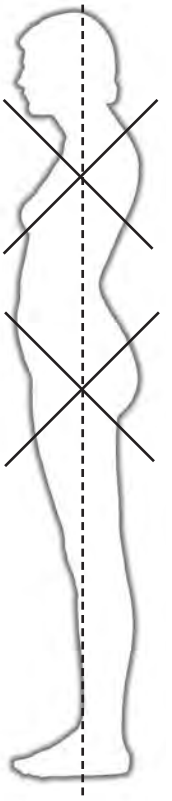
Postural Assessment

Muscle Balance & Posture

There are many influences on our posture. The first influence is gravity. The overcoming of gravity is the primary determination of the balancing act that the musculature performs to hold us upright. Other influences include bony structures, pathologies, emotional stressors, and certainly pain, along with occupational or recreational activities. (Ward, 203)

Changes to posture affect our musculature by altering the balance between muscles, making some muscles short and others long. When the relationship between muscles that are balanced against each other (agonist and antagonist, flexor and extensor, etc.) becomes imbalanced, posture and function of the body must change, usually for the worse. Shortness in muscle and tissue pulls body parts out of a balanced position, but this requires weak and long muscle to permit this to happen. (Kendall, 205) Imbalance occurs when one muscle becomes too high in tone and shortens as it tightens. The result is that its balancing/opposing musculature often lengthens and becomes weaker. The opposite is also true: if a muscle weakens and lengthens, then the opposing muscle becomes short and tight.



Jull and Janda have shown how this occurs in patterns that have become known as the upper cross syndrome and the lower cross syndrome (diagram at right). Janda noticed that the muscles that tend to tighten are the ones responsible for sustaining our posture in both static and dynamic states. These muscles are always "on," or working, except when the person is asleep. Many of these muscles, but not all, that tend to tighten are two joint muscles. The muscles that tend to go weak and long are referred to as "phasic" muscles. They are muscles that work only to perform specific tasks when called upon, but are not responsible for sustaining our posture. Therefore, they can often be "off," or not working, for most of the day. (Jull & Janda, 1987)

Changes to posture and function are often the predisposing factors leading to injury or overuse syndromes. Examples are: headaches, low back pain, rotator cuff strains, thoracic outlet syndromes and patellar femoral pain syndromes. On the other hand, muscle imbalance can be the result of traumas as the body tries to protect itself through splinting, or as we compensate for temporary losses of function. If the injury persists for more than one or two days, the body often adapts to its new posture and function and takes this as the new normal. Though antalgic movement patterns may lessen and disappear, the body is often left with changes due to the alterations in muscle balance that have taken place. The longer it takes an impairment to heal, the more likely the body will accept the changes to its function. The postural changes that occur due to muscle imbalance will eventually affect other structures (even changing the shape of bone).

Compression syndromes that are a result of postural deviations affect neurological, vascular, and lymphatic tissues creating neurological signs and symptoms, and/or vascular changes that directly affect the health and function of tissues. Joints are another structure affected by postural deviations, resulting in misalignment. This leads to degenerative joint change, or to a predisposition to injury.

Visceral organs also undergo stress when there are deviations to posture which affect the shape and orientation of the abdominal cavity (e.g., from an anterior pelvic tilt). Visceral changes include the tractioning of bile ducts, rotations of organs leading to possible physiologic alterations in function, and tractioning or compression of sympathetic nerves or ganglia.

Thoracic outlet problems, and other acquired nerve compression syndromes, are often the product of muscle imbalances. The neurovascular bundles can become compressed in the tissue's connective tissue elements, or between structures (bone, etc.) that are pulled out of position by muscle imbalances.

INSIGHTS

Axoplasmic Flow
Though it is somewhat of a digression, there is one important point that I would like to make here. Compression of neural tissue does not just affect nerve conduction, per se, as in conduction down myelin sheaths. What is also affected by compression is axonal flow (or axoplasmic flow), the movement of substances through the nerve cell's cytoplasm and down the axoplasm. This includes mitochondria, lipids, proteins, some organelles, and the like. Due to the length of the axon, there is a fast and slow transport system, both of which needs to be functioning correctly if nutrients are to be supplied to all areas of the cell in a timely manner. The axon terminals appear to possess ribosomes (which were probably transported there from the cell body), which can produce proteins. In this way, the terminal endings can make at least some neurotransmitters on site, from raw materials supplied by the transport system. Further, materials are sent back up the axon (retrograde transport) for breakdown, some parts are recycled, and others may be discarded by the cell body.

Lung capacity and function can be affected by postural deviations in the cervical spine and the rib cage: Scalenes shorten and lift the first two ribs making them insufficient to come into play when axillary capacity for the lungs is required due to increased demand. Changes of the rib cage mechanics can do the same, sometimes fixing some of the ribs in an inhaled or an exhaled position.

Muscle imbalance and the resultant postural deviations are often the primary reason for degenerative joint disease (such as osteoarthritis), especially in the spine, pelvis and lower limbs, and for degenerative disc disease in the spine. There is the obvious situation of changes to the curves of the spine, rotations of limbs, etc.

Tensegrity
The other more subtle reason is due to what is called the tensegrity (tensile/tension integrity) model. This is a term coined by the inventor and architect, Buckminster Fuller. It proposes that the spine should not be looked at as merely a column, or a set of blocks that are stacked one on top of the other with increasing compressive forces accumulating as we go down the spine. Rather, tensegrity is meant to explain how, when we add the ribs and muscles to the picture, the forces are distributed by the tension in the muscles, and fascia, through their attachments on the ribs and vertebrae in a way that reduces the compressive forces going through the spinal column. In other words, weight can be transferred out to the body wall. (See Myers for a good introduction to the term tensegrity.)

Creating an imbalance in the tension will change the dynamics of tensegrity of the trunk causing exponential stress on some muscles or connective tissue (cables) while others go lax and no longer do their job. Those taking the strain suffer from tensile overload – tendinitis, shortness, and hypertonicity. Those that are lax suffer atrophy. The bones (struts) suffer from the changes in tension, with weight shifting on or off them. This can affect their shape, their growth, and the level of the bone's density.

Further, due to the development of muscle imbalances, the rib cage no longer functions (as struts) to carry the trunk weight outward. Therefore, we have an exponential change in the compressive forces traveling down the spine. Further, these forces are no longer evenly distributed in the spine, but shift about passing unevenly through anterior surfaces of thoracic vertebrae, facet joints in areas of lordosis, uneven stresses on the cartilaginous discs layers, etc. In fact, if this tensegrity, or integration through balanced tension, were not natural to the body we would all suffer at an early age from degenerative joint and disc diseases, tissues contracturing, early organ failure and the like.

Tightness Versus Tautness
There is an important palpatory observation we need to keep in mind when investigating the musculature for shortness and excessive length. Muscles are palpated as lax, relaxed, as having normal tone, or as taut. We often make the common mistake of calling all taut muscles "tight," but what we are really feeling is tautness. We need to check the length of a muscle before we can say it is tight, because tightness implies a short, even contractured muscle. However, muscles can be long and taut. If a muscle is stretched, it becomes taut. If we have confused tautness with tightness, we can make the mistake of thinking a lengthened taut muscle is tight and, therefore, short, and proceed to lengthen an already overly long muscle. This could result in making the client's postural deviations worse.

