get accurate active range of motion on younger individuals. What you should pay attention to also is the arc of motion. So if they're lacking full extension but they have full flexion, so that's what their arc of motion is. And we'll talk about that in a minute when we talk about total lack of motion. But the arc of motion is something that's very important to understand, especially if there are different interventions that you're doing, whether it's using an orthosis to stretch a joint or whether it's maybe a surgical intervention that they're having.

So active range of motion limitations can be due to multitudes of things. I've put down some of the more common ones, but there are a couple other ones that are important to understand also. Limitations can be due to adhesions, denervation of the muscles, basically creating weakness is what the denervation would do. Edema can affect the amount of motion that a joint has because it takes up space in the joint that would allow it to move further. A joint can be subluxed, dislocated, or there could be bowstringing of tendons that affects the motion actively. There can be a lack of tendon continuity or tendon attenuation, and that may be discovered when you're trying to determine active range of motion. Or there can be joint restrictions. Active range of motion, a couple of other things that can really restrict how much your patient will move for you is possibly fear of moving. So if you have an acute post-operative patient or somebody who's just been taken out of a cast, active range of motion can be significantly limited because they haven't moved in weeks and they're very fearful of moving. Pain is also something that can restrict active range of motion. So sometimes, they are having pain when they move, and sometimes though it's fear of pain. They may be fearful of the pain that they had prior to being immobilized so they're not going to move. So frequently, I see patients and I take off their post-operative dressings or I see them the day their cast comes off. I don't measure active motion on that date because I know I'm not going to get anywhere near an accurate motion. So what I
might do is describe more of what their functional motion is that day. So now we’re gonna kind of talk about some of the specific joints. Thumb range of motion is pretty unique in that it has a highly mobile CMC joint with the saddle-shaped trapezium at its base so it allows a lot of motion for that digit. And that's why we can do so much with our thumb and that's why we are so functional and so not functional without a thumb.

So the first thing you can look for with thumb is just look at composite flexion, and that's to the base of the small hand. This is different when I talk about opposition, and I'll explain what the difference is when I get to opposition. So if you're doing true composite flexion, the thumb goes across the frontal plane, parallel to the plane of the palm and touches the base of the small finger. So that is different from opposition, and we'll get there in just a minute. Radial abduction is with the palm flat. It's parallel to the palm of the hand and it's coming out wide. And for that, I really look at one side compared to the other. It's very important when you're looking at their ability to grasp larger items or cylindrical items. If you have a tight first webspace, you can be very limited in your ability to grasp larger items. Palmar abduction is in the sagittal plane. It's perpendicular to the palm. So an easy way to get that is if you have them rest on the ulnar side of their hand and then come out away from their thumb. With children, I talk about the puppet hand. So we're gonna make a puppet mouth, which everybody knows what that is. And adduction from either palmar or radial abduction brings it back to the side of the hand. So what opposition is, it's actually a combined motion of composite abduction, rotation and composite flexion. So the difference with coming across the side of the palm is that you're rotating and bringing that first metacarpal away from the palm and then touching. So you still can have them touch the base of the small finger with opposition, but they have to do the rotating and coming abducting out and away from the palm first in order for you to be looking at opposition as opposed to composite flexion.
A tool that I use a lot is there's actually a tool out there that's used to define opposition. And it's going all the way to the base of the small finger, but you have to be able to oppose each fingertip first. And it's called the Kapandji opposition test. So there are 10 landmarks on a hand, and they have to go through and touch with the pulp of their thumb, each landmark prior to going to the next one. So if they can’t complete number four, you don’t go on to number five. And so you come up with an objective number for how much opposition that thumb has, which is that combined motion. So I think I have a video here that I'm gonna show doing the Kapandji opposition test. So what I would do is I demonstrate the test first for the individual, and then I ask them to go through the test and I have them touch the different positions. One, two. Then they have to oppose pad to pad, three, four, five, six. And now they are completely away and abducted from the palm before they go to the base of the small finger. So that's how that is different from the composite flexion. Now we'll go back to the slides and continue. But I think opposition is a really important movement to assess in the thumb, and it can be from thumb injuries, it can be from arthritis, it can be whenever the thumb is involved, I wanna look at their ability to oppose because that relates to a lot of function when we go back later and we're gonna talk about dexterity and in hand manipulation. Opposition is key to many of those task. Another way, and this is one of what I feel like is one of the more functional methods of determining motion, and that is landmarks with assessment.

