Dynamic Chiropractic – February 12, 2011, Vol. 29, Issue 04

# The Practical Neurological Examination, Part 1

## *Assessment of Mental Status*

By K. Jeffrey Miller, DC, DABCO

There are six standard components of a neurological examination: mental status, cranial nerve, coordination, motor, sensory and reflex testing. While they are standards in medical neurology, the same does not apply in chiropractic practice. Chiropractors are trained to test these standard components, but they seldom do so consistently. Of the six components, motor, sensory and reflex testing dominate chiropractic examinations, while mental status, cranial nerve and coordination testing are secondary and in some cases nonexistent. (This last statement is based on my many years of peer-review and malpractice defense work.)

This article is the first of six written to provide practical knowledge and examples of how to incorporate all six components into a standard examination in an efficient and productive manner. Let's focus first on mental status, or as it is often referred to as, higher cortical function.

**Evaluating Mental Status**

Mental status examination is concerned with the patient's

orientation to person, place and time; general information; short and long-term memory; spelling; and the use of numbers. This sounds like a great deal of testing to undertake, and it can be (for good reason) if the patient is suspected of having an altered mental status. However, a good screening of mental status is much easier than it sounds.

In the fourth edition of *How to Examine the Nervous System,* R. T. Ross states, "The majority of patients seen by a neurologist do not require testing of intelligence. In the course of history taking the patient's memory and intelligence are revealed and this is often sufficient." Despite the reference to neurologists, the same can be said for patients seen by a chiropractor.

So, what's the big deal? There are three issues. The first for the doctor is being able to identify, if asked, what it was that assured them that the patient's mental status was intact. The second concerns documenting these facts. Were they recorded in the patient's record? The third issue involves how mental status relates to informed consent.

The majority of initial interactions and conversations a doctor has with a patient are considered normal, meaning the patient has no difficulties understanding or responding to questions. Despite pain and anxiousness regarding the presenting problem, the history process was a reasonable exchange of information.

But what exactly are the interactions that make up a "normal" encounter and provide proof of "normal" mental status? The patient's completion of the initial history and financial forms in the reception room prior to seeing the doctor is a major factor. If the patient printed and signed their own name on the form, they are oriented to person. If the patient provided appropriate information to health-related questions, they are orientated to person *and* place because they know they are in a doctor's office. The patient is also orientated to place by finding their way to the office. If the patient made the appointment, showed up on time, dated the forms correctly, provided a timeline for their present illness or injury and provided dates for past health events (injuries, surgeries), they are oriented to time.

Questions on the history forms regarding past illness and injury and current complaints help assess short- and long-term memory. Chit-chat between the doctor and patient during the history can help identify the patient's recognition of current events and general information. The doctor can simply ask in a friendly manner about the patient's family, work, hobbies, etc.

The patient’s ability to spell, as reflected by the information provided on the entrance forms, helps in assessing their ability to use words. This can also be determined in the verbal interactions the patient has with the doctor and staff.

One of the few components of the mental status examination that cannot be assessed from the patient’s entrance forms and oral history is the use of numbers - although skill with numbers can sometimes be ascertained by watching and listening to the patient when the details of their insurance coverage or lack thereof are detailed.

There are exceptions here. The patient may not have completed the paperwork alone; they may have had help or another person may have completed the paperwork entirely. The patient may also have poor reading and writing skills. In these situations, obviously the doctor must look further and perform more complete testing.

The above observations become so mundane during the course of practice that unless they are out of the ordinary, they go unmentioned and undocumented. These observations are part of the art of practice.

**Document Your Observations**

A simple checklist following the history to confirm the observations would be a great addition to the patient record. Another way to document it on the patient record would a statement such as, "Based on the patient’s completion of the initial paperwork/history and their interaction with doctor and staff during the history and examination process, patient’s mental status appears to be within normal limits."

Recording normal mental status is important. Being able to explain how it was determined is just as vital. Someone will eventually ask. Recording the patient’s mental status is important both clinically and legally. For example, let’s say there are two malpractice cases involving plaintiff claims that they did not give informed consent for care. In the first case, the plaintiff claims that tests and treatments were never explained to her appropriately. In the second case, the plaintiff’s family claims that the plaintiff was not capable of giving informed consent due to a deficient mental status.

