How to be an Expert Muscle Tester

Foundations of Proprioceptive Medicine

Simon King
Chiropractor
Berkhamsted, Herts, UK
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The Power of Proprioception

Proprioception is more than body position sense. Understanding how proprioception works and what to do when it fails to work properly will allow you to get better results faster, with all your patients.

Proprioceptive Chiropractic is a system of diagnosis and treatment designed to remove interference to proprioception.

You can use this knowledge with whatever style of practice you currently use. It compliments all other therapies; the theory you learn here will help you understand what you already do from a different perspective.

You will learn the essential keys to preventing injuries, feeling better, overcoming illness and living longer – all through an understanding of proprioception.

What is Proprioception?

“The mechanism of sense of position and movement, by which muscular movements can be adjusted to a great degree of accuracy and equilibrium maintained.”

Proprioception controls and manages the way we move by controlling and regulating muscle tone. Without proprioception controlled movement is impossible and injuries would occur at the slightest provocation.

Proprioception allows us to walk, talk, eat, jump, land, run, laugh and talk. It is the combination of nerve input and output that means we can walk across uneven ground, flinch if prodded unexpectedly, pull away from a hotplate.

Most patients and their practitioners are totally unaware of the huge influence proprioception has on their lives.
Muscle Tone

- Creates Stability
- Creates Flexibility
- Prevents injury
- Prevents osteoarthritis
- Drives adrenal and kidney activity
- Controls posture
- Helps you live longer
- Prevents osteoporosis
- Improves mental function and feelings of wellbeing

Proprioception is so sensitive that we can feel just one hair moving on our skin. When a hair moves, nerve sensors send messages to the nervous system (spinal cord and brain). These messages form part of the input that is called proprioception.

INPUT is the name for messages going TO the central nervous system. INPUTS are also known as AFFERENTS or AFFERENT INPUT. They come from all parts of our body that are supplied by nerves.

By far the most afferent input comes from Muscle Spindle cells. These inputs tell the nervous system exactly what is happening to each and every muscle, all of the time. The nervous system uses these inputs to regulate our muscle tone.

Spindle Cells

Although the muscles that make us move are known as voluntary muscles, up to 90% of their function is totally subconscious or involuntary. This means that much of the continuous control of the muscles is done at a spinal level, without needing input from the brain.

Muscles are made up of thousands of fibres. Most of the fibres are motor fibres (known as extrafusal fibres) and these do the work of contraction. A smaller number of fibres within the muscle are known as muscle spindle cells (or intrafusal fibres).

Spindle cells are capable of contraction but they are mainly sensory in their function. Their primary job is to signal the tension on the muscle. Tension will change depending on the amount of action of the muscle; whether it is contracting actively or passively, quickly or slowly.
Spindle cells are one of the few types of sensory cells in the body that **spontaneously** generate nerve signals, and they do so continuously. For this reason, spindle cells are by far the most important proprioceptors in the body.

Nerve signals from spindle cells provide the stimulation to the nerves controlling the motor fibres that maintain normal muscle tone. The nerve signals from each motor
spindle are connected to motor neurons that control every extrafusal muscle fibre in that muscle.

Nerves from the **spindle cells** travel to the spinal cord where they enter via the dorsal roots. Most of the messages that reach the dorsal roots are then carried by **interneurons**. The messages they carry are passed on to other nerves.

**The Knee Jerk Reflex Explained**

The Knee jerk reflex is just one example of the **myotatic reflex**.

At rest muscle spindle cells in the quadriceps are constantly sending messages to the spinal cord. The rate of signal input to the spinal cord is dependent on the tension or stretch of the muscle. As the tendon of the quadriceps muscle is tapped, the muscle is stretched very slightly but rapidly. The muscle spindle cells are very sensitive to stretch. As they are stretched, the rate at which they are sending messages back to the spinal cord increases, to say 100 times per second. Not receiving any instructions to move otherwise, the cells of the spinal cord that control the contraction of the quadriceps now fire more rapidly, causing contraction in the quadriceps, sending the foot flying forward.