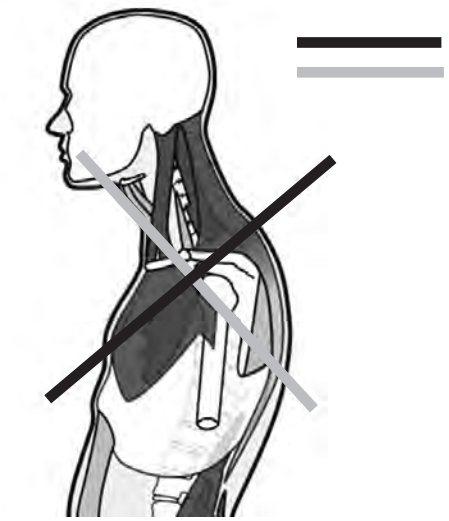
For example, clients with a forward head and shoulders posture often have an excessive kyphosis: tight pectoralis and posterior cervical muscles, with weakened and lengthened rhomboids, middle and lower trapezius muscles. The client often enjoys the mid-thoracic area being worked during massage and the therapist often mistakes the tautness of these muscles as tightness and proceeds to relax and lengthen these muscles further. This may make the client feel temporarily better but, in fact, it only makes their shoulders roll forward more and exaggerate their kyphosis.

One further consequence of the contracturing of a taut muscle, like the hamstrings of a client with an anterior pelvic tilt, is that the muscle loses its elasticity. So, though the hamstrings may have become "frozen" in a slightly lengthened position, they usually will appear as short on a length test (which requires by nature the muscle to stretch). Again, clients with these taut hamstrings love them being worked on, but if the therapist treats them in a manner that lengthens them, then the anterior pelvic tilt will increase, making things worse! Therefore, the need is for a careful and comprehensive postural analysis with landmarking.

Consequences Of Muscle Imbalance
We can go beyond the muscles mentioned by Janda and see further implications. One example: In the upper cross syndrome long rhomboid major, allow the serratus anterior to go short. The connective tissue component shortens as well over time and, hence, the serratus end up contractured (such as the client whose scapulae you cannot lift off the rib cage or mobilize well).

Further, if you lengthen the pectoralis, the sternocleidomastoid and posterior cervical muscles and then strengthen or "wake up" the inhibited rhomboids and lower traps and add tone to the deep neck flexors, those shoulders will still not go back if that serratus anterior (along with the latissimus dorsi and teres major) are not lengthened as well. To get a complete response, you need as complete a picture as you can get.

Observations & Inspection: Upper Cross Syndrome



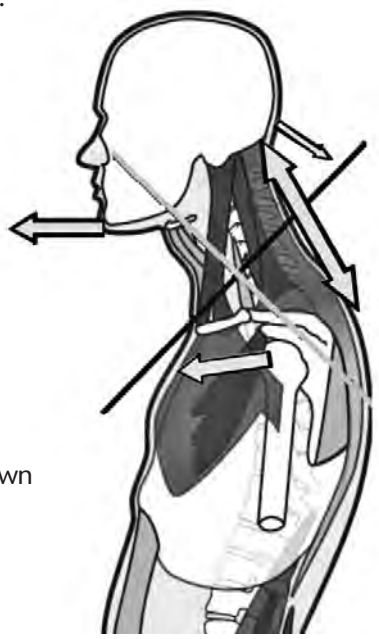
Tight Musculature
Weak Musculature

Weak:
Deep Flexors of Neck;
Rhomboids Infraspinatus & Teres Minor;
Middle & Lower Trapezium

Tight:
Suboccipitals;
Upper Trapezium & Levator Scapulae;
SCM & Scalenes;
Teres Major & Latissimus Dorsi & Teres Minor;
Pectoralis Major & Serratus Anterior

(Janda & Jull, 1987)

The upper cross syndrome produces the following shifts in structures by changing the length and strength of muscles.



Chin moves forward into protrusion

Shoulder rolls forward or is protracted

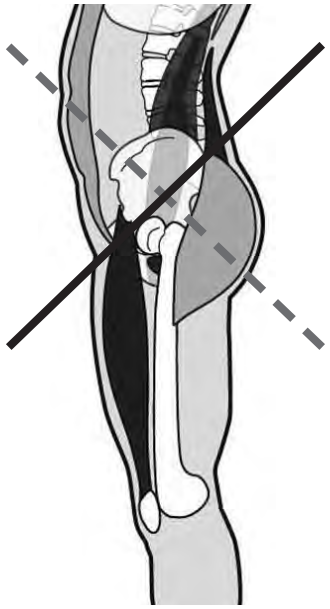
Upper ribs pushed down as if exhaling

The upper cervical spine (the OA joint and C2) are held in extension, while the lower cervical spine and upper thoracic are held flexed.

Thoracic kyphosis exaggerates and the musculature and posterior ligaments are stretched.

Observations made of a forward head posture and hyperkyphosis: Hyperkyphosis in the thoracic spine means that the upper and mid-thoracic spine is more flexed than normal while the lower thoracic segments are more extended. The increased flexion in the upper and mid-thoracic spine stretches the musculature on the back at these levels, making them long and, therefore, weaker/inhibited. In turn, the upper and middle ribs are depressed leaving the rib cage fixed and held as if the person is always exhaling, thereby decreasing lung capacity. This shortens the pectoralis major and minor pulling the shoulders forward with scapula protracted.

Hyperlordosis (Lower Cross Syndrome)
For the lower cross syndrome, the classic short (and tight) and long and weak muscles are organized as follows. This is a bilateral anterior pelvic tilt, which is one of the most common muscle imbalances found in the clinical setting. (Janda & Jull, 1987)



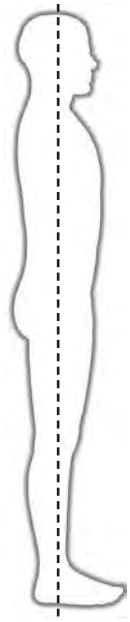
Short, Tight & Facilitated Musculature:
Lumbar Erectors, Quadratus Lumborum,
Iliopsoas, Rectus Femoris, Tensor Fascia Lata,
Thigh Adductors,
Piriformis

Lengthened, Weak & Inhibited Musculature:
Rectus & Transversus Abdominus,
Gluteal Muscles,
Vastus Medialis, Lateralis, Intermedius (Of Quadriceps)

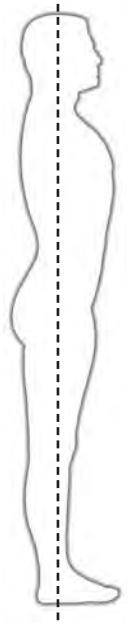
Note:
Hamstrings are not included in either listing because they are properly referred to as "taut," not tight and short. Taut means lengthened, but hypertonic. The hamstrings are stretched because they are the only muscle preventing the pelvis from rotating further anteriorly. Over time, they contracture and will appear "short" when tested for length.

Other Common Postures & Their Faults

Other common postural faults are described below, and again, are usually the product of muscle imbalances. Each chapter in this text has some further discussion on these and other postural impairments that occur from muscle imbalance or structural lesions.



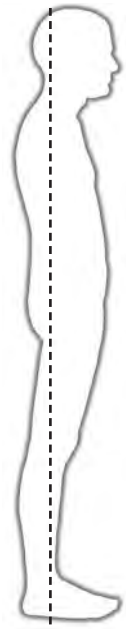
Normal Posture: Here, the ear sits roughly over the shoulder, the shoulder sits over the trochanter, and the gravity line runs just behind the patella and just in front of the malleoli. The spine has its proper elongated S-shape that provides a spring to cushion the joints and structures of the spine.