Both of these malpractice cases would be hard battles, especially the latter, as most doctors could not offer proof that mental status was assessed or taken into consideration. But the information is usually there, on the forms and via the initial patient interaction. Doctors must remember where the information is established in the record and correlate it appropriately.

In cases in which it is obvious from the history and entrance forms and the doctor and staff's initial interaction that the patient's mental status is intact, no additional procedures are necessary. Additional time is not required over the usual examination process. In cases in which mental status does raise questions, additional testing is required. The results are recorded and this information is considered in relationship to consent, continuation of care or patient referral. If obtaining consent from the patient does not appear to be possible, then the doctor must seek it from a relative or guardian.

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# The Practical Neurological Examination, Part 2

## *Assessment of Cranial Nerves*

By K. Jeffrey Miller, DC, DABCO

Of the six components of the neurological examination, the cranial nerve examination is perceived as being the most complicated and thus the most difficult and time consuming. In truth, the examination is indeed the most complicated, but complicated does not always equate with difficulty or time commitment. Initial screening of the cranial nerves can actually be relatively easy.

Ease in performing the assessment is associated with a common-sense approach that – much like the one taken in the earlier description of assessing mental status [Part 1, Feb. 12 issue] – relies heavily on observations. A good general screening of the cranial nerves can be performed while observing the patient during the course of a conversation (case history) and understanding the likelihood of pathology for some of the nerves.

**Cranial Nerves 1-2**

The first cranial nerve (olfactory nerve) is seldom tested in general screening examination. In fact, the bullet system for current procedural coding (CPT) does not recognize the first cranial with a bullet. This is also true for the 10th cranial nerve (vagus nerve). The most common reasons for diminished sensation of the first cranial nerve are cold, flu, sinus trouble and the natural loss of the ability to smell that occurs with aging. Isolated lesions of the 10th cranial nerve are rare.

The second cranial nerve (optic nerve) deals with sight. If the patient is wearing glasses or contacts, the examiner is alerted immediately to refractive problems of the eye. The patient's ability to drive to the office, read paperwork and navigate through the office are also clues.

**Cranial Nerves 3-6**

Cranial nerves three, four and six (oculomotor, trochlear and abducens nerves) deal with movement of the eyes. It is easy to observe if the eyes move together in a coordinated manner during a conversation, making converging strabismus and diverging strabismus easy to detect. Cranial nerve three also deals with pupil size and elevation of the eyelid. If the patient has pupils of unequal size and/or has ptosis, then a lesion of the third cranial nerve should be suspected.

The fifth cranial nerve (trigeminal nerve) provides sensation for the face and innervates muscles of mastication. Patients with altered sensation of the face are likely to notice the abnormality quickly and report it. People touch their faces frequently during the course of a day. They wash their face, brush their teeth, apply makeup, shave, wear glasses, blow their nose, eat, etc. Numbness and abnormal sensations are usually noticed during these activities. Patients are likely to report these findings as part of their recent history. In some cases, numbness may be a result of a previous facial surgery, which should also be reported during the history process.

If the patient is having trouble chewing, the muscles of mastication may be involved. A report of trouble should result in the examiner looking for dental and/or TMJ causes for the trouble.

**Cranial Nerve 7**

The seventh cranial nerve (facial nerve) innervates the muscles of facial expression. It also assists the ninth and 10th cranial nerves (glossopharyngeal and vagus nerves) with the sensation of taste. As for taste, a decreased sense of taste may be reported by the patient, but like the sense of smell, the sensation decreases gradually with normal aging.

Muscles of facial expression can be observed functioning during the conversation. Smiling, frowning, speaking, blinking, raising the eyebrows and other facial movements are easily observed. Common pathologies associated with facial muscle (seventh cranial nerve) dysfunction, Bell’s palsy and stroke are easily discerned by noting if the dysfunction involves the entire face (Bell’s) or only involves function below the eyebrows (stroke).

**Cranial Nerve 8**

The eighth cranial nerve (vestibulocochlear nerve) is mostly sensory, providing hearing and equilibrium. If the patient can hear and understand the examiner’s questions and instructions, then hearing is generally good. A hearing aid is also a good indicator of eighth cranial nerve function.

Dizziness or spinning sensations may be reported if equilibrium is abnormal. If the patient can get up and down, stand and walk with a steady gait, then equilibrium is probably intact.

