Assessment of Lower Extremity Posture: Qualitative and Quantitative Clinical Skills

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POSTURAL SCREENING has long been a part of clinical evaluation. It provides both qualitative and quantitative information on the characteristics of the human body. Over the last several years, injury assessment has evolved from single joint evaluation to assessment of the entire kinetic chain. This has sparked renewed interest in the value of the information derived from postural assessment. The postural presentation of the body may be considered a road map of habitual movement patterns. Evidence of asymmetry, medial to lateral or anterior to posterior, provides clues as to how the body has compensated to maintain optimal performance. These adaptations may not be beneficial in terms of pain-free function. For instance, asymmetrical weight bearing through the lower extremities after an ACL reconstruction may cause shifts through the pelvis, resulting in pelvic obliquities. Asymmetrical weight bearing may create a dependence on the hip flexors for stability, leading to disuse of the gluteus maximus and gluteus medius, which produces a further destabilizing effect on the pelvis manifested as femoral internal rotation: the “corkscrew” or “valgus” knee presentation seen in dynamic movement.

Poor postural habits, independent of injury, may result in similar sequelae. The commonly accepted posture of today’s youth encourages slouching, both when sitting and standing. Slouching disengages the trunk muscles, encouraging disuse of the local and global core stabilizers, thereby predisposing the extremities to overuse syndromes. For instance, habitually standing with feet externally rotated and with excessive anterior pelvic tilt deactivates the transversus abdominis, which focuses the posterior stabilizing load on the erector spinae rather than the multifidi. With the excessive anterior pelvic tilt, the gluteus medius and gluteus maximus are no longer in an optimal length-tension position, thereby forcing the iliotibial band to function as a stabilizer, one of the primary but often overlooked etiologies of ITB syndrome. Reduced activation of the gluteus medius and gluteus maximus results in a tendency for excessive internal femoral rotation, which is associated with the miserable malalignment syndrome and patellofemoral dysfunction. Habitual posture alone may play a primary role in the lack of core stabilization seen in many athletes. Without activation of the local and global core stabilizers, altered kinetic chain sequelae for both the upper and lower extremities can be expected. Interventions to address postural asymmetries play a substantial role in the remediation of chronic overuse conditions and may facilitate improvement in neuromuscular activation patterns. The initial qualitative visual screening of the entire kinetic chain may identify areas of dysfunction that warrant further assessment.

Qualitative Assessment of Posture

When first adopting the kinetic chain approach to posture assessment, deciding where to start, how to proceed, and what to do with the information can be overwhelming. A traditional approach is to suspend a plumb line above the individual’s head and perform the assessment from the top down. A more functional approach involves assessment from the feet upward, still using the plumb line as a guide line. Select an area of the clinic that has low traffic, and a flat, plainly-decorated wall to use as a backdrop. A plumb line can...
be as simple as a string tied to a set of keys. Ideally, the client would wear only elasticized close-fitting garments. Removal of shoes and orthotics allows for assessment of alignment without adaptations provided by external supports.

**Identifying Asymmetries**

The first step in performing the assessment is a visual scan for asymmetries of the client’s posture from front, side, and back views. Digital images can provide a permanent record of the assessment.

**Coronal View—Anterior**

Start by looking at the patient’s feet:

1. Does the patient stand with equal weight distribution on the right and left sides?
2. Are both feet pointed forward, or is one foot rotated differently than the other?
3. Does the medial longitudinal arch appear to be flattened, i.e., foot pronation?
4. Does the 5th ray appear to be laterally displaced (often seen in conjunction with a flattened medial longitudinal arch)?
5. Are the toes actively flexed (gripping the ground)?
6. Are any of the postural asymmetries evident on both sides?

Following assessment of the foot, the clinician should continue the visually scan up the lower leg:

7. Is there asymmetry in the soft tissue contours of the anterior compartment of the lower legs?
8. Is there asymmetry in the soft tissue contours of the posterior compartment of the lower legs?
9. Is there symmetry in alignment of the long axis of the lower legs? Specifically, does there appear to be an “A” frame appearance of the right and left legs?
10. Is there a rotational component evident in the positions of the lower legs? If yes, is the rotation symmetrical?
11. What is the position of the patella, i.e., is the patella malaligned in relation to either the thigh segment or the lower leg segment?
12. Is the overall alignment of the lower leg posture symmetrical, i.e., is alignment different or similar for the right and left extremities?