Military Posture: Named for the classic "head up, stomach in and chest out" position of a soldier at attention. It requires the person to extend their low back (increasing the lumbar lordosis) while lengthening or flattening the thoracic kyphosis as they protract their shoulders. Often, the chin is lifted, extending the upper cervical spine. Therefore, the low back and mid-back erectors are short and tense, abdominals are tense, rhomboids and lower traps short and tense. The suboccipitals are short and tense, along with the scalenes (holding the first two ribs up). The pectoral muscles are short and tense as well (lifting the ribs and sternum while lowering the clavicle onto the ribs beneath it).

For the military posture, and for any posture that generates hyperlordosis of the lumbar spine, the following is true: For the joints of the low back, this hyperlordosis closes the facet joints and they become weight- or load-bearing. If chronic, then the occurrence of osteoarthritis in these joints becomes more likely. The posterior IVD becomes loaded as well, leading to poor nutrition and, hence, health of the disc. This make the IVD more likely to degenerate (degenerative disc disease or DDD). The excessive lordosis also places an increased strain on the narrow pars articularis via the attachments of the musculature of the low back pulling the vertebrae into extension. This makes them susceptible to spondylolysis (fractures of the pars articularis), which, in turn, may further lead to spondylothesis (slippage of a vertebrae forward in relation to the one below). See the Lumbar Chapter for more on the topic of IVDs and DDD.

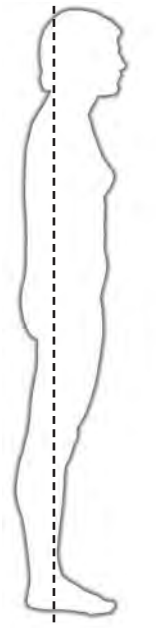
The thoracic flatness along with the expanded chest can lead to the ribs becoming fixed in an inhaled position, reducing the overall lung capacity since exhalation may become restricted. Posterior cervical pain, especially suboccipital, is a common occurrence for this posture, developing over time and becoming chronic.



Sway Back, or forward hip posture. The sway refers to the tendency of a person with this posture to sway back and forth (i.e., anteriorly and posteriorly). The reason for this is that with the hips thrust forward their weight will shift onto the toes. This creates a feeling of imbalance so the musculature of the legs and hips will alternate in tension causing the person to sway back to front as they remain perched on their toes. (Kendall, et al, 2005) The lumbar spine is extended (hyperlordotic) at the lowest lumbar vertebrae, which are sitting on posteriorly rotated hips. And, the hip joint is in extension, as are the knees. (The thoracic kyphosis and cervical lordosis are also exaggerated.) The first one or two lumbar vertebrae and lower thoracic vertebrae are often flattened and resist motion. This adds to the compressive force on the lowest hyperextended lumbars.

Muscles Creating Sway Back Posture:
• Tight and hypertonic muscles: Lumbar erectors, quadratus lumborum; hamstrings and gluteus maximus; (for the knees: vastus medialis, vastus lateralis, vastus intermedius).
• Weak and inhibited: abdominals, except for internal oblique which may be hypertonic (Kendall, et al), iliopsoas, rectus femoris.

Common Hyperlordotic Issues:
• Posterior thoracic fatigue is a common complaint from clients;
• Neck pain with impairments to cervical motion occurs frequently;
• Protracted shoulders set up the shoulders for rotator cuff injuries;
• Knee tissues and joint structures are under consistent strain.



Flat Back posture occurs when there is a greatly reduced or absent lordosis in the lumbar spine. There is also an increased upper thoracic kyphosis and forward head posture. Because the lumbar spine curve is decreased – flattened – the body will compensate for this by throwing the head forward (upper thoracic hyperkyphosis and upper cervical hyperlordosis). Often, the whole body tilts forward, resulting in the toes, grabbing the ground and the toe flexors, therefore, contributing to a pes cavus (high arch) in the foot.

Therefore, the pelvis-lumbar complex has:
• The lumbar spine flexed; resulting in stretched low back erectors;
• A posterior pelvic tilt with extension of hip joint. Tight and short hamstrings, abdominals with both a lengthened rectus femoris and iliopsoas.

The flat back, or lack of the lumbar lordosis, on top of the posteriorly rotated hips, results in degenerative disc disease due to the lack of a natural springiness that comes from a proper lordotic curve. The forward head posture produces cervical pain from strained muscles, overloaded facet joints and spasming suboccipital muscles. This is a recipe for chronic headaches or migraines.

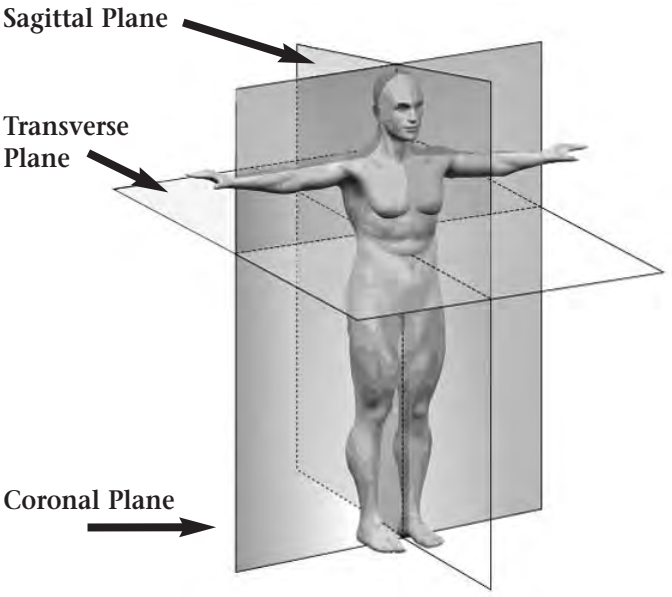
General Postural Examination

Introduction
We will present here the classic postural examination (with one important difference) done standing, and will add seated, supine, and prone examinations as well. These could all be done as an initial or detailed postural examination, or done separately, depending on the information needed.

The author would like to point out that in his own practice he prefers to include some motion in a postural examination. The motion included can be found in the Comprehensive Examination of the Spine section of this book, which is just before the chapters on the sacroiliac joints and the spine. We have gait analysis as a separate section in this introduction, but many therapists (including this author) would incorporate this in a postural examination as well. However, this is often only included when the client's condition and goals warrant it. Therefore, the therapist has a lot of flexibility with how they do their postural assessments, and can have several options available depending on the client's condition, needs, and the therapist's clinical judgment.

If possible, use a plumb line, especially if you are just learning these skills. With experience, many therapists develop quite a trained eye and no longer need a plumb line. The plumb line should begin, or be centred, in the anterior and posterior views, exactly in the middle between the two feet. In the lateral views, the plumb lies just behind the malleoli of the ankle.

What Are We Taking Note Of?
We are noting orientation and asymmetries of structures in vertical (sagittal), frontal (coronal) and in horizontal (transverse) planes:
• Rotation and/or sidebending of one or both limbs, hips, shoulders, and in the truck and head;
• Bilaterally compare levels of paired structures, bulk of tissues, length, and proportions, etc.



Points To Remember As You Begin Your Postural Assessment
1) When you find structures or levels that appear to be asymmetrical or not level, then always check above and below that area/structure for its cause or compensations. Rarely does an impairment stand alone.
2) Be sure you are not being misled. Is something that appears higher or lower, more anterior or posterior, rotated and/or sidebent actually the issue or cause of the asymmetry? Alternatively, is the other side possibly out of position and leading you to believe as you do? For example, one elbow, the left, is farther from the body than the other. This can imply that the trunk is sidebent left, moving the left shoulder farther from the mid-line. This can certainly be true sometimes. However, on the contralateral right side, a protracted shoulder may make the right arm lay closer to the body, making the normal space (on the left) appear as if it was abnormal. Experience helps sort these out. Therefore, along with looking at the surrounding structures and tissues to see which areas show impairment or compensation, also look to the body as a whole to give you the appropriate answer.