**Cranial Nerves 9-10**

As mentioned earlier, the ninth and 10th cranial nerves deal with taste. They also deal with phonation and swallowing. If the patient reports voice changes or an unusual voice tone, then further questioning is warranted. Reports of difficulty with swallowing should also be investigated further.

**Cranial Nerves 11-12**

The 11th cranial nerve (accessory nerve) innervates the sternocleidomastoid and trapezius muscles that move the head and shoulders. The posture and turning of the head, and shrugging of the shoulders during conversation are clues to function of the 11th cranial nerve.

The 12th cranial nerve (hypoglossal nerve) innervates the tongue. Like the ninth and 10th nerves, it controls swallowing. Most important is its role in articulation of speech. Clear pronunciation during the history process and other conversations is the key to identifying proper function of the tongue and 12th cranial nerve.

The observations described above if normal, could be stated in the patient record by saying, "Cranial nerves are within normal limits by history and observation." If this is stated, the doctor must be able to explain the observation related to each nerve.

If there are abnormalities detected or a more detailed examination is warranted, the doctor should perform a more extensive examination of the 12 cranial nerves.

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[IMAGE]

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# The Practical Neurological Examination, Part 3

## *Assessment of Coordination*

By K. Jeffrey Miller, DC, DABCO

Coordination deals with the ability to move in a smooth manner and the capability to perform alternating movements. Coordination relies on proper function of multiple aspects of the nervous system, including proprioceptive, motor, sensory, extrapyramidal, vestibular and – most importantly – cerebellar function.

As with mental status and cranial nerves (the first two of the six neurological components in this series), the observation component of the examination cannot be overstated. Coordination is relatively easy to test and dysfunction can be easily identified by observation, especially if a lesion is significant.

**Daily Activity Clues**

Since multiple aspects of the nervous system contribute to coordination, dysfunction can be identified during a variety of daily activities. If a patient presents with a wide stance or walks with the feet farther apart than normal, cerebellar dysfunction may be present (although other neurological functions may also be contributors). A broad-based gait is termed *ataxia* or *dystaxia*.

*Dysarthria*, or the slurring of speech, can be the result of a deficit in coordination. Since this sign is frequently associated with stroke, the patient should be evaluated for other signs of stroke and be assessed for abnormal coordination utilizing the tests described below.

Judging distances is often difficult with cerebellar-coordination abnormalities and dysfunction. This is evident when the patient reaches for an object. The patient may fall short of the object or overshoot the object.

The inability to perform movements that are rapid and alternating (clapping or toe tapping) in a smooth, coordinated manner is another sign of cerebellar-coordination problems. When rapid alternating movements are not possible, the condition is *dysdiadochokinesia*.

Movements that are described as "ratchet like," "jerky" or "choppy" are also common in cerebellar and coordination dysfunction. Normal movement is smooth. When one considers the essence of the signs detailed above, they can be summed up by saying that all movements should be repeatable, deliberate, smooth and on target.

While any of these signs may be readily observed, their absence does not guarantee the absence of coordination problems. Testing is necessary to confirm the absence or discover subtle findings that indicate dysfunction.

**Testing Recommendations**

There are several testing recommendations: finger to nose, finger to finger, heel to shin, rapid alternating movement testing and Romberg's test. The *finger-to-nose test* is probably the most familiar of the coordination tests. It is performed by the patient extending the arms laterally and attempting to alternately touch the nose with the index fingers. The patient's eyes are closed.

While it is important that the patient find and touch the nose, it is as important – if not more so – that the patient is able to perform the task quickly, smoothly and repeatedly. This is a factor missed by many examiners, as the tendency is to have the patient touch the nose only once with each index finger. The inability to touch the nose in a repeated, smooth manner is a sign of an abnormal test and cerebellar-coordination dysfunction.

The *finger-to-finger test* evaluates coordination and is intended to help identify a patient who is having trouble judging distances due to a disturbance of coordination. The patient is instructed to touch their nose with their index finger and then touch the examiner's finger. The examiner's finger is held up in front of the patient 18 to 20 inches away. This is done repeatedly with the examiner moving their finger between touches. Unlike the finger-to-nose test, the finger-to-finger test is performed with the patient's eyes open.