Continue the visual examination by noting the relationship between the thigh and lower leg.

13. Is knee varus or knee valgus evident, either unilaterally or bilaterally?
14. What is the relationship of the midline of the tibia to the femur?

Next, focus on the thigh:

15. Does the thigh appear to be either internally or externally rotated at the hip, either unilaterally or bilaterally?
16. Does the thigh appear to be either adducted or abducted at the hip, either unilaterally or bilaterally?
17. Does the thigh appear to be flexed or extended at the hip?

The final element of lower extremity postural assessment in the coronal plane involves the hips (relationship between the femur and pelvis).

18. Is there a greater weight shift toward one side? Does the client have a tendency to stand on one leg?
19. Does one side of the pelvis appear to be shifted more forward or backward in comparison to the opposite side?
20. Does there appear to be a difference in height of the iliac crests? This can be best assessed by having the patient place the hands on the hips (over the iliac crests) and noting any difference in height between the patient’s hands.

Common postural malalignments that may be identified from an anterior view are illustrated in Figure 1 and 2.

**Sagittal View**

Start with an overall view of the patient from a side view, and then note the following:

1. Does it appear that the right and left sides align with one another in the coronal plane? If so, you should not see the opposite lower extremity.
Figure 1  Postural malalignments that may be identified from an anterior view.

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Another example of postural malalignments that may be identified from an anterior view.

2. At the feet, any deviations observed during the coronal plane assessment should also be apparent from the side view, such as foot rotation, medial longitudinal arch flattening, and toe positioning.

3. Does there appear to be either a lack of full knee extension or hyperextension?

4. Does the hip joint appear to be flexed, or is it in a neutral position?

5. Assess the extent of lumbar lordosis. Is the lordotic curvature gentle and restricted to the lumbar region or pronounced and evident in the thoracic region?

6. Repeat the sagittal view assessment from the opposite side.

Common postural malalignments observed from a sagittal view are illustrated in Figure 3.

Figure 2  Another example of postural malalignments that may be identified from an anterior view.

Figure 3  Common postural malalignments observed from a sagittal view.
Coronal View—Posterior

The final phase of the assessment involves viewing the patient in the coronal plane from a posterior vantage point, starting at the feet:

1. Does the Achilles tendon align vertically on the posterior lower leg or does it tend to curve in a lateral or medial direction?

2. Is there symmetry in foot position? Does one foot appear to be pronated and the other supinated? A leg length discrepancy may be manifested as foot pronation of the longer extremity and foot supination of the shorter extremity.

3. Check for each characteristic assessed from an anterior view:
   - Foot rotation
   - Leg rotation
   - Long axis of lower leg alignment
   - Soft tissue contours of the lower leg
   - Knee varus or valgus alignment
   - Femoral rotation
   - Hip abduction/adduction
   - Symmetry of hip contours
   - Pelvic obliquity.

Common postural malalignments observed from a posterior view are illustrated in Figure 4.

Common Lower Extremity Postural Malalignments

Postural malalignments identified by a qualitative visual assessment should be further evaluated. Often, joint dysfunction is the result of exposure to forces that exceed its load tolerance. Common postural malalignments and associated with joint dysfunction include the following:

Foot Pronation

Look for the following:
- Peroneal muscle tightness.
- Posterior tibialis muscle weakness, discomfort, and tenderness on palpation.
- Calcaneal eversion. Check for restricted passive motion of the calcaneus. There may be tenderness on palpation of the Achilles tendon. Test for diminished flexibility of the gastrocnemius-soleus complex.