Through interneuronal connections, messages are simultaneously sent to the hamstring muscles to inhibit their contraction since the hamstrings are antagonistic to the quadriceps.
Standing on the tack starts the flexor withdrawal reflex. The knee flexors contract; the knee extensors are automatically inhibited.

Normally this reflex is transient. It may become permanent if the source of the irritation is not or cannot be removed.

Many inputs signal danger – touching a hot element, a mosquito biting, the sting of a nettle and all demand action to remove the irritation.

If the input is significantly irritating we will go to any lengths to remove the irritation and return our body to its normal state.

What happens if you try to walk with a small pebble in your shoe, or try to run after spraining your ankle? The abnormal afferent input will result in changes in muscle tone.
designed to prevent you from moving normally. This protects you from danger or further injury. If the irritation remains, you may move that way permanently.

The only way you can get rid of a bad afferent input is to MOVE. Movement demands muscle action. Muscle action can occur via messages from the brain OR reflex activity.

Whenever a muscle receives a command to contract, its opposite mover will receive a command not to contract. This is the LAW OF RECIPROCAL INHIBITION. Facilitation (a command to contract) always leads to inhibition of the opposite action.

Diminished muscle tone is often the result of muscle inhibition. When muscles are inhibited they cannot contract effectively. Reduced muscle contraction can lead to:

- Joint injury
- Muscle strain
- Osteoarthritis
- Repetitive Strain Injuries
- Recurrent Injury
- Muscle ache
- Trigger Points

With an understanding of proprioception, you will be able to diagnose the cause of muscle inhibition quickly and easily and you will learn how to increase a muscle’s strength – permanently, without exercise. With this knowledge you will often increase your patient’s strength by 10-50%, instantly, without exercise. In one case we increased a lady’s strength by 500%.

With this sort of improvement, you will be a hero. Your patients will be able to exercise more, burn more fat and resist more injury.

Any other therapy you do with them will be many times more effective and satisfying.
Injury Prevention: When Reactive IS better than Proactive.

What is the best way to prevent an injury? Exercise for flexibility and strength? Yes, but there is a problem.

Our muscles have two quite distinctive roles. In “Principles of Neural Science” Kandel describes these as feed-forward and feed-back. Although the terms are confusing at first, the difference between them is very important when advising athletes and patients about injury prevention.

Feed-forward control is the type we would normally associate with voluntary action. It is used to produce the PROPULSIVE force needed for a bench press or the extension of an arm to pick up a pencil. Such an action is initiated with a cortically generated plan that integrates the senses of sight, sound, balance and touch to formulate an outline of the desired movement. Processing of the plan involves complex feedback mechanisms influenced by the cerebellum, thalamus, vestibular and other brain centres.

This sort of proactive control is an open-loop system. The response is not directly connected to the sensory input but is not independent of it either. The ability to reach out and pick up a pencil involves a series of checks and balances that could well be altered if the pencil was to suddenly move or start to fall.

Proactive muscle control is the system most commonly employed in training and rehabilitation schemes designed to increase muscle strength through controlled repetition of deliberate actions.

However, clinical experience suggests that it is rare that injuries occur from failure of proactive or feed-forward control. Injuries tend to be sustained as one movement ends and another one begins.

The second type of movement control is feed-back or REACTIVE control. This is a closed-loop system in which signals from sensors are compared with a desired state, represented by a reference signal. It is used to resist, reverse or oppose an existing force and uses a quite different set of processors than the PROACTIVE system.

If I drop a tennis ball and you reach out to catch it, your ability to compute the angle and velocity of the ball, work out where your hand needs to be and move it there would all be
defined as proactive control. The reflex reaction of your biceps, triceps, flexor and extensor muscles from the stretch on their respective muscle spindles as you catch the ball would constitute reactive control.