The examiner moves their finger between touches to prevent the patient from finding the target from memory. If the patient cannot touch the finger repeatedly, falls short of touching the finger or overshoots and misses the finger, the test is positive for cerebellar-coordination dysfunction.

The *heel-to-shin test* is a good test for coordination problems affecting the lower extremities. The patient (seated or supine) is instructed to place the heel of one foot against the lower shin of the opposite leg. The patient is then instructed to slide the heel up and down the shin repeatedly. As with all of the other

cerebellar-coordination tests, the action should be quick and smooth. The heel should remain in contact with the shin throughout the test. The test is abnormal if the patient's movements do not meet these criteria.

*Rapid alternating movements* can be assessed by clapping, alternating pronation and supination of the hands, drumming the fingers, alternate patting of the hands on the thighs and/or tapping the toes. Abnormal findings would fail to meet the normal requirements that movements be repeatable, deliberate, smooth and on target.

*Romberg's test* is a standard test of coordination, but it is not very specific. It can help to identify whether a problem exists, but it can be difficult to determine where the lesion resides. Posterior-column, vestibular, cerebellar and other problems can contribute to abnormal findings. Posterior-column disease is considered to be the most likely.

The test is performed by having the standing patient place their feet close together, first with the eyes open and then with the eyes closed. The abnormal finding occurs when the patient loses their balance and/or begins to fall. The test is especially positive if the patient's loss of balance is sudden with the closing of the eyes. A mild degree of swaying is not abnormal, even in the normal patient.

The examinations recommended here should be more than enough to determine the existence of coordination abnormalities. Once identified, further testing to determine the location and exact nature of the lesion or disease is warranted.

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This article is the third of six written to provide practical knowledge and examples of how to incorporate all six components of the neurological assessment into a standard examination in an efficient and productive manner. Part 1 of this series appeared in the Feb. 12, 2011 issue; part 2 appeared in the April 9 issue.

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# The Practical Neurological Examination, Part 4

## *Assessment of Motor Function*

By K. Jeffrey Miller, DC, DABCO

Testing motor function has several facets. Strength, lower motor function, upper motor function and tone are standard neurological components of motor testing. Some also bring manual muscle testing (reflexive test, applied kinesiology) into this realm, but it has a different purpose and performance, and will not be discussed in this writing.

In orthopedics, neurology and chiropractic, motor testing usually applies to testing the strength of individual muscles associated with specific nerve root levels and rating the strength using a scale of 0 to 5. The nerve root levels are primarily those that extend into the upper (C5-T1) and lower (L2-S2) extremities. The scale ranks muscle contraction from no contraction (0) to full strength against gravity (5). See **Table 1** for the complete scale.[1]

**Table 1: Muscle Strength Rating Scale**

| Rating | Degree of Function |
|---|---|
| 0 | No contraction / no movement |
| 1 | Evidence of contraction |
| 2 | Movement through partial or full ROM with gravity eliminated |
| 3 | Movement through partial or full ROM with resistance limited to gravity |
| 4 | Movement through full ROM against gravity with some resistance |
| 5 | Movement through full ROM against gravity and resistance / normal strength |

The muscles typically tested for motor function in the extremities appear in **Table 2**.[2] In testing these muscles, the examiner applies a force that the patient resists using the muscle in question. There are rules to follow to assure accurate testing and results.[3]

The examiner must also keep in mind that in addition to proper testing techniques, the side of handedness also plays a role in strength assessment. The side of handedness is typically 10 percent stronger than the opposite extremity.

First, isolate the muscle to the greatest degree possible. The most common mistake here is making contact with the extremity beyond the most distal end of the muscle. This means the examiner has usually crossed a joint beyond the distal end of the muscle. The examiner must contact the most distal end of the muscle *without* crossing the next joint. Otherwise, the test involves more than the joint that the muscle in question moves and other muscles.

**Table 2: Muscles Typically Tested to Assess Motor Function**

| Nerve Root Level(s) | Muscle(s) |
|---|---|
| C5 | Deltoid |
| C6 | Wrist extensors |
| C7 | Wrist flexors/finger extensors |
| C8 | Finger flexors |
| T1 | Finger adductors/abductors |
| L2-L4 | Quadriceps |
| L4 | Tibialis anterior (heel walking) |
| L5 | Extensor hallucis longus |
| S1-S2 | Gastrocnemius/soleus (toe walking) |

Second, the examiner should stabilize the area above the joint moved by the muscle, when possible. Third, the examiner must hold the testing pressure for a steady 3-5 seconds. A pumping motion should be avoided. This could irritate the muscle and associated joint. Pumping also prevents the examiner from detecting the smooth, gradual weakness (giving way) felt when a true weakness is present.