So frequently, if you're wanting to look at composite finger flexion, you can define fingertip to palm. Do they all touch the palm? And at that point, it doesn't matter where on the palm they touch. Or a real common measurement that is used is fingertip to distal palmar crease. So technically, if you have no restrictions in limitations, every fingertip should be able to touch the distal palmar crease with composite finger flexion, and that allows a full tight grasp. What you do is you measure that in centimeters. So you can use most finger goniometers or wrist goniometers have a centimeter measuring ruler on them, or you can use a separate ruler. It doesn't really matter. And
you wanna measure from the base of the pulp, not from the fingernail, to the distal palmar crease. So it's actually just the distance between how, what the distance is between them touching it or not touching it. And I think these are really, they're quicker. I think they're a lot more meaningful when you're trying to just look quickly at motion. So sometimes you can look at total active motion of the finger if you're wanting an objective number. And total active motion is great if you're going to be graphing some of the measurements or if you might go back and do some research later. It's a great number to use for that. It's not as functional of a measurement I don't think. But what it does do is it incorporates the extensor lag. So I think sometimes when you don't have full motion, it is important to know that that extension lag is a part of a number. So what you do with total active motion is you measure all three of the joints of the finger. You add all of the flexion numbers. Then if there are any extensor lags, you add those two and you subtract that from the total of deflection and you come up with the number with the total number. If there's hyperextension, it's not an accurate number anymore. So it doesn't take into consideration hyperextension. So if you have individuals that have that, I would encourage you to use just actual joint measurements. Total passive motion is the same formula that you would use for total active motion.

Once I've looked at active range of motion, if I am wondering about the tendon glide or just the more natural type of motion if the tendons, if I'm worried that they're not, that there's an attenuation problem or that there's a glide problem, I will look at tendon integrity really quickly through using tenodesis motion. So I'll have them completely relax their hand and I'll go through active wrist extension and flexion. If they have trouble relaxing and doing active wrist extension flexion, I'll have them completely relax and I will manually move their wrists into extension as far as I can and flexion as far as I can. And you need to look for fingers going into a relaxed flexed position with wrist extension and going into full extension with wrist flexion. And then I know that that tendon is there, it's gliding, and that isn't the problem with their lack of motion if I've
determined that. So once you've looked at active range of motion, if you notice that there's a deficit, then I might assess passive range of motion. And it depends on the diagnosis and the acuity of the injury and where they are if I'm going to assess passive range of motion my first visit or if I'm going to wait and assess it possibly my second or third visit. And that is really knowing your diagnosis and knowing what we talked about on part one where you know who your patient is and you know what their diagnosis is when they're coming in. So passive range of motion is the ability of a joint to be moved through its normal arc of motion by means outside the body. Basically, by you. So you're assessing the capacity of a joint. It may be affected by soft tissue integrity or stiffness. There could be joint incongruence such as possibly a subluxed joint or a dislocated joint. Or there can be capsular structures that are surrounding the joint that are limited and limiting the passive motion. Limited motion due to structures outside of the joint. It's important to determine that. If passive range of motion is greater than your active range of motion, so say they tried active range of motion and you felt like you were getting there at an accurate effort and they had limitations but passively you can move it through the full range, it may mean that it's limited by either adhesions of the muscle tendon unit, weakness of the muscle tendon unit or actual tendon integrity. You should always document active and passive range of motion if you are thinking that that's one of your limitations or problems.

So once you've determined active and passive range of motion, some of your diagnosis you may wanna actually determine the integrity of the joint. So when you're looking at the integrity of joint, you're looking at the surrounding structures of the joint, which is the ligament integrity and the volar plate on the volar aspect of the joint. You can perform radial and ulnar stress test. When you're doing the ligaments of the joint, you wanna have it in a close packed position. So for closed packed position to test the integrity of the collateral ligaments, or even the volar plate, you want the MP joint to be in flexion, and that's it's close packed position. You want the PIP and DIP joints to be in extension. If it's an acute injury and they have not yet had an X-ray and somehow
they've made it into your clinic, I'm always very cautious with doing any ligament stress joint. So if there's the potential of say a partial tear of a collateral ligament, you don't want to create harm by doing your assessment. What the X-ray shows that there's a little evulsion fracture with a partial tear of a ligament, or it may show that the volar plate has evulsed. So it's really important to have some clear diagnostics before you start to stress to join very significantly. You wanna also look then at your muscle/tendon length tests when you're looking at motion and when you're noticing that there are some limitations in motion. So if there's a limitation in motion, does this individual have intrinsic tightness? It may be because of the position they were casted or the position that they've held their hand in.