Reactive control depends mostly on the myotatic or stretch reflex.

It is the reactive myotatic muscle control mechanism that prevents an ankle sprain if a rock gives way suddenly under your foot. The sudden stretch on lateral ankle stabilisers will increase the firing from those muscle spindles, directly stimulating the motor neurons to increase their output, limiting the excursion of the ankle and preventing damage to the ligaments, bones and joints. It is reactive muscle control that will tighten every shoulder muscle at the end of a throw to keep your arm attached to your trunk and it is reactive muscle control that will make the necessary changes to stabilise your vertebrae when you bend over to pick up a lawn-mower.

Reactive muscle control prevents injury by constantly adapting muscle tone to the tension applied to the muscle. It thereby limits the amount of load transferred to ligaments and joint capsules and because it uses spinal-level reflexes, it does so at speeds that could not be achieved with cortical processing.

Being a PROPRIOCEPTIVE neurological mechanism, reactive muscle control is not related to the physical capacity of the muscle or the training of the individual. Good control can exist in a 50kg 83 year old woman just as easily as in a 25 yr old 80 kg body-builder but both can suffer from proprioceptive interference that leaves them with a faulty reactive mechanism.

Reactive feed-back control is often found lacking in patients with injuries. Although researchers have found persistent muscle inhibition after injury, most assume (wrongly in my opinion) that the inhibition was caused by the injury. It is equally probable that the injury was caused by the inhibition.

Naturally, it is easy to measure inhibition in a group of injured subjects. It is much more difficult to prove that inhibition causes injury although there is some evidence to demonstrated just this. Unfortunately, if the researchers are measuring proactive strength, they will miss the reactive strength inhibition that is essential in preventing injuries.

Manual muscle testing is the easiest way to simulate the perturbations of movement that occur in daily life. By applying an unknown and theoretically unpredictable manual force,
manual muscle testing stresses the patient's reactive feedback control loop, allowing the practitioner valuable insight into this injury-prevention mechanism.

By temporarily changing proprioceptive variables like position, stretch, tension and pressure, the examiner can find changes in reactive inhibition. It is often then a simple procedure to permanently correct those proprioceptive abnormalities and leave the patient at a higher functional state, less prone to injury and more responsive to treatment.


Golgi Tendon Organs

Golgi Tendon Organs are another type of sensory organ within the muscles. They are thought to switch a muscle off if the load becomes too heavy, but their true function is still something of a mystery.

Skin Receptors

There are many different kinds of skin receptor. The most common are:

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Nerve Fibre</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hair Follicle Ending</td>
<td>A-beta</td>
<td>Responds to hair displacement. Wraps around hair follicle in hairy skin.</td>
</tr>
<tr>
<td>Ruffini Endings</td>
<td>A-beta</td>
<td>Responds to pressure on skin.</td>
</tr>
<tr>
<td>Krause corpuscle</td>
<td>A-beta</td>
<td>Responds to pressure.</td>
</tr>
<tr>
<td>Pacinian corpuscle</td>
<td>A-beta</td>
<td>Responds to vibration. Most sensitive in 150-300 Hz.</td>
</tr>
<tr>
<td>Hz range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meissner corpuscle</td>
<td>A-beta</td>
<td>Responds to vibration. Most sensitive in 20-40 Hz.</td>
</tr>
</tbody>
</table>
Free nerve endings

A-delta and C

Different types of free nerve endings that respond to mechanical, thermal or noxious stimulation. Various types are found throughout the skin.

Merkel Cells

A-beta

Responds to pressure of the skin.

Each skin receptor has its own form that makes it able to pick up specific types of stimuli. All contribute to proprioception. For our purposes they can be best defined according to their function:

Skin receptors are capable of detecting

- Light touch
- Deep touch
- Vibration
- Pain
- Hot
- Cold
- Inflammation

Anterior Motor Neurons

Anterior motor neurons are the cells in the spinal column that send messages to the muscle fibres to make them contract.