The feel of a true weakness must be discerned from weakness due to pain or that of a patient attempting to fake weakness. Weakness that is true is usually a slow release, while weakness associated with pain is usually quick and can be accompanied by facial expressions of pain and guarding of the area. Attempts to fake a weakness are often identified by movement that is ratchet like or cogwheel in quality.

In grading a weak muscle, the true nature of the 0-5 grading scale must be understood. According to Clark, the 0-5 scale is nonlinear.[3] Thus, a rating of 4 does not equate with the muscle having 80 percent of its normal strength and a rating of 3 does not equate with 60 percent of normal strength. A rating of 4 actually reflects a loss of 50 percent of a muscle's strength.

The weakness described above is typically associated with lower motor neuron (peripheral nervous system) lesions. It is a flaccid weakness. This is opposed to a spastic weakness seen with upper motor neuron (central nervous system) lesions.

Weakness is the only common symptom among lower motor and upper motor neuron lesions. The remaining characteristics of lower and upper motor lesions deal with deep tendon, superficial and pathological reflexes. With lower motor dysfunction, deep tendon reflexes are decreased, pathological reflexes are absent and superficial reflexes are present. With upper motor dysfunction, deep tendon reflexes are increased, pathological reflexes are present and superficial reflexes are absent.

If motor testing reveals muscle weakness, the testing of deep tendon, pathological and superficial reflexes should always follow.

The flaccid and spastic weaknesses of muscle described for lower and upper motor neuron lesions relate to muscle tone. Tone is related to a muscle's ability to resist passive stretching.[4] The normal muscle will have a degree of stretch related to the individual's physical condition. With a lower motor neuron lesion, the muscle will lose tone and the terms *hypotonic, flaccid* and later *atrophied* apply. With an upper motor neuron lesion, the muscle will gain tone and the terms *hypertonic*, *spastic* and *ridged* can apply.

A contradiction to the above rules is the presence of spasm. Spasm is a hypertonic state and can be present in conjunction with lower motor neuron lesions. It is most prevalent with joint injury. Muscle spasm serves as a protective mechanism stabilizing the joint.

Tone can be assessed during muscle strength testing and during palpation. Tone is particularly pertinent in the chiropractic documentation of subluxation as required by the Medicare PART system. The "T" in PART stands for tone. Since most of the components of PART are required for each Medicare visit, the assessment of tone will occur almost daily as opposed to other motor assessments that may only occur during initial and progress examinations.

For Medicare documentation, tone is generally noted for the immediate area of the subluxation in question, but it can be noted for an entire spinal region. There has to be a happy medium here. Noting spasm, etc., at a single spinal region (e.g., T5) does not make sense, as it would be almost, if not completely, impossible to isolate the individual muscles associated with a single segment. Similarly, saying a region is in complete spasm, etc., also fails to make sense in most cases.

Routine use of muscle strength testing is an important aspect of proper examination and diagnosis of neuromusculoskeletal conditions encountered in chiropractic practice. It helps differentiate lower and upper motor neuron lesions, and can help isolate individual nerve root involvement. Take a new look at this aspect of neurological examination and refine your skills.

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# The Practical Neurological Examination, Part 5: Assessment of Sensory Function

By K. Jeffrey Miller, DC, DABCO

There are five primary sensory modalities typically tested in a routine neurological examination.[1] Three of these, vibration, joint position sense and pinprick, are the focus of this discussion. Light touch and temperature are discussed, but not described in detail. Likewise, higher sensory functions such as stereognosis and graphesthesia are not discussed, as they are seldom the reason for presentation in a chiropractic practice.

Light touch is carried in two separate spinal cord tracts, the posterior column and the spinothalamic tract. This makes it difficult to detect abnormalities unless there are pathologies affecting both tracks.[1-2] A quick, simple way to test temperature is to touch the patient with a tuning fork. The metal instrument at room temperature is cooler than the patient's skin temperature and should feel cold. If this does not hold true, more formal testing using tubes of hot and cold water can be used.