What's really interesting is everybody has seen those distal radius fracture. Elderly patient that comes in and they've had their wrist casted. But lo and behold, they also, the wrist caught their MPs and held it in extension the whole time. This individual was afraid to move their fingers so now their hand is completely stiff because the MPs were in an extended rather than a flexed position and they haven't moved their fingers. So it's important to determine where is that nut tightness from. That individual, it's probably intrinsic tightness so there's a test you can do to determine if there is intrinsic tightness. And what you wanna do is you wanna hold the MPs in extension. And on the test for the intrinsic, the wrist position does not matter. So you hold the MPs to extension and you passively flex the IP joints. It should say both the PIP and DIP joints and you note the range of motion. Then you put the MP into flexion, and again you passively flex the IP joints and note the range of motion. Your test is positive for intrinsic tightness if the PIP range of motion is greater with the MP flexed, which gives laxity or puts the intrinsic on slack than with that extended. So if you've determined they have intrinsic tightness, then that's gonna help lead to your treatment of addressing that, whether it's through intrinsic stretches or whatever else you may decide to do with treatment. Another really important ligament length test, muscle ligament length test, can be critical to hand function is the oblique retinaculum ligament.
So this is an interesting ligament because it goes, it runs dorsal to the axis of the PIP joint and it is volar to the axis of the DIP joint. So it is very important in DIP extension, but it can get tight very quickly with a PIP injury. And you can get basically a swan neck position from this ligament getting too tight. So the way that you're going to test this, the oblique retinacular ligament should be tight when you have PIP extension, and DIP flexion is when it's at its tightest. And the way you test it is basically that position. You hold the PIP in maximal extension then you flex the DIP. If the motion is less than after you flexed the PIP and stretched it, then you've got oblique retinacular tightness. And by less of course it's gonna feel tighter. But if you actually lose motions, so the DIP doesn't move as much is how you can tell if that's tight, and the oblique retinacular ligament, if it gets tight, it affects somebody's ability to hold tightly to a ball. So say if they're a football player, a basketball player, softball player, it affects your ability to be able to grasp tightly with the cylindrical grasp. It affects your ability to be able to pick up coins and very small objects. So it is an important ligament to address and then to address it with treatment if you need to.

So then you wanna look outside of the hand. So we looked initially inside of the hand. We looked at the individual joints. We've looked at the ligaments. We've looked at the intrinsic muscles. And if you still notice that there's limited motion, you might wanna look at the extrinsic muscles to determine what's limiting that motion. So there's excuse me, there's extrinsic extensor tightness/length test, and there's an extrinsic flexor tightness/length tests, and I'll go over both of those for you. The extrinsic extensor tightness/length test, once you look at the extrinsics, now the wrist and elbow position along with the forearm position affects this test also. So for this one, you hold the MP in extension and you passively flex the IPs. But before you do that, you need to have the elbow extended and the forearm pronated to put those extrinsic extensor tendons already on their tight range. Then you repeat IP flexion with the MP in flexion. The test is positive if the IP range of motion is greater with the MP in extension versus flexion. If you vary the wrist position, it does affect the results so try to make sure that
you’re consistent with that wrist position whatever your position you use it on. And before you do this, you’ve already ruled out whether there are any IP limitations in the actual joint structure prior to completing this test because that will affect your outcome also. So there’s an image of, you can’t see the forearm but there’s an image of the... It should have an extended elbow, pronated forearm, either slightly extended or neutral wrist, and there’s an image of the test being done. So the extrinsic flexor tightness/length test is just kind of a little bit of the opposite if you think about it. So you place the wrist in neutral and passively extend the digits. Then you slowly increase wrist extension. Now for this one, the elbow is again extended and the forearm is supinated rather than pronated to get those flexors on there, in their lax position. And as you extend that wrist, they should be able to maintain IP extension. The test is positive for tightness if the patient’s unable to maintain the IPs in extension as the wrist extension is increased. So if their fingers curl up tightly and you can’t even passively get them out, then there’s extrinsic tightness. Again, you need to make sure and have ruled out IP joint tightness prior to doing this test.

