As one of the most up-to-date, functional and cost effective clinical texts available, this book is designed to improve your clinical efficiency & accuracy of physical assessment. To assemble the information contained in this text from individual sources would cost hundreds, if not thousands of dollars. Countless hours of research & design were spent to develop the content & format. This text bridges the gap between basic classroom learning and clinical application. Information sources include: hundreds of original journal articles with cutting-edge information, evidence-based texts, cadaver dissections & thousands of hours of multidisciplinary clinical experience.

In order to get the most clinical utility from this text, it must be available at all times, as such the books size allows for easy transport & storage. Do not be fooled, this text contains more useful information than most full-size textbooks. Coil binding allows the book to lay flat & all information is further supported by numerous web-based learning materials (videos, images, quizzes). Another cost saving measure is free web based video support, allowing review from any computer with internet access. Individual chapters are marked with soft tabs & icons, and the start of each chapter provides a detailed table of contents for that section.

This text is not only financially less costly, but environmentally more responsible, using about 70% less paper and requiring much less in shipping fuel consumption for delivery. In addition, the use of web based video consumes 33% less energy and emits 40% less CO₂ than an included DVD. To help ensure gender equality, ‘his’ & ‘her’ are used interchangeable throughout the text. The ‘ ⊥’ symbol signifies a section containing humor, although laughter is optional ⊥.
Posture Assessment

**Definition:** evaluation of a person's body position and/or structure in standing; assessed in 4 positions.

It is used for overall observation, gathering assessment information, monitor patient progress, noting positional changes. It may also be useful to observe a patient in a seated position (especially office workers) or in the stance they spend most of their day (cashiers, machinist)

**Procedure** (patient is examined in their habitual, relaxed standing posture):
- Explain procedure to the patient - but do NOT use the word posture! - “I would like to observe how you normally stand” - “try and stand as relaxed as possible.”
- Observe body in 4 different positions (anterior, right lateral, left lateral, & posterior view)
- Plumb line is suspended from the ceiling to be used as an alignment device.
- **Performed from the feet up to the head**
- Patient is best observed in underwear or swim suit
- Patients using orthotics should first be viewed with corrective devices in place, and then without (be sure to record type of device)

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<table>
<thead>
<tr>
<th>Functional Causes</th>
<th>Structural Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Ligament laxity</td>
<td>- Age (osteoporosis)</td>
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<tr>
<td>- Muscle tightness</td>
<td>- Respiratory conditions</td>
</tr>
<tr>
<td>- Fascial restrictions</td>
<td>- Leg length discrepancy</td>
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<tr>
<td>- Muscle tonus</td>
<td>- Scoliosis</td>
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<tr>
<td>- Excess weight</td>
<td>- Pelvic angels</td>
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<tr>
<td>- Joint dysfunction</td>
<td>- Anatomical variation</td>
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<tr>
<td>- Pain</td>
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<td>- Muscle imbalance</td>
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<td>- Joint mobility</td>
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<tr>
<td>- Poor habits</td>
<td></td>
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<tr>
<td>- Type of shoes</td>
<td></td>
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<tr>
<td>- Peer pressure</td>
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**Common Postures**

**Kyphotic-Lordotic**

- **Head:** forward
- **C-spine:** hyperlordosis
- **T-spine:** hyperkyphosis
- **L-spine:** hyperlordosis
- **Pelvis:** anterior tilt
- **Hips:** flexed
- **Knees:** hyperextended
- **Ankle:** plantar flexed, legs are behind midline

**Flat Back (military spine)**

- **Head:** neutral
- **C-spine:** hypolordosis
- **T-spine:** hypokyphosis
- **L-spine:** hypolordosis
- **Pelvis:** posterior tilt
- **Hips:** extended
- **Knees:** extended
- **Ankle:** slightly plantar flexed

**Sway Back**

- **Head:** forward
- **C-spine:** hyperlordosis
- **T-spine:** mild hyperkyphosis
- **L-spine:** mild hyperlordosis
- **Pelvis:** posterior tilt, but anterior to midline
- **Hips:** extended
- **Knees:** hyperextended
- **Ankle:** neutral