In testing vibration, joint position and pinprick sensation, emphasis should be placed on testing each modality at the distal end of the extremities. The rational for this is based on the fact that if a modality is intact at the most distal end of the extremity, then it is intact proximally.[3]

**Testing Vibration**

A 128 Hz tuning fork is recommended for testing vibration. Following a brief description and demonstration for the patient of how the test will be performed, the patient is asked to close their eyes and the doctor proceeds by placing the tuning fork on the great toes and the distal end of the index fingers. Placement of the tuning fork should be performed with the fork vibrating *and* not vibrating in a random order. The patient should be able to differentiate between the two.

If the patient is not able to detect or differentiate the sensation, the examiner proceeds by testing in a distal to proximal direction. The tuning fork should be placed on the following landmarks in the lower extremities: the malleoli of the ankles, the shins, knee caps and the anterior superior iliac spine. The tuning fork should be placed on the following landmarks in the upper extremities: the styloid process of the wrist, the olecranon process at the elbow and the clavicle near the acromioclavicular joint. Points on the trunk and head can also be tested. Placement should be on the sternum and mentum of the mandible (chin).

Problems with vibration can be related to the peripheral nerve, the sensory portion of the nerve root, a plexus, the posterior column and/or the higher brain centers that interpret vibration sense. Abnormalities must be compared to the findings of other neurological tests for differential diagnosis.

**Testing Joint Position Sense**

Joint position sense should also be tested using the great toes and the index fingers. Following a brief description and demonstration for the patient of how the test will be performed, the patient is asked to close their eyes and the doctor proceeds by flexing and extending the toe or finger. Testing can also be performed by maintaining the toe or finger in a neutral position. The patient is to identify the position.

The examiner should hold the digits by the lateral and medial sides during testing. Contact with the nail bed should be avoided, as pressure sense of the nail bed may help identify the position of the digit for a patient.

If the patient is not able to determine the position of the joint(s), the examiner proceeds by testing in a distal to proximal direction. Position of the ankle, knee and hip should be tested in the lower extremities. The wrist, elbow and shoulder should be tested in the upper extremities.

Problems with joint position sensation can be related to the peripheral nerve, the sensory portion of the nerve root, a plexus, the posterior column and/or the higher brain centers. Abnormalities must be compared to the findings of other neurological tests for differential diagnosis.

**Testing Pinprick Sensation**

Pinprick sensation can be tested using a variety of instruments. Safety pins, pin wheels and needles are common. For safety reasons (preventing the drawing of blood) and questions of sanitation/sterilization, the use of toothpicks is recommend. They are cheap and disposable.

As with vibration and joint position, pinprick testing will occur distally and only move in a proximal direction if abnormalities are detected. Testing is performed by poking the patient in the recommended areas. The areas recommended are said to be the areas of purest innervation for the nerve roots and peripheral nerves listed.[1]

For the upper extremities, the dorsal aspect of the thumb web is tested (radial nerve, C6), followed by the tip of the index finger (median nerve, C6), the tip of the middle finger (median nerve, C7) and the tip of the little finger (ulnar nerve, C7).[4] For the lower extremities the medial side of the foot (L4, tibial nerve), the top of the foot (L5, superficial peroneal nerve) and the lateral side of the foot (S1, sural nerve) are tested.[4]

If flat toothpicks are used, bear in mind that they have a flat end and a pointy end, so dull and sharp sensations can also be tested. In either case, if an abnormality is detected, additional dermatomes and areas of peripheral nerve innervation must be tested. The challenge here is determining the truest areas of innervation. Dermatome and peripheral nerve charts vary greatly from one test to the next. This author prefers those found in *Hoppenfeld's Orthopedic Neurology*.

As with vibration and joint position sense, problems with pinprick sensation can be related to the peripheral nerve, the sensory portion of the nerve root, a plexus, the spinothalamic tract and/or the higher brain centers. Abnormalities must be compared to the findings of other neurological tests for differential diagnosis.

Testing sensory modalities can be an important part of neurological testing. However, it must be remembered that it is the least reliable. Responses are highly dependant upon patient perception, making them more subjective than other types of testing. The examiner must keep this in mind and remember to compare the results of sensory testing to other neurological tests in differential diagnosis.