So that was kind of looking at motion, and you have to look at motion first, there’s kind of a sequence that you should go through when you’re taking these measurements. And for those of you who listen to the first half, we talked about you first just look at the hand, you look edema, you measure edema, you look at the wound. Now we’re doing some more touching of the patient. We’re also doing some more active movement. So I always start with movement because you need to first know if there’s full motion in the joint and if there’s joint restrictions because that’s going to affect my later assessments that I’m doing. So the next thing I’m going to look at is strength. There are some different ways we can look at strength. With the upper extremity, you can do a manual muscle test, which I’m sure everybody hopefully got extensive teaching in school on. With manual muscle testing, you can either measure the groups of the muscles, which is more of a functional manual muscle test, so you can look at just elbow flexion or wrist flexion without isolating the two different flexors of the wrist. Or
you can attempt to test through positioning specific muscles. You need to make sure that you’re using a excuse me, consistent scale. The scale that I use is the zero to five scale. Zero is no movement, five is full motion and strength. With strength testing, if they have limited joint motion, that’s okay. It’s full motion for that joint that we’ve already determined. So say they have an elbow flexion contracture, so when I’m testing elbow extension, I wanna make sure they get out just to where their maximal is. You should also, when you start manual muscle testing and you start resisting muscles, you need to note any pain with an excursion of the muscle tendon unit.

An example I put on here was with the first dorsal compartment with De Quervain tendonitis. But actually, it’s with any muscle tendon unit. If they experience pain, that may be part of what you’re dealing with. So this is where you start really watching for those pain behaviors and listening to their pain reports and documenting pain. This will help you to narrow down where your limitations are. The next thing that everybody is familiar with is grip and pinch strength. And I just really, I know we all do it, I wanted to go over what the standard method is. Again, it keeps us all consistent, it keeps us all using the same methods so that if I test and then you test and they go to your clinic, I know that from one test to the next, we’ve been consistent. So the standard method for using a dynamometer is the patient should be seated in a chair without arms because they cannot have their arms supported on any object. The only exception I make is if they truly can’t support their arm. So say I may have a brachial plexus injury where they do not have enough elbow flexion to maintain it, but they have good hand strength and I do need to assess that. I may prop their arm on the arm of a chair or on a table, and then I would document that exception. Their elbow needs to be at 90 degrees with the shoulder adducted at the side of their body and neutral rotation for the shoulder. The form should be in neutral. The tester should be holding the dynamometer. So they’re not holding the weight of the dynamometer. You should hold out for them. And then their wrist, it’s kind of a range in what it could be, but for the maximal grip, typically zero to 30 degrees of extension and zero to 15 degrees of ulnar
deviation is what's acceptable for grip strength testing. The standard for testing is taking the average of three trials for the extremity.

For norms, there are norms out there, but our strength is also varied because, based on our physique, based on what we do with our hands, based on our age, our sex, everything, there are so many variations and norms that I typically, if they have an uninvolved side, will use their uninvolved side as their norm. But you can go out and find some norms. There are some you know population specific norms, but just keep in mind that if they're a sedentary person, they may not be able to reach those. For pinch strength, the basically, the standard method should be seated with the forearm in neutral. The elbow at 90 degrees at the side with the wrist neutral to slide extension. The examiner should hold the gauge, and you can allow pronation instead of neutral for tripod and tip pinch because that's actually the position of the forearm when we do those two pinches, and that is an acceptable exception to make. I think what a lot of us do, and even what this image shows, is resting on the table top when they're testing pinch. But really, the standard method is to do it with their arm at their side just like with the dynamometer. My thing is if you're gonna make exceptions, it's fine. But just make sure that you document those exceptions. The other thing with the three, the average of three trials on grip strength, there are multiple studies out there that show the maximal effort on a one trial, and it's a reliable method of testing also.