All muscles have a resting muscle tone, which means they have a natural low level of contraction. Muscle contraction occurs when the anterior motor neuron sends a signal to the muscle. Even at rest, an anterior motor neuron fires at about 50Hz (50 times per
Foundations

second). The contraction this produces is enough to stop the muscle going slack. This is called resting muscle tone.

Motor neurons receive as many as 10,000 or more inputs. Each input provides either an excitatory connection or an inhibitory connection. A single input cannot cause the neuron to fire. Each input supplies only 0.5 to 1 millivolt and many of these inputs will be inhibitory (or negative) inputs. The nerve requires 70 to 80 millivolts before it will fire.

The rate of the output from the AMN is regulated not just by messages of intent from the brain but also by constant input from muscle spindle cells and inhibitory and excitatory impulses from receptors in the skin, joints, tendons and ligaments.

Researchers in Adelaide performed a classic experiment that illustrates the mechanism. Electrodes able to measure muscle facilitation or inhibition were placed in the masseter muscle of human volunteers. Two different forces were applied to the same central incisor tooth. The first force was a steady pressure, the second a brisk tap. Steady pressure on the tooth caused the muscle to move into an excitatory state while a brisk tap caused muscle inhibition. Excitation allows us to bite hard when we need to while inhibition will hopefully prevent tooth damage if we bite on something hard unexpectedly.

Regulation of Muscle Tone

Muscle tone regulation is totally subconscious.

Proprioception is traditionally defined in terms of how the brain knows where the body is in space. BUT The chief role of proprioception is the regulation of MUSCLE TONE.

Proprioceptors are mostly stimulated by pressure or stretch. They act through various reflexes to adjust muscle tone and enable smooth movement. The sum of the reflexes activated by proprioceptors is known as proprioception.

What reflexes are active in the following examples?

1. Preventing a sprained ankle. You are walking across some rocks. One of the rocks moves as you step on it. You slip but catch yourself.

   The __________________________ reflex.
2. **Preventing a sprained back.** You bend over to pick up a pen. Picking up a weight from the floor puts considerable strain on the joints of the back.

   The _______________________________ reflex

3. Someone puts an icecube on your back

   The _______________________________ reflex

4. You touch a hot kettle just after it has boiled

   The _______________________________ reflex

5. You catch a ball

   The _______________________________ reflex

6. You hold a pen

   The _______________________________ reflex

7. You jump off a chair

   The _______________________________ reflex
Proprioception and Joint injury

Almost everyone agrees that injuries are caused by an outside force. This is totally wrong. It's not the force that causes the injury, it is our inability to resist the force that causes the tissue damage we call injury. Some forces are so great that no normal body can resist them but many of the injuries people suffer are sustained with very modest forces, often with activities the person has been able to manage hundreds of times before.

Muscle tone is the key to resisting injury. Muscles that are proprioceptively normal will operate correctly in the split seconds needed to resist outside forces. If anything interferes with proprioceptive input, then the output that would normally result is compromised to a degree that may allow tissue damage.

We know that joint damage can cause local muscle weakness.\(^2\)

**Muscle inhibition following knee injury and disease.**

“It has been observed that knee extensor muscles cannot be fully activated during voluntary contractions following knee injuries. This muscle inhibition has an unknown origin and appears to hinder full rehabilitation of the affected joint. …” Herzog W; Suter E Sportverletz Sportschaden 1997 Sep;11(3):74-8

NB It is also possible/likely that many of the knee injuries could have originated from muscle weakness.

Some studies suggest that the influence of abnormal proprioception extends far beyond the immediate joint.\(^3\)

**Local sensation changes and altered hip muscle function following severe ankle sprain.**

“The author concludes that both local sensory and proximal muscle function changes are associated with unilateral severe ankle sprain.”


Another Australian study suggests that muscle weakness predisposes to injury.\(^4\)

**Muscle Weakness Predisposes to Injury**

“These results indicate that preseason isokinetic testing of professional Australian Rules footballers can identify players at risk of developing hamstring muscle strains.”