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# The Practical Neurological Examination, Part 6: Testing of Reflex Function

By K. Jeffrey Miller, DC, DABCO

Discussion of reflex testing concludes this series on the six primary areas of neurological examination, which also includes mental status, cranial nerves, coordination, and motor and sensory testing. When performed and interpreted correctly, reflex testing provides the examiner with some of the most object evidence that can be obtained in neurological testing. Deep-tendon, pathological and superficial reflexes all supply a wealth of information on localization and identification of upper and lower motor neuron lesions.

Deep tendon reflexes appear to be straightforward to evoke and interpret. The examiner simply strikes the muscle tendon and rates the response on a scale of 1 to 4.[1] Effortless, right? Not really.

The technique of evoking a deep tendon reflex is not as easy as it looks. Examiners often poke or stab the tendon instead of striking it with a swinging motion that allows the hammer to rebound. It takes practice to develop this technique. Proper technique has a lot to do with reflex hammer selection and the grip the examiner uses. There are many different types of reflex hammers,[2] most named for the neurologist who developed them. (**Table 1**) Heavy hammers typically work the best, especially if held at the distal aspect of the handle with a firm but flexible grip. Some hammers have long handles that provide a longer leveler for a firm strike.

**Table 1: Types of Reflex Hammers**

| Hammer Name | Description |
|---|---|
| Taylor | Probably the most common; rubber triangle, typically red. |
| Buck | Smaller hammer with heads on either side of differing sizes. A small pin screws into the top and a brush into the bottom of the handle. |
| Babinski | A wheel with a rubber edge attached to a long plastic or metal hammer. |
| Dejerine | Similar to the Buck hammer, although the head is the same on both sides; usually there are no attachments and the hammer is much heavier. |
| Berliner | Looks like an axe; a single head with a long, curved, narrow edge. |
| Tromner | Has a very large head on one side and a very small head on the opposite side. A heavy hammer. |

The strike must be firm; somewhere between treating the patient as if they are fragile and drawing blood. It should hit the tendon directly or the examiner's finger as it palpates and isolates the tendon. This may be uncomfortable for the examiner initially, but with practice the sensitivity decreases. Isolating the tendon with the finger or thumb is preferable to attempting to strike the tendon. Isolation provides a better target (it can actually be seen). The reflex is often more brisk and can be felt.

Isolation of the tendon brings up another common problem with the examiner's ability to elicit a deep tendon reflex: Many examiners can only strike the precise spot with their dominant hand. Some cannot strike the precise spot with either hand. Since the nail bed of the finger or thumb is similar to the size of a nickel, it is recommended that the examiner tape a nickel to a countertop and practice striking it until they can strike the same spot each time with the hammer rebounding appropriately.

Once the examiner has perfected the ability to properly strike the tendon, there may still be times that a reflex is hard to elicit. In these cases, two procedures are recommended. The first is to use a Jendrassik maneuver (basically distract the patient).

For example, if the reflex in question is in the upper extremity, have the patient clench their teeth. If it is in the lower extremity, have the patient clench their fists. Distraction helps bring out the reflex.

The second procedure for a reflex that is hard to elicit is to strike the belly of the muscle. This works well and provides the same information.

As mentioned earlier, interpretation is typically recorded on a scale of 1 to 4. The scale is odd in the fact that normal is in the middle of the scale and not on the high or low end of the scale. (**Table 2**) There are also different versions of the scale. Some versions have pluses and minuses associated with the numbers, and one version goes from 1 to 5. Scale use may differ between examiners and the interpretation of the degree of reflex may also differ. A normal reflex to one examiner may be interpreted as a decreased reflex to another examiner. The scale has low utility.

**Table 2: Deep Tendon Rating Scale**

| Number | Characteristic of Reflex | Suspected Lesion |
|---|---|---|
| 0 | No reflex | Lower motor neuron |
| 1 | Diminished reflex (hyporeflexia) | Lower motor neuron |
| 2 | Increased reflex (hyperreflexia) | No lesion |
| 3 | Continued motion ("beats" associated with a single strike (clonus) | Upper motor neuron |

A better method of reflex interpretation is to use the patient to establish normal and judge by symmetry. Some people have very good reflex responses, while others have very poor reflex responses.