So frequently, with pediatrics, or with patients that I have, I have a lot of pain patients. And if they have pain, then I will just do one test in order to, A, not increase their pain; or B, because kids will get all squirly the harder they try, so I frequently, with children, only use one test, one time. The types of pinch that you do need to look at is the tripod pinch, which is the three jaw chuck. That's the thumb against the pads of two fingers, and what typically I'll do is have them tuck the ulnar two digits under because a lot of times, people will wanna bring that third finger in. So if you have them tuck it first and do the motion before you put the gauge there, then it's a lot more effective and it's a
way to eliminate the use of the third digit. The lateral or the key pinch is the thumb against the radial side of the index finger, and that should be the middle phalanx, not against the tip and not against the PIP joint but it’s really against the middle phalanx of the bent index finger. And tip pinch is the thumb against the index finger pad when you’re assessing that. After you’ve looked at that standard, gross strength of grip strength, maybe manual muscle test, then you wanna really, what does strength mean though? It doesn’t mean anything unless you can use that strength.

So I’m a huge proponent of you need to take it to that next level of determining what their functional strength is. So there are some different ways we can do that. And one method of functional strength assessment is using some equipment that’s available and out there such as the BTE or the Cybex. There are some standard tool test that use functional strength such as the Bennett Hand Tool test that is on this image here. And those are good because they objectify and give you numbers. It doesn’t necessarily mean that they can take it from doing something on the BTE, say if they’re able to pull a certain amount, that not necessarily relate to can they pull the thing that they need at their job? But it’s as close as we can get. The way to make that accurate is if you go out and actually analyze that activity at their job or you analyze what they need to do and see what the actual forces are required. But it’s as close as we can get, and you do get some objective numbers. What I like these types of functional assessments for is it will actually put their bodies in the position that they need to be to perform the activities, and it’s actually objective so that I can do test and retest and show that they’ve made improvements in that. What I actually wanna do then at the end is have them perform the task and make sure that they’re strong enough to be able to complete the task.

So now we need to look at sensibility or sensation. First off, you’ve already done your subjective component as we talked about the last session, and that is finding out what their symptoms are. So I do not necessarily assess sensibility or sensation on every
patient that walks in the door. I do it based on two different things. If they report any type of sensory impairment, tingling, numbness, sometimes aching can be from nerve compression. So any of their subjective reports will clue me into needing to do sensibility testing. The other one that I do it on is if it is an actual diagnosis that involves sensibility. Then I need to test it and make sure, even if they say no I don’t really have any problems, we need to look at that sensibility or sensation at that point and just make sure that the testing shows that those nerves are responding accurately. So there is a hierarchy of testing or of sensation that you should look at. And first is the autonomic or the sympathetic component of testing, and that is it is the only truly objective test that there is, is how their body reacts to a certain stimuli without them having to report the sensation. Every other component involves them reporting what they’re feeling, so it leads to some subject differences that you may see. After the autonomic or the sympathetic part, the first hierarchy of testing should be detection.

Your second part should be discrimination, being able to discriminate from one input to the other. Then comes quantification, and lastly comes identification, being able to identify that sensory input. There’s a progression of sensory recovery. And this is with a nerve that has been completely lacerated and repaired. It can also... It typically will follow this path with the nerve compression that has had the compression removed, especially more so with a long-standing compression than with a temporary or briefer compression. So the progression of sensory recovery is pain or temperature should return first. 30 cps of vibration should return second. Moving touch returns before static touch, which is interesting. 256 vibration is next. Two-point discrimination. Localization to touch. And lastly, stereognosis. Now as I get ready to do these talks, it’s always interesting because there are several articles out there that do show that individuals have variations in this recovery. But I think it’s important to know what should be expected. And even though there are some studies that show there are some variations, the variations are usually back up at the top so they might get vibration back before they get pain or temperature, or they might get moving touch
And it's usually those first three that I've noticed on the studies that I could find that showed the variation. So it's important to understand that, but it's still also I think highly important that you know what the normal return should be.