In practice, we find that virtually all musculoskeletal pain and injury was either caused by, or results in, muscular weakness. For those who want to be strictly accurate, the muscle itself has not lost any permanent strength but it is in a state of inhibition.

Quadriceps weakness has been shown to be a **causative factor** in osteoarthritis of the knee\(^6\). This is not surprising. Ligaments can only be active at the end of a range of motion, it is muscles which control the movement of joints. If a muscle is inhibited, abnormal movement patterns of the joint will eventually lead to instability and degenerative change. Theoretically, the same mechanism could also cause spinal and hip degenerative change.

**Osteoarthritis.**

*Quadriceps weakness is now thought to cause osteoarthritis of the knee.*

“Torque is lower in women with OA than in women with no knee problems” Wessel J, J Rheumatol 1996 Feb;23(2):328-31.

“These data demonstrate that patients with knee OA have reduced muscle function and functional capacity compared to controls”. Fisher NM; Pendergast DR. Scand J Rehabil med 1997 Dec;29(4):213-21.

“Quadriceps weakness may be present in patients who have osteoarthritis but do not have knee pain or muscle atrophy; This suggests that the weakness may be due to muscle dysfunction. The data are consistent with the possibility that quadriceps weakness is a primary risk factor for knee pain, disability, and progression of joint damage in persons with osteoarthritis of the knee”. Slemenda C, Brandt KD Ann intern med 1997 Jul 15;127(2):97-104.

**Proprioception and Energy Levels**

One of the most interesting developments in the field of proprioception is the discovery that, at least in animals, function of the adrenal glands and kidneys is, to a large degree, regulated, controlled and driven by afferent impulses from the muscles of the lower leg\(^6,7\). While chiropractors have always suspected a link between nerve function and internal organ function, missing the pivotal role of muscle tone may have hampered our investigations.
Proprioception need not be confined to mechanoreceptors since proprioception is simply afferent sensory input. Muscles may change their state in response to a wide variety of sensory challenges such as taste, smell, vision and hearing.

Proprioception also explains the results obtained by many forms of chiropractic, osteopathy, massage, reflexology, acupuncture and other physical therapies.

*Decrease in elbow flexor inhibition after cervical spine manipulation in patients with chronic neck pain.* Suter E; McMorland G Clin Biomech (Bristol, Avon) 2002 Aug;17(7):541-4

“Significant dysfunction in biceps activation was evident in patients with chronic neck pain, indicating that this muscle group cannot be used to the full extent. Spinal manipulation decreased muscle inhibition and increased elbow flexor strength at least in the short term.”

*Decrease in quadriceps inhibition after sacroiliac joint manipulation in patients with anterior knee pain.* Suter E; McMorland G; Herzog W; Bray R J Manipulative Physiol Ther 1999 Mar-Apr;22(3):149-53

“Patients showed substantial muscle inhibition in the involved and the contralateral legs as estimated by the interpolated twitch technique. After the manipulation, a decrease in muscle inhibition and increases in knee extensor torques and muscle activation were observed, particularly in the involved leg. In patients with bilateral anterior knee pain, muscle inhibition was decreased in both legs after sacroiliac joint adjustment.”

*Mechanical force spinal manipulation increases trunk muscle strength assessed by electromyography: a comparative clinical trial.* Keller TS; Colloca CJ Vermont J Manipulative Physiol Ther 2000 Nov-Dec;23(9):585-95

“The results of this preliminary clinical trial demonstrated that MFMA SMT results in a significant increase in sEMG erector spinae isometric MVC muscle output.”

**King’s Principle No 1**

“The primary role of proprioception is the generation and constant adaptation of muscle tone.”

**King’s Principle No 2**

“Too much or too little muscle tone; doesn’t just indicate a problem, most of the time it IS the problem.”