Standing Postural Exam

Artificial Pose

Note: Much of this information is needed to compare with supine and prone examination so that we are not misled by what we see when the client is on the table in those positions. The major difference for these instructions about a standing postural assessment is that the author considers it important that the client should be standing in a natural pose when doing a postural assessment. Only after seeing the client in this more natural position, should the client be asked to have their feet together, etc., as has been traditionally done.

An artificial pose, such as pictured here, can be instructive, but not until after you have observed the client in what is a more natural posture for them. You see more clearly their holding patterns, their asymmetries, etc., in the natural pose. While the artificial pose is just that, artificial.

Therefore, once you establish a more natural pose (see pictures below) do not correct the client's feet positions, head positions, etc. You are trying to have them stand as they naturally do, or as is much as possible even though they are in a clinical setting.

• Note the differences in where the plumb line runs up the body in the artificial pose versus the more natural pose, in the pictures below.

Establishing Natural Posture

To assist in establishing a natural posture instruct client to look up slightly (i.e., you do not want them watching their feet) and take a couple of steps, while staying in place. Then, tell them to stop and do not alter their position

Plumb Line
The plumb line, with the ideal posture, should run up equidistance between the knees, through the pubis symphysis, navel, mid-sternum, centre of the neck, through the chin, nose, and between the eyes. Check for levelness of knee creases, PSISs, greater trochanter heights, iliac crest heights. Check the levels of the patella, side shift in hips (pelvic obliquity), and level of greater trochanters, ASISs, and iliac crest heights, waist, levels of clavicles, acromions, jaw orientation, ear and eye levels.

Note: In the pictures on the previous page, the client leans to the left. The shoulders seem level, but the contour of the upper shoulders are not the same. However, the left hand is more inferior than the right). The right iliac crest is slightly higher (this all would be clearer life size). She does seem to compensate for this somewhere along the way, as the shoulders seem level from this view. Yet, at the cervical spine, she again bends to the left, and does not compensate at the suboccipital region (head).

Important: Compare the artificial pose in those pictures with the more natural posture. With that pose, you would not see the tilt to the left, even in the cervical spine or head! The tilt of the body and head is even clearer when the client is walking in place, the head will lean left, but not right (it only comes back to being straight.

First Observations
First, observe the natural orientation of the whole person. Take note of obvious asymmetries. Many students take too long to do their assessments because they waste time trying to observe, or find, minute differences. At this time in the assessment, it is suggested that any small differences under 1/8th of an inch should be ignored for now. We may concern ourselves with these minor differences once we palpate landmarks.

It is then useful to look at the lower body, hips and down to the feet, and focus there for several seconds, noting orientation of structures (rotation of limbs or truck and head) and asymmetries side to side (level, bulk, length, etc.). If need be, then check and focus from knee to feet; and then knee to hip, for a few seconds each. Observe the upper body, hips to top of the head. Again, you can divide your focus, after a cursory view of the whole upper body, into looking from hips to shoulders, shoulders to neck and head, then arms. It is suggested that your observations begin at the feet since it is from here that the body can first begin to become unbalanced or asymmetrical.

Caution: Though you may observe an asymmetry in one place, you cannot prejudge the issue and assume that the cause for that is in (or completely in) that very structure or tissue. It could be compensation from a structure/tissue that is above or below. In other words, it could be the result or consequence (a secondary or tertiary impairment) of some other (original) impairment.

Compensations are often an appropriate response by the body; it is the body's attempt to compensate for impairments, or for asymmetries (length or size differences) that are structural or functional.

Much of this information will be needed to compare with the supine and prone examinations, or even more importantly, when treating the client, so that you are not misled by what you see when the client is on the table in those positions. In other words, when the client is prone or supine the body weight will change the orientation of rotations, sidebendings, etc., that were observed during the standing postural exam. Therefore, you may need to consult your point-form written notes.

INSIGHTS

Common Asymmetries & Some Consequences

Presented here is a partial list of (common) asymmetries and an example or two of what they might mean. Keep the caution on the previous page in mind. (See the appropriate chapter for more on these possible connections/consequences.) The more assessment you do, and the more you understand your anatomy and joint motions, the more you will understand how varied and numerous are the possible implications of asymmetry. However, this does not really make things more difficult, rather the more specific and effective (not to mention safer) you will be able to make your treatments.

Asymmetry	Consequences
One foot rotated in or out, (normally foot is to be turned out 7-15°).	If foot is turned out, it may be pronated. This, in turn, may show up at knee as a valgus knee on that side. If turned in, foot may have a high (and possibly more rigid) arch, which could create a varus orientation at knee. (See Ankle, and Knee chapters for more.)
Knee observations as above; observe patella orientation	Valgus knee will put strain medial collateral ligament and meniscus of knee; while valgus would put strain lateral ligament and meniscus of knee. Increased strain means increased risk to injury.
Hips unlevel	Could be from a real bony leg length difference or, more likely, from a muscle imbalance side to side and anterior to posterior. When one-sided, or more on one side than the other, pelvis is unlevel. In turn, sacral base is tilted. This causes spine to sidebend and rotate to correct for this, i.e., it produces a scoliosis. Further, unlevel hips may imply a sacroiliac joint impairment.
Rotations in trunk can lead or be due to spinal lesions or impairments	This can increase strain on sacroiliac joints, change orientation of shoulders (which always leads to some sort of problem there or in arms), or neck issues.
One shoulder more protracted (and usually lower)	This leads to imbalanced strain of rotator cuff muscles. Some muscles become longer (stretched), some shorter, with inevitable consequences to: 1) muscle tissue health, and 2) poor mechanics for shoulder motion and, hence, an increased risk of osteoarthritic changes in joint.
Sidebent cervical spine	This will stretch (facet) joint and muscle tissues on one side, and shorten muscle and compress joints on the other side, leading to neck pain. Further, a sidebent cervical spine can compress one side of joints and muscles involved in conjunction of skull and spine (occipital-atlanto joint) leading to suboccipital headaches.
Rotation or sidebending of head	Will impact immediately on occipital-atlanto joints, and atlanto-axial joint below that, not to mention what can happen in cervical spine as a whole.

Standing Lateral View

Most therapists will look at the client from each side, get a lateral view. If possible, depending on the room available to you, try to move yourself to look at the client from each side. If you need the client to turn sideways, then have them take one or two steps in place to re-establish their natural posture.

Observe client from each side. Note how plumb runs through expected landmarks. If client must turn, then have client turn to one side, re-establish natural pose, then make observations; and then have client turn to the other side, repeat establishing pose and make your observation.

The landmarks for the plumb line are: just behind the lateral malleoli, just behind the patella, through the greater trochanter, through the middle of the glenohumeral joint and the external meatus (ear canal) of the ear.

One of most important levels to observe is from the PSIS to the ASIS. Normally, the ASIS is 5-15° lower to a horizontal line running through the PSIS (posterior to anterior). Women, in general, tend to have greater pelvic tilt anteriorly than men. A tilt of more than 20° implies that the innominate is anteriorly rotated, while zero or less (i.e., the ASIS is higher than the PSIS) implies that the innominate is posteriorly rotated.

Note: In the pictures above you can see how the client's body as a whole rotates to the left (i.e., the right side's landmarks from the knee up are significantly forward of the plumb line compared to the left view). Her right innominate (hip bone) is anteriorly rotated. This will make a leg functionally longer (see the Hip and Innominate chapter for more) as the acetabulum moves slightly anteriorly and inferiorly, making that hip joint lower.