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**Clinical Tip:** Consider having a section of clinic wall painted with a grid for more accurate postural and AROM assessment
**Anterior View**

**Vertical Landmarks:** pubic symphysis, umbilicus, xiphoid, suprasternal notch, nasal bones

**Horizontal Landmarks**
- Foot angle, arches, malleoli
- Fibular heads level
- Knees straight (varum/valgum)
- Patellae point straight ahead
- Level at symphysis pubis
- ASIS level
- Iliac crest level
- Palms (hands) face body in relaxed position
- Elbows carrying angle (5°-15°)
- Waist angles (equal, arms equal distance to waist, IR/ER)
- Ribs/sternum, clavicles/AC Joint (level & symmetrical)
- Shoulders (level, normal for dominant side to be lower)
- Trapezius neck (slope on dominant may be greater)
- Nose (midline)
- Jaw (in resting position)
- Head (straight at midline, tilting, rotation)

**Lateral View x 2**

**Vertical Landmarks:**
- Anterior to lateral malleolus
- Fibular head
- Greater trochanter
- Acromion
- Bodies of cervical vertebra
- External auditory meatus/tragus

**Horizontal Landmarks**
- Knees (slightly flexed 0-5°)
- Pelvic angle (normal male 0-10°, female 15-30°)
- Chest (pectus excavatum/pectus carinatum)
- Muscles of abdomen
- Chest and back
- Shoulders (anterior rotation or military stance)
- Spine (normal spinal curvatures)
- Ear lobe - align with acromion and iliac crest other vertical landmarks

**Posterior View**

**Vertical Landmarks:**
- S2
- C7
- Inion (EOP)

**Horizontal Landmarks**
- Heels (straight, angled in/out)
- Achilles tendon (straight, angled in/out)
- Popliteal fossa levels
- Gluteal folds (level, symmetry)
- PSIS level
- Arms (equal distance from body)
- Waist angles (equal/level, equal distance from body)
- Ribs (protruding)
- Spine (straight, curved laterally)
- Scapulae (inferior angles level)
- Shoulders level
- Head (midline)
Range of Motion (ROM)

The purpose of ROM assessment is to establish a patient baseline of ability (outcome marker), to locate potential pain generators (muscles activated, tissue stretched, tissue compressed), and offer some therapeutic effect through body movement.

Active ROM - patient moves body part themselves

Passive ROM - movement done by examiner without patient assistance (normally greater than AROM)

Physiologic barrier - end of active joint movement (as far as the patient can move)

Elastic limit - elastic resistance that is felt at end of passive range of movement; further motion towards anatomic barrier may be induced passively by examiner

Anatomic limit - limit of anatomical integrity; limit of motion imposed by anatomic structures; forcing movement beyond this barrier will produce tissue damage (sprain/strain/fracture)

Joint play - discrete, short-range movements of a joint independent of action of voluntary muscles, determined by springing each joint in neutral position

Star Diagram: used to record AROM & PROM information in an efficient format

Spinal Joint

Peripheral Joint

Example Right Shoulder Joint

Text version equivalent

- Shoulder flexion both active & passive is limited to ~50% (~90°) into flexion
- Shoulder active adduction is limited to ~50% (~15°) into adduction
- All other ROM is WNL (AROM < PROM)

- Each line represents 100% motion in that direction, therefore a mark half way on a line indicates 50% ROM ability; examiner should record any pain, abnormal movements or clunks & location within ROM
Ear & Otoscopic Exam

Inspection & palpation
1. Size, shape of auricle
2. Position & alignment of head
3. Skin condition (color, lumps, lesions)
4. Auricular & tragus movement
5. Evaluate external auditory meatus (size, swelling, redness, discharge, cerumen)

Otoscopic examination
To help align external auditory meatus to slope of ear canal, apply traction to the pinna:
Adult: traction pinna posteriorly & superiorly
Infant: traction ear inferiorly (perhaps posteriorly)