Muscle weakness causes joint instability

**Medicine has no answers to functional weakness.**
The 12 year prognosis of unilateral functional weakness and sensory disturbance. Stone J; Sharpe M; Rothwell PM; Warlow CP J Neurol Neurosurg Psychiatry 2003 May;74(5):591-6

"Many patients assessed by neurologists with unilateral functional weakness and sensory symptoms as inpatients remain symptomatic, distressed, and disabled as long as 12 years after the original diagnosis. These symptoms are only rarely explained by the subsequent development of a recognisable neurological disorder in the long term."

Videos

What if the tack never goes away?
What if the tack never goes away?
What if the tack is a cyst?

Facilitation and Inhibition

PRESSURE AND STRETCH are the main tools we use to influence proprioception.

*Proprioceptive Input from Pressure - sensors of Teeth*

Researchers in Adelaide looked at the effects of gradually increasing pressure on the teeth as opposed to tapping the teeth and how that effected the strength of the masseter muscle.

Gradually increasing pressure on the incisors resulted in immediate FACILITATION of the masseter muscle.

Tapping the incisors resulted in immediate INHIBITION of the masseter muscle.

Turker KS; Brodin P; Miles TS; Exp Brain Res 1994;100(2):307-15
Principles of Muscle Testing

Any muscle or movement can be tested. How you do the test is much more important than what you test.

There are three different types of contraction

1. Concentric: the muscle contracts and the origin and insertion approximate.
2. Isometric: the muscle contracts but the origin and insertion neither approximate or separate
3. Eccentric: the muscle contracts and the origin and insertion separate.
4. How to perform the test:
   a) Move the limb to the start position.
   b) Have the patient perform a maximal isometric contraction for about two seconds while you meet their effort.
   c) Start the test slowly. Muscles don’t reach their full strength until about 2 seconds into the test.
   d) After two seconds (or however long it takes for them to reach full power, slightly increase your resistance and see if their contraction meets your input or fades away.

A strong muscle holds or pushes you away under reasonable test conditions. A weak muscle fades.

A muscle fades when it cannot continue to increase in strength.

Don’t be impatient. It takes time to learn good testing but the results are worth it.

If a muscle is strong, it will often overcome your testing pressure. It is acceptable to let a strong muscle do a concentric contraction as long as the pressure you maintain is constant.

Timing

- Go slowly, any muscle can be overcome with enough speed
- Make sure the instructions are well understood
- Adjust your timing and strength according to the response of the patient.
- A strong muscle continues to hold or gets stronger.
A weak muscle starts to fade.
Always compare bilaterally

Position

Starting position is critical.
Most muscles move in an ARC around a pivot point.
Good positioning isolates the muscle to be tested as much as possible by removing the action of synergists and approximating origin and insertion of the tested muscle.

Strength

Always adjust the test strength and timing to suit the patient.
Have enough leverage to be able to take their muscle to maximum strength and still have a little in reserve.
Try to get as close to 100% of the patient’s ability without hurting them
A muscle failure is usually total (a digital response, not an analogue one)
Don’t worry about “subtle” weaknesses. A truly weak muscle is distinctive.

Recruiting

If a muscle is weak, the patient may attempt to:
Subconsciously use agonist muscles to hide muscle weakness (recruiting). This often involves bending the elbow or knee or rotating the limb or the body slightly.
If you have to, hold the limb in position.
They may not be able to sustain the starting position.
Alter the direction of the test.
Go into cramp.
Alter their body position to change their vector.
Push erratically.
Fudge the test in some other way.
Basic Muscle Testing

To keep things simple, we are only going to be looking for strong or weak muscles. You need to get your hands on as many muscles as you can. Ask for feedback from the person being tested. Don’t presume you are doing it right. Let your patients coach you.

It is easier to test movements than individual muscles.

This simple 5 step sequence is designed to detect most proprioceptive problems.