Important: Compare the artificial pose above with the more natural posture. With that pose, you would not see the tilt to the left, even in the cervical spine or head! The tilt of the body and head is even clearer when the client is walking in place, the head will lean left, but not right (it only comes back to being straight.

Detective Work

As you compile a list of suspicions, while progressing through the postural assessment, you may find that several observations begin to suggest certain possibilities. You keep these in mind as you proceed through your whole testing protocol. To put the same point another way, positive results can become linked together, or coalesce, which can help you develop more specific concerns as you move along with your testing. These, in turn, can guide what specific areas need more thorough investigating with specific testing. Further, what detailed testing may not be appropriate at this time helping you avoid uninformative testing. In the end, this means you do more efficient testing, in a much more rational order. You carry out your detective work by this process.

Posterior View

Have client turn with their back to you and have them establish a natural posture. Start between feet, gluteal cleft, lumbar spine, thoracic spine and ribs, neck and head. Observe arches of feet, orientation of Achilles tendons, knee creases, etc.

The plumb line starts between the feet, through the gluteal cleft, up through the spinous processes (lumbar, thoracic, cervical) and anion on the occipital bone and the scapula should be relatively equidistant from the mid-line. Check first if Achilles tendons are straight or on an angle (valgus or much more rare, varus), then check the levelness of knee creases, PSISs, waist creases, lower angle of scapula, acromions, occiput and ears.

Palpating & Checking Landmarks
Once you have made your cursory observations, move closer to the client and begin palpating bilateral landmarks. Again, start at the feet. Check levels side to side. Though some possible interpretations are presented below, they are only meant as examples. Each chapter later in this textbook provides more detailed and thorough reasons for such findings.

Remember: Use your dominant eye when doing the checking of landmarks, especially as you must be close to the client. (See instructions on finding your dominant eye.)

Sitting behind the client: Landmark and palpate the levels of arches of the feet, Achilles tendons' orientation, ischial tuberosities, trochanters, PSISs, iliac crest heights, (creases of) waist, inferior and superior angles of scapula, mastoid processes.

Arches & Feet

Slip tips of index and middle finger as far as you can under one (longitudinal) arch, then the other; compare heights. Note if forefoot (one or both) look wider than the other (or than normal). If so, then anterior transverse arch may have fallen. (Will check further in prone or supine).

The transverse arch runs across the foot at the heads of the metatarsals. This arch helps the foot to toe-off using the big toe when walking or running. The bone of the big toe is quite large and made to take that stress. When the transverse arch falls, the client is more likely to toe-off on the second toe, which being smaller, is prone to having a stress fracture. Also, not coming off the big toes interferes with the efficiency of walking or running.

In other positions for observation and palpation, supine or prone, for example, you may note that there is a callus under the head of the second metatarsal. This is a sign that the foot is toeing off that toe. This also occurs to those who have Morton's Foot. This is where the head of the second metatarsal is further forward than the first or big toe. Further, the fall of the transverse arch can lead to a compression syndrome between the metatarsal heads that pinches a sensory nerve that will grow into a neuroma, (see the Ankle and Foot chapter).

Achilles Tendon

Note orientation of Achilles tendon: Normal is horizontal.
A valgus orientation means that insertion on heel is more lateral than it is superiorly at its origin. This implies pronation of hindfoot. You can imagine valgus orientation of Achilles tendon if you roll weight of your feet onto inside/medial edge, (i.e., pronate your feet). Best done seated.

Ischial Tuberosities

Palpate for superior insertion point for hamstrings, where posterior thigh meets gluteus maximus. Need to go deep with pressure directed slightly superiorly.

There are several possibilities for unlevel ischial tuberosities: 1) There is a bony difference in leg lengths, or a difference in functional leg length; 2) A lower ischial tuberosity on one side may mean that that side's innominate is posteriorly rotated, or that the higher side's innominate is anteriorly rotated; 3) The sign of a "hemi-pelvis," i.e., that one side of the pelvis (one of the innominates) is literally smaller than the other side. In this last situation, the iliac crest on that high side would appear level or even lower that the other sides iliac crest height. (See the Hip and Innominate chapter for more on all of these, and on other findings.)

Greater Trochanters

Place edge of index fingers on top of greater trochanters.

Like the ischial tuberosities, above, or the PSISs and iliac crest heights, on the following page, there are several possible explanations for unequal heights. Both the Hip and Innominate, and the Sacroiliac Joint and Pelvis chapters have more much on this. As there are numerous, inter-connected reasons, we will leave them for discussion in those specific chapters.

However, there is a good possibility (that though inequalities were found in the lower limbs), that the Trochanters do palpate as level, nonetheless. Hidden in those lower limb inequalities may lurk some compensations that leave the hips level. Or the asymmetries seen may be the body's way of compensating for unequal bone length in the lower limbs. To repeat a previous refrain: you need to be thorough in your investigation, like any good detective.

INSIGHTS

Compensatory Structural Patterns Versus
The Asymmetry Of Tensile Forces Within The Body

Sometimes, therapists will go right to the hips, and if the iliac crests appear level they will assume all is well with the lower limbs. Assuming that if there are inequalities they must be successfully compensating for each other since the hips are level, is a very misleading assumption, which could leave you wandering for several treatments trying to understand what is going on and finding no answer. It is not appropriate to assume that compensations that are alternating are benign. They may be, but they may not be. What is important is the flow of tensile forces as they move up and down the body. It is these variations of tension (and laxity) that precipitate many impairments or injuries. In fact, someone could look relatively balanced visually, but the imbalance and asymmetry of tension/laxity could still be happening and wreaking havoc on several tissues and joints in the body.

PSISs

Palpate PSISs bilaterally with thumbs. Tuck edge of thumb under PSISs in order to compare accurately.

The PSISs can be very large. Therefore, to try and gauge their level may be misleading if you place your thumbs on their large posterior surface. It is best to tuck your thumbs under the PSISs in order to assess their levelness one to the other. Practice finding this site quickly as it is a very common area needed to be palpated for numerous tests. Some therapists will first find the illiac crests (laterally) and follow their edges down to the PSISs. See immediately below.

Iliac Crests

Place index fingers on top of iliac crests at most lateral point.

Note: The levelness of the iliac crest heights may point to there being no serious lower limb inequalities, or that there are successful compensations for inequalities/impairments. Successful in that things become level, but these compensations may be failing and producing impairments locally and at a distance. It is through the direction and intensity of the tensile forces that compensations above and below are produced. This is what allows a seemingly minor impairment or asymmetry to have such large effects at great distances from that source.

Scapulae

Place pad of thumbs under inferior lateral angles; also compare angles from mid-line (spine). Further, check superior lateral angles: they should be only slightly closer to the mid-line than inferior ones.

Palpating these angles and observing the distance of each scapula's medial border from the spine can give clues about curvatures in the spine, or just commonly hint to a protracted (forward) or retracted (drawn back) shoulder.

Acromions

Place pad of thumbs under inferior lateral angles; also compare angles from mid-line (spine). Further, check superior lateral angles: they should be only slightly closer to the mid-line than inferior ones.

Mastoid Processes

Palpate with tip of index fingers (or pads of thumbs). This helps to establish how level base of skull is.

Anterior Landmarking
The primary landmarks to check are the trochanter heights, ASISs and iliac crest heights, along with the acromions. However, you can add, if you wish, inferior angle of patella and repeat check of arches of the feet and mastoid process levels.