Knee Valgus/Miserable Malalignment Syndrome

If valgus alignment of the knee was identified, check for
- Tenderness at the insertions of the pes anserine, iliotibial band, and infrapatellar tendon. These structures may be overloaded by rotational forces acting at the knee.
- Assess patellar mobility. Restricted medial glide of the patella may result from development of contractures in the lateral patellar retinaculum.
- Assess for knee hyperextension, which may be due to joint hypermobility or chronic knee extension overload. Poor neuromuscular control of the pelvis may result in a chronic anterior pelvic tilt that positions the center of body mass anterior to the knee joint. To compensate, the individual may “lock” the knee in
extension, which may contribute to the development of knee hyperextension.

- Assess pelvic tilt. Anterior tilt of the pelvis will draw both femurs into internal rotation, which accentuates knee valgus and foot pronation.

Weight Shift to the Right or Left

Several factors may contribute to a standing asymmetry:

- Anatomical or functional leg length difference.
- Poor neuromuscular control of the pelvis and hips.
- A history of previous injury with incomplete rehabilitation. A tendency for asymmetrical transmission of forces that was adopted to relieve discomfort or to compensate for an injury-related functional deficiency may persist beyond the point of injury resolution and produce an asymmetrical stance position.

Excessive Lumbar Lordosis

Lordosis that extends from the lumbar region to the thoracic region of the spine is indicative of primary reliance on the erector spinae to support the posterior spine, with less reliance on the multifidi. This will be accompanied with an anterior pelvic tilt, and may be accompanied by knee hyperextension.

Pelvic Obliquities

Asymmetries in the pelvic region may present as one iliac crest higher than the other, or inequality in the positions of the ASIS or PSIS on either side of the pelvis. Pelvic obliquity may be related to sacroiliac asymmetry or may be a result of asymmetrical restrictions of hip ROM. Assessment of hip IR/ER, both in a prone position (hip extension) and a seated position (hip flexion), may identify imbalances.

Injuries Associated With Postural Malalignments

Postural malalignments can increase tension on one muscle group, while an antagonistic muscle group may be shortened and rendered less flexible. Overuse muscle injuries may occur to the muscle that is subjected to greater tensile load. Table 1 presents common overuse conditions and the associated postural malalignments and muscle imbalances.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Associated Postural Malalignments</th>
<th>Associated Muscle Tightness</th>
<th>Associated Muscle Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior tibialis strain/tenderness</td>
<td>Foot pronation</td>
<td>Peroneals</td>
<td>Posterior tibialis</td>
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<tr>
<td></td>
<td>Asymmetrical foot external rotation</td>
<td>Gastrocnemius</td>
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<td>Soleus</td>
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<td>Anterior tibialis strain/tenderness</td>
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<td></td>
<td>Asymmetrical foot external rotation</td>
<td>Soleus</td>
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<tr>
<td>Hamstrings strain/tenderness</td>
<td>Anterior pelvic tilt</td>
<td>Quadriceps</td>
<td>Hamstrings</td>
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<tr>
<td></td>
<td>Femoral internal rotation</td>
<td>Hip flexors</td>
<td>Gluteus maximus</td>
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<tr>
<td></td>
<td>Knee valgus</td>
<td>Iliotibial band</td>
<td>Gluteus medius</td>
</tr>
<tr>
<td></td>
<td>Foot pronation</td>
<td>Peroneals</td>
<td>Hip adductors</td>
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<tr>
<td></td>
<td></td>
<td>Gastrocnemius</td>
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<td></td>
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<td>Soleus</td>
<td>Transverse abdominis</td>
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Malalignments in the lower extremity kinetic chain may be the underlying cause of chronic syndromes such as shin splits, hamstring, groin, hip flexor strains, patellofemoral dysfunction, iliobial band friction syndrome, hip bursitis, piriformis syndrome, and low back pain. Postural assessment, followed by a more focused clinical evaluation of lower extremity kinetic chain components, is important for identification and correction of factors that may contribute to chronic overuse injuries. Postural malalignments and associated asymmetries frequently result from poor postural habits or subtle adaptations to minor injuries. Identification of postural malalignments and implementation of appropriate corrective measures may decrease susceptibility to overuse syndromes and acute injuries and may simultaneously enhance athletic performance.

**References**


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