1. **Hip Abduction**
Stand at the foot of the table. The patient is face-up. Keep the patient's knee straight and the leg low so that the movement is parallel to the floor. Start the test at 30-45 degrees from the midline. Stabilize outside the other leg. Do both sides.

2. **Hip flexion**
Stand at the side of the table. The patient is face-up. Lift their leg to 45 degrees. Place your hand (the one closest to their feet) on their shin and push down at a slight angle (allowing for the arc of movement). Do both sides.

3. **Shoulder Abduction**
All of the shoulder abductors and flexors can be tested. Just keep the elbow straight. Stand close to the side of the patient to do the test.

4. **Neck Flexion**
Be careful with this test. Too much force can give the patient a whiplash. Ask the patient to lift their head off the table. **DO NOT LIFT THEIR HEAD FOR THEM.** Any patient who cannot lift their head off the table deserves immediate referral for X-Ray examination. Once they have proven they can lift their head, place your palm on their forehead and gently resist their efforts to push their head to their feet. You can also test each side in turn, as well as both together.

5. **Opposite shoulder Abduction**
We have just completed the first stage of proprioceptive testing. The patients we have just looked at are lying flat. They have no stress on their body and nothing to distract them. If they were weak on any or all of these tests, they have a LEVEL 3.
A level 3 weakness is a weakness that is persistent. It is affecting their body continuously and is likely to be having a severely detrimental effect on the patient’s health. At this stage we have no clue as to the origin of the weakness, we just note its presence.

Any patient who is strong in all 5 areas should now move to examination for a level 2 weakness.

**Level Two Examination.**

Searching for a level two weakness is very similar to searching for a Level 3 weakness. All of the tests are similar. The biggest difference is that there is a stress added to the body. The patient is asked to stretch one limb while the test is performed. It is usually easiest to stretch the limb being tested, although a level two weakness will be present if any limb is stretched.

All stretching does is activate the spinal muscles. Contracting these muscles causes more input into the nervous system. If the spinal muscles are inhibited, the overall tone of the CNS will be depleted, causing a weakness that was hidden while the patient was at rest.

A level 2 neck weakness is found by having the patient tuck their chin down before performing the test.

Most level 2 weaknesses are general; they affect the entire body.

A Level 2 weaknesses are not as severe as a level 3. However, the patient has a significant problem since they are in a state of weakness every time their spinal muscles are being used.

Level 2 weaknesses are often caused by METAL somewhere in or on the body.

**Level 1 Examination.**

A level 1 weakness is a weakness of a muscle or movement when the muscle is fully shortened.

The muscle should still hold under testing even if fully shortened or contracted, even if it cannot generate quite the same level of power.
The neck is tested the same way as for a level 2 weakness.

Level 1 weaknesses are often seen in other muscles that are usually in a shortened state. These include

**Hip adductors**
Support the opposite leg and pull the involved leg out. Keep both legs straight.

Full abduction of the shoulder. Keep the patient's palm out and their elbow to their ear. The elbow must stay straight. Have them try to pull the elbow to the ear while you feel for the fade.

**Latissimus Dorsi**
The patient's arm is by their side. Rotate their arm so that the back of their palm is by their side. They pull in to their side while you resist. A weakness of this muscle nearly always results in a bent elbow. You may have to hold the elbow straight with your spare arm.

Level 1 or “full-shortening” weaknesses are often cause by metal and sometimes caused by nutritional deficiencies (especially iodine).

**Over Facilitated**

There is one other “global” state that needs to be addressed and that is one of hypertonicity or overfacilitation.

“Global” is probably an overstatement as this condition seems to mostly affect the proximal muscles. It is only ever a compensation for an underlying weakness – how to find this weakness will be covered in module 3.

Mechanical deformation (perpendicular compression) of a spindle cell normally produces inhibition of the muscle being tested. If the tested muscle is inhibited, it's antagonist must be facilitated.

So test any muscle and then test it again while you are digging your fingers firmly into the belly of the muscle. A normal muscle will test weak. Deltoids and quadriceps are easiest to test.
If the deltoids and quads do not fail with compression of their spindle cell, they could be hypertonic or they could just be very strong.