Greater Trochanters

Palpate and landmark superior edge of trochanters.

ASISs

Palpate under side of ASISs.

Iliac Crests

Palpate superior lateral edges of iliac crests.

Acromions

Check levels of acromions from the front.

Landmarking From The Side
From this position, the most import landmarking is done to the ipsilateral ASIS and PSIS. Normally, the ASIS should be 5-15° lower than the PSIS. Any more than that amount of anterior rotation and the innominate is said to be anteriorly rotated. If the angle back-to-front is zero or higher (than level), the innominate is said to be posteriorly rotated. You must check both sides, as there usually is a difference. This is invaluable information to have to understand what otherwise might appear as contradictory findings of other landmarks and postural positioning (see the Hip and Innominate chapter).

ASIS & PSIS Levels

Tuck edge of one index finger under inferior edge of ASIS and other hand's index finger under inferior edge of PSIS. Estimate levelness or slope. Check both sides and compare.

INSIGHTS

Postural Challenges For Stability
Just prior to having the client sit, you may wish to do a specific postural challenge. This is done to evaluate the stability of the client's overall natural posture.

Anterior-Posterior Challenge

Place a finger or two on manubrium and a couple of fingers on and below C7 vertebrae. Very gently push client about a 1/2" backward and then forward. Observe how well client can keep their balance and whether they were willing to more easily go forward or back (or topple).

A client who has their weight on the heel of the foot will feel that they will topple backward easier. Often the client will have a flat back and posteriorly rotated innominates/pelvis. On the other hand, if they seem to be willing to topple forward more they have their weight on their toes. In this case, the client's overall posture seen with a plumb line from the side has the hips and shoulders forward of the plumb line.

Some clients will easily sway back and forth several times with seemingly no preference, forward or backward. This implies a sway back, where the lumbar spine is extended, (hyperlordotic) at the lowest lumbar vertebrae, which are sitting on posteriorly rotated hips. In addition, the hip joint is in extension, as are the knees. The thoracic kyphosis and cervical lordosis are also exaggerated. (See the Lumbar Spine chapter for more on this.)

Seated Postural Examination
Important: Note, when the client sits down, if any of the previous landmarks change orientation, one to another. If some, or most, alter, then this implies that many sources of postural asymmetries found with this client have come from the lower limbs (hips down). However, if the asymmetries remain, then their sources will be found in the upper body (from the pelvis up).

Asymmetry
If the asymmetries in the trunk do remain, and the iliac crest heights are unlevel, then you may wish to slide a lift (shim) under the ischial tuberosity on that low side. If the client's left iliac crest is lower by 1/4 of an inch, place a magazine or some such lift of similar height, under the left ischial tuberosity and see if the asymmetries stay the same, lessen or disappear. (When using a lift or shim, have the client sitting on a firm surface.)

If things become (more) level, then our problem is within the pelvis. Either a hemi-pelvis (one side smaller than the other) or, a severe rotation of one innominate to the other. There are two possibilities for this unilateral rotation:
1) A severe anterior rotation of one innominate can shift the ischial tuberosity posteriorly, making that side's innominate seem lower when sitting;
2) Alternatively, a severe posterior innominate will shift the ischial tuberosity anteriorly, making that innominate seem higher when the client is sitting.

One hint for unequally rotated hips is a difference in heights of the PSISs! See immediately below.

Check PSISs

Landmark PSISs (thumbs under PSISs).

Proceed to re-check the iliac crest heights, angles of scapulae levels and their distance from the spine, as well as the acromion and occiput levels. All of this should take less than 30 seconds.

Rationale For Continuing Postural Assessment In Supine & Prone
This is usually where most postural examinations end. The therapist would now try to put together the numerous observations made so far and inter-relate as many as possible into some suspicions.
• For example, in the previous picture, the client presents with the pelvis rotated left and the right iliac crest and trochanter high, yet the right ASIS is low. This would imply that the right innominate is rotated anteriorly, which also makes it slightly internally rotate (inflare); In turn, this would make the right leg functionally longer. However, the right leg is slightly shortened by the right valgus knee, the weight shifted over the left leg and with the right hip also shifted anteriorly (leaving the right leg on an angle which shortens its overall height.)

To help compile these possibilities into suspicions, we may need a little more information. A lot of this can come from supine and prone comparisons of landmarks. Further, even if everything appears different, since we most often treat clients laying on a table, we need to note these changes so that when we work we can tell if our treatment is producing the results we want as we work, and not have to wait until the end of the treatment to re-assess and find if we were successful. Otherwise, we run the risk of continually missing the mark for our outcomes.

Supine Landmarking
Note: Supine and prone landmarking, while giving more information, may be too much information for a new student. Most of the implications of what are found here will be much better understood once the Hip and Innominate, and the Sacroiliac Joint and Pelvis chapters have been mastered. You will often find these instructions re-occurring there with much better explanations available because the anatomy and physiology (functioning) of the tissues and joints are explained in more detail.

However, for more experienced students, or for practicing massage therapists, this information may be of use as presented here. Similar to the standing client, we can assist the client to lay in their natural orientation: Client is crook-lying. Ask them to lift their hips off the table, and then let them drop back down to the table. The musculature around the pelvis will pull according to their current tautness (short or long) and, so, leave the client lying supine according to their muscle balance. Have the client let you passively pull each bent leg into extension. Begin your observations in supine from this point.

Natural Position Supine

Crook-lying with hips raised, client drops them back onto table and lets therapist passively straighten one leg at a time. Therapist applies less than one pound of traction applied momentarily. This traction is not meant to travel past the knees, and is used only in an attempt to negate some inequalities brought about by lowering legs from crook-lying.

Natural Position Supine

Thumbs need to be under the bottom edge of malleoli. Observe medial malleoli levels. Note if one leg appears longer/shorter, or equal. You will want to compare your findings here with those found regarding levels of ASISs.

Check ASISs

1. Level Of ASISs Horizontally

2. ASISs Heights From Table

3. Check For Inflare/Outflare

1. Have thumbs under ASISs. 2. Place thumbs on anterior surfaces of thumbs on ASISs. 3. Place thumbs under ASISs and reach with index fingers to umbilicus (navel). Compare distances one side to the other.

Findings

• Check if ASISs are level in superior-inferior direction (horizontal plane). This helps us uncover innominate rotations, (anterior or posterior). Therefore, if one ASIS is lower than the other, then that innominate is anteriorly rotated, or the other is posteriorly rotated. Your results above of the standing side view assessment of PSIS-ASIS levels will help decide which is which. (See further testing in the Hip and Innominate chapter.)

Note: Compare these results with the malleoli levels seen above. This could provide a clue for a functionally long or short leg being present, or the possibility of a bony leg length difference. If the difference seen right to left in the malleoli is matched by the difference right to left in the ASISs, then we may have a functional leg length difference. This is going to have repercussions from the arches of the feet to the levelness of the eyes! Again, there is much more detail on this in both the Hip and Innominate, and the Sacroiliac Joint and Pelvis chapters.

• Check if heights of the ASISs from table are symmetrical (anterior-posterior direction). This may help confirm rotation in the pelvis. Note: It is wise to rely more on the standing assessment's findings of the direction of rotation than on the supine or prone findings. When clients lay down, the upper or lower body weight may cause the body part to roll opposite to its standing orientation.
• Distance from the mid-line using umbilicus gives us clues to inflares or outflares. When the ASIS is closer to the mid-line than its pair, it is called an inflare (or internal rotation of the innominate). When the ASIS is farther from the mid-line that the other, it is in an outflared position (or external rotation of the innominate). Which is which depends on further testing and evaluation (covered in detail in the Hip and Innominate chapter). You could have checked for inflares and outflares in the same manner when the client was standing. But still check when the client is supine to understand how the body is responding to being supine.