So we're gonna look at detection first, and detection is touch threshold. So there are several different ways you can assess this and look at this. Touch threshold can be looked at just through light touch. So if you're bedside, say you have in-patients and you're seeing somebody that's bedside for some reason or possibly in a skilled nursing facility or if you just don't have your little bag of tools with you, you can do light touch typically with a Q-tip or even with your fingertip if you want to determine just kind of to get a baseline of are they even, where is their detection? You can do deep pressure, and you can do vibration. Some of the tools that are out there to determine detection are the monofilaments, and there are different brands. Even though most of us are familiar with Semmes-Weinstein, there's also the WEST monofilaments or vibratometer, which there aren't a lot of hand therapists that carry around vibrometers, but there are some clinics that do, especially if you're in a clinic with say a neurologist possibly. The next thing you can look at is spatial discrimination, being able to localize and discriminate the orientation. So this would be your two-point discrimination and your touch localization. Then lastly, you're gonna look at their ability for identification. This is shape, texture and object identification without vision. So that's always the key part is you need to make sure and have vision occluded, but the second key part with this is it needs to be something that they can identify. So you don't wanna put an object in their hand that they wouldn't be able to identify or if they have a language barrier or if they have a communication barrier, you wanna make sure that they have the ability to describe it. So frequently, when you get into the identification, you wanna possibly have those maybe five objects laying out in front of them so they can point to it or give descriptors and you can aid them with giving them descriptors to use. So you wanna make sure that it's not an individual that has other impairments that are gonna make it look like their identification is impaired.
So I wanna go over the specifics on the most commonly used sensibility tests that you're going to be performing in your clinic so that you're comfortable with those methods. And what I highly recommended and when I have students or a new therapist coming in, I have them practice a lot. The more you do it, the more adept you get at using these skills and it becomes second nature. And you wanna get it to the point like any motor skill that you don't truly have to think too much about it that you can automatically do and you're looking more at their response and add how they're reacting to the exam. So once you, we're gonna use the discriminator, which is the circle with the two-point discriminators and it's got the distances between the points to find on it. Some people use a closed, I'm sorry, a paper clip, not a close pin, a paper clip, and we'll do that for just a crude two-point discrimination. But remember, that's not defined as far as how far those are apart. I guess if you actually measure it, you would maybe know. And it's a quick tool if you don't have a discriminator with you. This is an innervation density test. It is testing the person's ability to perceive the number of stimuli, and it's really we're gonna talk about doing it primarily on the fingertips. The patient's hand should be supported with the vision occluded. So understand that this test can move the fingers. So at times, they will feel the movement and not the points and then they're just really good guessers so they may be guessing. So if you support their hand, I'll either put a towel underneath it so their fingers are resting completely against it. Some therapists put putty, a big ball of putty where their hand rest in it so it can't move. But you need to have their fingers rested on something.

So static and moving two-point discrimination. The point should be applied to the digital pulps. Static testing is performed in a randomized sequence on the digital pulps in a longitudinal fashion with the points perpendicular to the skin. And this is really important. You need to have your head down at the level of their fingertips so you can make sure that it's going perpendicular and you're not laying those points a little bit against the skin and giving more innervation than you should. Static testing is
supposed to begin at five millimeters of distance between the two points, and testing is proximal to distal. The patient’s response should be one or two based on how many points they feel. Dynamic testing should begin at eight millimeters between the two points, and the points are across the width of the pulps and traced from proximal to distal. You should use just enough pressure to blanch the skin. Make sure the points are perpendicular because frequently you’ll see people slanting it just a little bit. You use a random order to test so there’s no set order. And this is important part. To actually be considered accurate, you need to have seven out of 10 correct responses. I know very few, I'm in clinical surgeons all day long and I know very few surgeons, residents, fellows, therapists who actually go to the point of getting seven out of 10 correct responses. I’m not saying that fewer are not correct, and I really think that if you're truly needing to define if there's a sensory impairment, so say if they're going to be getting a physical rating based on their sensory impairment, or if they're going to possibly be getting surgery based on the outcome, you need to then do the seven out of 10. I don't know that you need to do it every time. If no response or inaccurate response is given, the distance between the ends is increased by one millimeter until seven out of 10 responses are accurate. If they continually give an inaccurate response through all of them, and that's how I document it. Testing was not completed due to inaccurate responses so they need to have maybe some more detailed sensory assessments performed. That might be an indication that you need to do a nerve conduction study or an EMG or something like that. And I compare it to the contralateral side. Beware that compression neuropathies can still have a normal result. Sensitivity is 32%, so that's being able to detect it's being accurate with those that actually have a condition. Specificity is 81%, and that's being accurate with those that do not have a condition. So it's much more specific than it is sensitive. And I think you should be aware of that when you're using that assessment.