To differentiate, press firmly into the belly of the antagonist (pecs or lat dorsi for deltoids, hamstrings for quads) and test the agonist again.

By inhibiting the antagonist, we should be facilitating the agonist but all too often this already facilitated muscle receives more facilitation and goes into fatigue or inhibition.

Summary – A hypertonic muscle is one that doesn't fail when it's muscle spindles are compressed but does fail when the spindles of it's antagonist are compressed.

What do the tests mean?

Interpretation of tests.

The tests don’t “mean” anything. They are just indicators of the ability of the patient’s body. Strong tests indicate a fully functional proprioceptive system, good muscle tone and reasonable nutritional status.

A weak test indicates some degree of Proprioceptive Intrusion into the normal function of the nervous system.

To find the cause of the proprioceptive intrusion, alter all of the most common causes of proprioceptive intrusion one at a time and treat or advise accordingly.

Searching for a Solution

Fortunately, proprioception is very sensitive to change. If you change proprioception, you will often get a change in muscle strength. We are looking for changes that take a weak muscle or muscles back to strength.
The following is a list of the most common causes and how to test for them.

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<thead>
<tr>
<th>Cause</th>
<th>How to Test</th>
<th>Treatment Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body piercing</td>
<td>Remove</td>
<td></td>
</tr>
<tr>
<td>Jewellery such as neck chains, watches, rings</td>
<td>Remove</td>
<td></td>
</tr>
<tr>
<td>Glasses</td>
<td>Remove or close eyes</td>
<td></td>
</tr>
<tr>
<td>Dentures</td>
<td>Remove</td>
<td></td>
</tr>
<tr>
<td>Metal fillings or crowns</td>
<td>See next seminar</td>
<td></td>
</tr>
<tr>
<td>Vertebral subluxations</td>
<td>Change the patient’s position</td>
<td></td>
</tr>
<tr>
<td>Dehydration</td>
<td>Give a large glass of water</td>
<td></td>
</tr>
<tr>
<td>Scars (surgical or traumatic)</td>
<td>Contact, push or pull scar</td>
<td></td>
</tr>
<tr>
<td>Nutritional Deficiency</td>
<td>See next seminar</td>
<td></td>
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<tr>
<td>Wired Bras</td>
<td>Undo or remove the bra</td>
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<tr>
<td>Chemicals</td>
<td>See next seminar</td>
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Notes on treatment

Be gentle. Be sensitive. Be aware.

You have knowledge that is extremely privileged. None of your patients or their husbands, wives, friends or doctors will know anything about proprioception.

Often it is not the patient that will give you any trouble; it will be their “friends.”

I am sure you will find your own way but all of the changes you will suggest from the information you have gathered today, are reversible and are thus very safe. The hard part is sometime getting the patient on board. Getting better may mean giving or finding alternatives to their favourite things. See if the patient is willing to try something new. Ask them to try it as an experiment.

There are a few patients who are afraid of changing anything in their lives. It’s not worth making an enemy of these people. You may have to allow them to be sick.

Homework

Basic Muscle Testing Online Video demonstrations.

Certificates in Proprioceptive Medicine will be awarded by the Association for the Advancement of Proprioceptive Medicine on completion of a case study. The case study should include:

History
Examination findings with objective strength measurement if possible
Proprioceptive findings
Advice or treatment given
One-week follow-up.
Photos (showing change) are appreciated. Pre and post video can be posted on www.proprioception.org.uk as part of the continuing body of evidence being accumulated by the Association for the Advancement of Proprioceptive Medicine.
Either obtain the patient’s written consent to give the file for examination (it will be returned) or change the patient’s name.

Bibliography

1. Turker KS; Brodin P; Miles TS Reflex responses of motor units in human masseter muscle to mechanical stimulation of a tooth. Exp Brain Res 1994;100(2):307-15