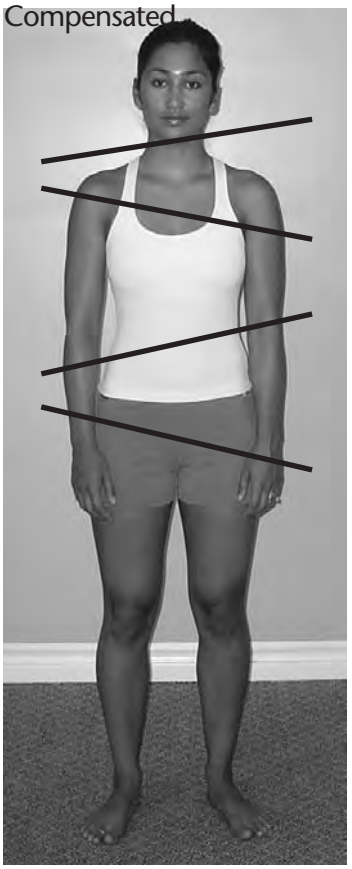
These flares can appear on their own (due to muscle imbalance, etc.) but usually accompany hip rotations: anterior rotation with an inflare, and posterior rotation with an outflare. (Further explanations and testing for this is in the Sacroiliac Joint and Pelvis chapter.)

Checking For Rotations: A General Fascial Examination Of The Trunk & Upper Body

Introduction To Advanced Observations

Students should leave the following until they are proficient in postural assessment (in particular) and general orthopaedic assessment skills (in general). Note: the picture for compensated patterns does not actually match the pattern shown. On the other hand, the uncompensated pattern shown is more like the client's real pattern. A more advanced set of observations would be:

Compensated

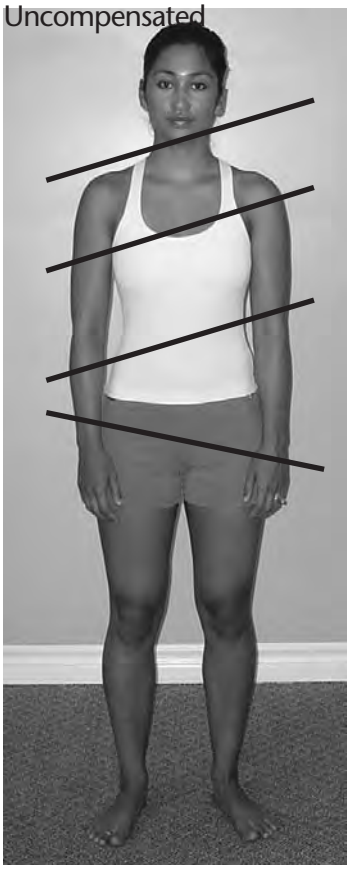


• If asymmetries are found, how does the body compensate? When one area of the body is out of balance, note if the compensations, above and below the impairment site, are alternating one side to another, or front to back and these are considered moderately successful compensations. On the other hand, do several compensations in a row run the same direction, which is a sign of an uncompensating response, usually indicating a more serious lesion or set of lesions?

For example, if the right hip is higher than the left, a compensating body would have the lumbar spine sidebend right over the higher side. The thoracic spine may compensate, slightly curving left. This leaves the shoulders in a more normal position than the hips.

Using the same example of a higher right hip, an uncompensated body may sidebend also to the right, exaggerating the shoulder asymmetry, forcing the neck and head to try to compensate.

Uncompensated



• Compensatory patterns are discussed in most chapters, looking at how impairment at specific areas may impact on the body as a whole.

Fascial Examination Part I:

Static Assessment Of General Myofascial Patterns
We can bilaterally compare the heights (off the table) of the hips (ASISs), lower rib cage, upper ribs, anterior shoulders, and left and right occiput. In other words, check the heights of all of these from the table, comparing one to the other.

Note: An alternating pattern is common, and shows the body is compensating efficiently (see the insight on the next page). In this case, a client may be symptom free, or at worse present with minor pain or impairment. However, if all of one side is high, the pattern cannot be alternating. In this case, a client usually presents with high degree of pain or impairment.

An example of an alternating pattern is:
Right ASIS higher; **Left** lower ribs higher; **Right** shoulder higher; **Left** occiput/mastoid process higher.

A so-called uncompensated pattern is when two or more of these landmarks are not alternating. This is often seen in clients who present with moderate to severe pain.

1. ASIS Heights

Note which ASIS palpates as higher off table.

2. Lower Rib Heights

Use lower ribs to compare bilaterally their heights from table.

3. Anterior Shoulder Heights

Place finger pads lightly on the anterior surface of humerus.

4. Occiput Heights

Check with single finger pad under each side of occiput. For more accuracy, use mastoid processes.

Now, compare directions of rotation from one set of landmarks to the next. By noting rotations and their sequence (opposite or same direction), we can see the overall fascial patterning in the pelvis, trunk, shoulder girdle, and head and neck. Be sure to use light touch when landmarking. After all, you do not want to push unequal sides down into the table.

INSIGHTS

Upper Ribs Heights

Finger pads over ribs two and three just below clavicles. See important note immediately below.

Note: The reason why you may want to include this area in the landmarking and checking for heights and rotation is because this is a very common area for rib impairment. Further, it reveals the state of the upper thoracic vertebrae, which act as a base for the cervical spine. In fact, many manual therapists, especially osteopaths, consider the first few thoracic vertebrae as functionally part of the cervical spine.

- This idea of linking the upper thoracics as part of the cervical spine complex makes it even clearer why the shoulder girdle is used to check the cervical-thoracic junction between C7 and T1. The shoulder girdle is then seen as hanging from a muscular and connective tissue sling, which runs from the occiput down to T3 or T4. The shoulder girdle can then be imagined as a horizontal bar (or coat hanger) extending outward that exaggerates any rotation in this transition zone (just like the ribs can reveal the more subtle rotations or sidebending of the thoracic vertebrae).

The upper cross syndrome, with its protracted shoulders and forward head posture (hyperlordosis of the cervical spine), compresses the upper chest, increasing the torsional forces generated on the anterior portion of the ribs, while increasing the kyphosis in the thoracic region. See the beginning of this section on posture for the upper cross syndrome, and note how well it matches the sympathetic-response posture described above.

Further, the upper ribs can be torsioned by the tensile forces generated between the lower ribs being rotated one way and excessive rotation of the shoulder girdle in the opposite direction during use of the upper limb. Excessive rotation of the shoulder girdle in the same direction as the rib predisposes the shoulder girdle, ribs and/or lower cervical spine to eccentric strain. This makes the upper ribs a very common area for rib motion impairments.

Therefore, it is easy to imagine these upper ribs, the shoulder girdle and the lower cervical spine as a highly interconnected area and transition zone between the upper cervicals (and head) and the trunk. Further, this interconnectedness has consequences in the origin of thoracic outlet syndromes (TOS), for example.

You can think of the arms as long levers that can put enormous strain and torsional forces through the ribs and upper thoracics if the person performs unbalanced or awkward activities with them, such as pulling, lifting, reaching, etc.