If a person has good responses symmetrically (side to side, upper and lower), then that is probably normal for that person. If a person has poor responses symmetrically, then that is probably normal for that person. Thus, the absence of reflexes is not necessarily pathological. (*Note:* Lower-extremity deep tendon reflexes are usually a little more responsive than upper-extremity reflexes.)[3]

If a person has good responses in most muscles, but one muscle provides a decreased response, it is a sign of hyporeflexia. If a person has minimal responses in most muscles, but one muscle provides a greater response, it is a sign of hyperreflexia. Using the patient as their own baseline and symmetry are key factors in diagnosis using deep tendon reflexes.

Final notes on the performance and interpretation of deep tendon reflexes pertains to the number of times a tendon/muscle is struck during testing and the number of responses to each stroke. The examiner should not strike a tendon / muscle once and move directly to the next tendon / muscle. Each tendon / muscle should be struck three to four times with a steady rhythm. This is required because a muscle involved in a lower motor neuron lesion may have a good initial reflex that fades or disappears with succeeding strikes. This cannot be

detected using a single strike.

A single response "beat" is expected with each hammer strike. More than one beat from a single strike is termed *clonus*. This is an indicator of upper motor neuron pathology, especially if the beats exceed three in number.[4]

Pathological and superficial reflexes share a unique inverse relationship. Under normal circumstances, pathological reflexes are absent and superficial reflexes are present. Under abnormal circumstances (usually upper motor neuron pathology), pathological reflexes present and superficial reflexes disappear.

The most common and familiar pathological reflex is Babinski's reflex. This is evoked by scraping the plantar aspect of the foot posterior to anterior along the lateral border, then continuing across the ball of the foot. A normal response is no response. If the toes extend and flare the response is abnormal and it is considered a sign of an upper motor neuron lesion. (*Note:* Babinski's reflex is a normal finding in infants up to 18 months old.)

When Babinski's is recorded in the patient record, it is described as present or absent instead of positive of negative. Some examiners record it as "toes up going" for abnormal responses and "toes down going" for normal responses. This is confusing, as a down-going response is actually a normal plantar reflex and not a normal finding for Babinski's.

While Babinski's reflex is typically the only pathological reflex performed, the examiner should be familiar with other pathological reflexes for purposes of conformation and differential diagnosis. Hoffman's reflex for the hand is a good choice here. This involves the "nipping" of the end of the middle finger as though the examiner is attempting to pinch it off. Normally, there is no response to this action. The abnormal response is flexion of the thumb and fingers.

Hoffman's reflex has the same meaning as Babinski's and is recorded in the same manner: present or absent. The reflex is considered the upper-extremity equivalent of Babinski's. (This fact is frequently the subject of board examination questions.)

The stroke, pinch or general action required to elicit pathological reflexes must be firm. Similar to the method described for the strike for a deep tendon reflex, somewhere between treating the patient as if they are fragile and drawing blood. This is the opposite for superficial reflexes.

Superficial reflexes require a very light contact and action. Lightly stroking the bottom of the foot causing the toes to flex is the plantar reflex. This is why recording the Babinski's reflex as "toes down going" is confusing. "Down-going toes" is a normal plantar reflex, not a normal Babinski's reflex. The ability to apply the correct technique in testing superficial and pathological reflexes often separates the technicians from the doctors.

Superficial reflexes are recorded as *present* or *absent*, although these terms have opposite meanings for superficial and pathological reflexes. Present is normal for superficial reflexes and abnormal for pathological reflexes. Absent is abnormal for superficial reflexes and normal for pathological reflexes. Again, the reflexes have an inverse relationship.

The examiner should be familiar with other superficial reflexes. The corneal, pharyngeal and abdominal reflexes are recommended for study, but will not be detailed here.

This concludes the series on neurological testing. Here's to better testing for better diagnosis and patient care.

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This article is the last of six written to provide practical knowledge and examples of how to incorporate all six components of the neurological assessment into a standard examination in an efficient and productive manner. Part 1 of this series appeared in the Feb. 12, 2011 issue; part 2 appeared in the April 9 issue; and part 3 ran in the June 17 issue; part 4 appeared in the Aug. 12 issue; and part 5 ran in the Sept. 9 issue.

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