The indications for testing for two-point discrimination. Nerve lacerations with repairs or graphs. Nerve compressions after surgical releases. Longstanding nerve
compression with motor changes. You’re gonna find it more accurate. The problems with testing is even though you do it to blanching, there's no force control. There's not been any inter-rater reliability studies done that I could find. Skin topography can alter results. So those individuals that have a lot of hard callous or things like that on their hands, I think it greatly affects their evaluation. The vibration of your hands can alter the results. It’s difficult to control the velocity or the speed of the points, and so there’s a limited repeatability with this test. Semmes-Weinstein monofilaments are the second evaluation that you will probably use quite often in the clinic. It's a standardized evaluation. It correlates with the ability to functionally discriminate light touch to deep pressure. The test evaluates a cutaneous innervation of the median ulnar and radial nerve because again we’re gonna right now look just at the fingertips. Do know though that this test can be used on other parts of the body. So there are standards out there for using it on feet with diabetic patients. There have been plastic surgeons who've used it on other body parts when they've done reinnervations. I'm doing a research study with one of our plastic surgeons who's reinnervating some ocular muscles and so we're doing the WEST, which is a Semmes-Weinstein type of monofilament testing. So it can be used on other parts of the body.

For the Semmes-Weinstein on the hand, the patient should be seated with their upper extremity in a comfortable and supported position, and their vision needs to be occluded. The thing to know with this is the sensitivity is 82% and specificity is 86%. So it's a much more accurate test at determining those who do have a condition. So as far as the method of doing this, the application by standardized methods, it should be applied perpendicular to the skin for 1.5 seconds. Monofilament should bend in a C. So the monofilaments control how much pressure is applied. And then you remove it for 1.5 seconds. There should be three trials, all within 1.5 seconds for the number 1.65 through 4.08. And you only do one trial for 4.17 up to the 6.65. And that’s kind of a key important thing to know because you can't go too fast. If you watch some people, they’ll go really fast or they’ll wait too long in between. So it’s a build up of sensation
so it needs to be on that consistent schedule. And what you learn is in your head you just learn, remember how you used to learn to count seconds? It’d be one Mississippi, two Mississippi. So I kind of go one Mississippi then at that I know I get my second and a half and you can find whatever little moniker you want to help yourself stay at 1.5 seconds. So those are the two standard methods that most therapists who are dealing with hand or upper extremity caseloads are using. There are some other threshold tests that you may find that you’re using. You may use vibration with the tuning fork or vibrometer. You can look at temperature, and there are some standard devices out there that you can order that actually help to control the temperature when you’re testing for that.

And you may wanna look at stereognosis. And stereognosis is something that I look at a lot of times with some of these. So I work with some neurological patients with CP and so I’ll do stereognosis testing because if you’re going to expect them to incorporate that hand, if they have sensory impairments with inability to identify objects, it’s going to limit their ability to use that hand. There is a standardized stereognosis test out there you can find in the literature with 12 standard items. So if you’re gonna do a lot of it, I would suggest that that’s the method that you use. But you can just put objects in their hand and ask them. Then the last thing that you need to look at is so, if they have a sensory function, that’s important. It’s important to identify it and to educate them on that, especially if there’s a sensory loss. Really important for injury prevention and knowledge. But we also need to know, is the sensibility that they have in their hands functional? So there are some standardized tests out there to use for function of sensation, and that is the Moberg pick up test. It’s a pretty standard one that I like to use. There’s also touch localization or tactile gnosis. What tactile gnosis is, it’s stereognosis which is objects. It’s also textures and the ability to perceive different shapes. So then back to when I said the very first level of sensibility testing or the objective test. If you’re in a clinic where you are dealing with nerve lacerations, brachial plexus, traumatic injuries, things such as that, even
longstanding nerve compressions, you may want to do some of those autonomic or sympathetic tests. And there are some standard ones out there that I'm not going to go over the methods of only because of a time constraint, but the Ninhydrin sweat test, there's a sudomotor function you can look at. Nerve conduction studies are considered an autonomic or sympathetic test. And the O'Riain wrinkle test is another one. The last part of sensibility or sensation that you need to look at is provocative testing. So sometimes your patients will say, "Yeah, my testing came out normal, but every time I'm doing this activity, my hand goes numb," or "These fingers go numb." Or, "I get this pain." So you may need to do some provocative postures or even, I'll take it to the point of having them do that activity. It's then, "Bring your crochet in and let me watch you crochet and let's see what's happening," and then I test them when they say their symptoms come on. It's more challenging if it's something at work because they can't necessarily bring their work in. But if it's an avocational activity, they can bring it in and we can test it.