Fascial Examination Part 2:

Motion Palpation Of Rotational Bias At Spinal Junction Zones

No one is without some rotations in the spine or trunk, and this is simply due to handedness. What is telling is whether the rotations generally alternate one level to the next. There are four transition points in the spine that need to be checked. This is done by engendering gentle rotations to the left and right at specific spots. Note: We mentioned in Part I the reasons why and how we could at times be misled about rotations when checking heights of landmarks of a supine client. The following testing is more reliable as we are checking the quality of motion of structures and tissues.

To check the mobility of these transition zones, simply place two or three fingers under each of the areas listed below. Rock gently and relatively slowly each portion of the body by lifting one side and then the other a 1/2 inch to an inch). Look for ease and quality of motion on one side or the other. The side to which an area of the body is more willing to roll toward, i.e., moves toward with ease, is the direction that the myofascial tissues are pulling that side toward (which in supine shows as moved anteriorly). In turn, resistance to movement on one side implies that this side is not being pulled anteriorly, and is probably being pulled posteriorly.

Place your hands/fingers under the:
1. Pelvis while observing the quality of pelvic rotation. Check by gently rocking the pelvis up and down, i.e., the lumbosacral junction;
2. Lower thoracic ribs while observing motion around the waist, i.e., the thoracolumbar junction;
3. Shoulder girdle while observing the preferred motion direction at the cervicothoracic junction;
4. Occiput while testing the mobility and preference for rotation at the atlanto-occipital junction.

In the order listed above, check the heights off the table of the specific landmarks. The body is rotating to the side that compares lower at each of the landmarks. If the rotations alternate between the sets of landmarks, the client is considered to be “compensated.” This implies successful accommodation (for now). Therefore, the client may be asymptomatic or they may suffer from minor to moderate lesioning or impairment.

If the rotations are not always alternating, then the thought is that the client is “uncompensated.” This is usually found in clients with severe lesions or impairments, often, but not always, trauma based. Gordon Zink, D.O., is the originator of these observations. In his clinical practice (mostly in hospitals), he noted that the “uncompensated” client often suffered from some systemic pathology, or an organ, gland disease process, while the compensated did not. An outline of Zink’s proposal can be found on-line in a dissertation on compensating and uncompensating patterns. (Pope)

Compensating, Uncompensating & Rotations: Seeing Fascial Tension Directions
The most important information that this can give is to see if the client is compensating successfully, i.e., are the rotations alternating as we proceed up from the pelvis.

These rotations are accompanied by sidebending. (See Fryette's rules of spinal motion in the chapters on the spine.) Sidebending, in turn, lifts one side and its tissues superiorly (creating a convexity on that side) while the other side's structures and tissues are moved inferiorly (concavity on that side). Convexity in the ribs opens up the spaces between the ribs, while concavity compresses several ribs.

Remember, in general, we can say that the motor for the postural asymmetries we will discuss is muscle. What we are going to describe below is the fascial tensions that can be generated by muscle imbalances. If chronic, these postures will change the length and tension within the overall fascial complex that the body is wrapped in. Therefore, for the purpose of treatment, we not only would have as an outcome the re-balancing of muscle length and strength, but also the overall fascial web as well. If we focus only on muscle, we cannot get the results we seek in treatment.

Therefore, this analysis speaks about the rotations at special areas of the spine, namely what has been called the transitional joints or area of the spinal column. Further, it speaks to the tension found in the fascia as a response to these rotations that have become postural due to sustained muscle imbalance.

A very common example of an alternating pattern and an attempt to balance tensile forces is the following (for a right-handed person with a right lead foot):

At The Pelvis
• The right hip is more anterior (off the table) than the left, implying the pelvis (at the lumbosacral junction) is rotated left. This creates an increase in tension of the tissues and fascia between the ASISs.

Note: The anterior rotation of the right hip (innominate) is principally ascribed to tight hip flexors: a short and tight rectus femoris tensor fascia lata (TFL) and the iliopsoas. More is involved than this, but we will leave that aside for now. In turn, the ilium, being attached to the inside of the right innominate and inserting on the lesser tubercle of the femur (medial) along with the psoas, will internally rotate (inflare) the innominate. This inflare is also helped by the TFL.

The right ASIS is closer to the mid-line than the left. In turn, the PSIS on the left is also found to be closer to the mid-line. (See the Hip and Innominate chapter). This creates tension and torsional forces running round the pelvis, There is an always an attempt at a balance of forces within any structural asymmetry. The following have similar consequences.

At The Rib Cage
• The left lower ribs are higher than the right, implying that the lower rib cage is rotated to the right at the thoracolumbar junction. A myofascial twist, i.e., torsion, is established (from lower ribs to shoulder girdle) in the rib cage, opening some ribs and closing others in a criss-cross pattern: Opening apart the lower left ribs (as if inhalation was happening there) and closing the right lower ribs (as if exhaling). However, the upper left ribs are closed/compressed (exhaled) and the right upper ribs are opened (inhaled). How so? This is because of the next observation: The shoulder girdle is rotated left.

At The Shoulder
• The right shoulder is higher than the left, implying that the cervicothoracic junction (and, hence, the cervical spine) is rotated left. (Protracting the right shoulder, tipping the shoulder slightly down. retracting the left and lifting it. The cervical spine above the shoulder girdle often bends and rotates to the left.)

At The Head

• The left mastoid process (or left side of the occiput) is higher off the table, implying that the occiput/head is rotated to the right – at the atlanto-axial joint. Further, the occiput is tipped to the right at the occipital-atlanto joint (by the left condyle of the occiput going into flexion and the right into extension. The consequence of this later adjustment or compensation is for the left space between C1, the atlas, and the occiput to be opened, while the right side's space is closed, possibly compressing neurovascular tissues, etc.).

Uncompensating Patterns & Ill Health

However, you may find that one or more of these levels do not compensate in an alternating pattern to the one above or below and we then have what is called an "uncompensated pattern." Two or three junctions may be rotating in the same direction. These tensile forces amalgamate into serious torsions passing through joints above and below as well as on site.

Serious injury is unavoidable, impairments will multiply, and these forces traction and/or compress the neurovascular-lymphatic tissues, interfering with their flow. This interference with fluid movements added to all these torsional forces distorting the musculoskeletal posture must inevitably affect the organs of the body. This may explain why Gordon Zink, D.O. found his clients with serious health problems and diseases often had uncompensating patterns.

Prone Landmarking

To perform prone landmarking, you may purposely have the client now lay prone; or you may wait for when, or if, specific testing has the client prone at some future time. Check the following: levels of plantar surface of heels, ischial tuberosities, PSISs (and height from table), and the lateral curves in spine, tissue bulk of erector spinae, and scapula orientation.

Heel Levels

Ischial Tuberosities

PSISs

Lateral Curves

Tissue Bulk of Erectors

Scapular Orientation

Compare your results of prone landmarking with supine, as well as with the results of your standing postural assessment.

Gait Analysis

Note: This section of the introduction, which is concerned with the assessment of gait, is divided into two parts. Part I is the classic way of analyzing gait, with a few additions. Part II is a different approach to gait analysis, which attempts to see gait within the context of the whole body.

Part I: Classic Gait Analysis

Introduction
Every standard text on general orthopaedic testing will have the basic information on the terms employed for such an analysis of walking. The classic divisions are:

Stance Phase
- Heel strike
- Foot flat
- Single leg stance or mid-stance
- Heel-off
- Toe-off

Swing Phase
- Initial swing (acceleration)
- Mid-swing
- Terminal swing (deceleration)

Remember: Just like a standing postural assessment, try to get as many views from various directions as possible. Also, do not try to see everything at once. First, look at the feet as they walk back and forth, then note the knees as they walk back and forth. Then watch the hips, and so on up the body. Lastly, watch all areas working together.