Once you've looked at sensation, you've looked at motion, you've looked at strength, we now need to really look at how do they use their extremities? So there are some manual dexterity tests that are all standard that are out there. It's really whatever you have in your clinic, but I highly recommend that you need to take it to this level. You cannot just measure motion, strength and swelling and then start your treatment. You really need to know if this individual is able to use what they have. So you can use nine hole peg test or the Minnesota Rate of Manipulation. Nine hole peg is basically grasp and release. Minnesota Rate of Manipulation is in-hand manipulation. And there are a multitude of test out there so I don't really, I am not here to endorse any one test. What I say is fine, what works for your population and use that. There are things such as the Jebsen-Taylor, the Minnesota Rate of Manipulation, Purdue Pegboard. Functional dexterity test is one I like because it's short and quick. I included on your handout, there are some that are normed for the pediatric population. So I had that information, and I included it here. I'm not going to go over it at this time, but now you have that to
refer to. And what I did was put who it’s normed for from the pediatric population. So they’re also normed for adults, but if it’s portable, how much time it takes and how quick is it to do, or what does it look at? So that’s what those are. What I really like to do for functional abilities and ADLs is you can do a self report, but I also like to have them sometimes actually perform those tests for me. If I have an individual who says they have trouble with fasteners, say buttons, I need to look how do they button or what is the limitation so that I can define it better? If they say, "Oh, I never wear tight shoes because I can't tie my shoes," well then I need to see that. There are some standard functional capacity assessments that are designed for workers that you can use. So it kind of depends on what facility you're in and what you're doing, but I do highly feel like you need to take it to the level of function and look at that also.

So in summary, you need to summarize your data to get a full picture. You need to document your key components that are limiting these individuals. And you need to be able to define if they have limited motion, why do they have limited motion? If they have limited motion and it doesn't limit them in any functional activities, I may need to document it but not address it in my treatment. I need to set goals for my components. So say I want them to have increased wrist motion, but why? I need to take it to that point of deciding what are they not able to do that I need to get them to do? So they don't have first extension and they need to be able to get up out of the floor or up out of a wheelchair and they need to push up with their hands, you need to have wrist extension. So therefore, that’s what I’m looking at. You need to reexamine your individual intervals to determine if they're making progress and to determine if your treatment is making a difference. So we're not just evaluating components. I'm not just looking at a hand. I'm looking at this individual and finding out why this issue with their upper extremity is keeping them from doing what they need to be able to do. It can be work, it can be school, it can be play. It can be whatever is important to them, and we've talked about that at the first session. The issues with the evaluation process are how do we define limitations? And I think you kind of heard my bias regarding norms
earlier, so norms are good. But really, it's more about function in my head. Just remember that you're really dealing with this person, not a hand patient, and you need to listen and make sure you're working toward their goals along with your goals. Thank you, and I'm happy to answer any questions that you guys may have.

- [Fawn] Thank you, Valeri. We do have a question that came in. Let me read it.

- Okay.

- [Fawn] Can you talk about 32% sensitivity? How is this okay?

- [Valeri] Well, I think that's a really good question. I'm not sure I think it's okay. I put the research out there, I put the evidence that we have out there, and I think it's for you to decide if it's okay or not. What's interesting with that two-point discrimination is that it is used a lot. The surgeons that I'm in clinic with use it frequently, and they'll do one or two trials and document it. So do I think that's okay? I personally do not, and I think that's why I include that in my information because I think a lot of us use tools that we're not really, we've just been told to use them and we don't always know to really think about them and look further into them. Any other questions? I wanna thank everybody for your attention. Okay.

- [Fawn] Yeah, thank you so much. And if anyone does have a question that you think of at a later time, go ahead and jot down her email. She'll be happy to answer those. I appreciate everyone's time today and you attending this session. And if you missed the earlier one, please find it in our library. Thanks again, Valeri, for a great series.

- [Valeri] Thank you very much.

- [Fawn] Have a great day everyone.