1. Inspect external canal
2. Note cerumen, discharge, lesions, foreign bodies
3. Redness & swelling of canal wall
4. Inspect tympanic membrane
   - Membrane integrity
   - Short process of malleus (lateral process)
   - Manubrium of malleus (‘handle’)
   - Umbo
   - Cone of light (light reflex)
   - Red reflex (vascular strip that supplies tympanic membrane)
5. Pneumatic otoscopy
   - Use insufflation bulb, brisk puff of air to observe tympanic motion
   - Normal: membrane moves briskly in & out with ease, ↑ motion normal in infants younger than 7 months
   - Abnormal: sluggish or absent response may indicate presence of fluid or pressure behind membrane
6. Hearing acuity
   - Weber, Rinne (tuning fork)
   - Voice test, ticking watch test
7. Vestibular function
   - Swivel chair test, Dix-Halpike maneuver

On-line videos demonstrations & clinical chart forms are available at http://www.prohealthsys.com
There is usually no C1 dermatome as it has no dorsal root ganglion; the nerve (suboccipital nerve) is purely motor in function.
Cervical Spine PROM

Compare bilaterally; if possible palpate joint during PROM & use the shortest level possible, apply over pressure at end ROM; introduction statement:
“If any of the actions or movements are painful or uncomfortable please let me know.”

PROM may be performed with the patient seated or supine

**Flexion** (> 50°-70°)
Tissue Stretched: upper trapezius, splenius cervicis & capitis, longissimus capitis, suboccipitals, nuchal ligament, interspinous ligament, posterior IVD, posterior facet joint capsule

Tissue Compressed: anterior neck muscles, trachea, esophagus, carotid arteries

**Extension** (> 50°-70°)
Tissue Stretched: anterior neck muscles, anterior longitudinal ligament, anterior IVD, trachea, esophagus, carotid arteries

Tissue Compressed: posterior neck muscles, posterior intervertebral discs, facet (z-joints) joints, vertebral artery

**Lateral Flexion** (> 45°-60°)
Tissue Stretched: 
- **contralateral:** trapezius (upper), longissimus capitis, SCM, lateral IVD, carotid artery, z-joints
- **ipsilateral:** trapezius (upper), longissimus capitis, SCM, lateral IVD, carotid artery, z-joints

Tissue Compressed: 
- **contralateral:** trapezius (upper), longissimus capitis, SCM, lateral IVD, carotid artery, z-joints
- **ipsilateral:** splenius cervicis & capitis, suboccipitals

**Rotation** (> 80°-90°)
Tissue Stretched: 
- **contralateral:** splenius cervicis & capitis, suboccipitals

Tissue Compressed: 
- **ipsilateral:** splenius cervicis & capitis, suboccipitals

--- = may indicate, s = stabilization, = examiner force, = motion, r = reliability, sw = sensitivity, sp = specificity, cm = positive/negative likelihood
anterior view
poster view

1. Interosseous membrane
2. Distal radioulnar ligament
3. Triangular fibrocartilage (TFC)
4. Radial collateral ligament
5. Ulnar collateral ligament
6. Intercarpal ligaments
7. Carpometacarpal ligaments
8. Phalangeal collateral ligaments

Median nerve
cutaneous distribution

Median Nerve
Palmar Branch
distribution

Tensor Carpal
Ligament
(flexor retinaculum)

Ulnar Nerve

Radial N.

1st metacarpal
Trapezium
Trapezoid
Extensor tendons
Hamate
Capitate
Modified Phalen’s Test

Procedure
Same as Phalen’s Test except examiner applies pressure with index & middle finger over the carpal tunnel while holding the wrist in flexion.

Interpretation
(+): Numbness or tingling over the distribution of the median nerve,
increased anterior wrist pain or subsequent weakness of thumb opposition → Carpal tunnel syndrome

Clinical notes
This examination procedure may be more sensitive than Phalen’s Test alone (SN: 61 SP: 83)\(^5\)

Phalen’s Test

Procedure
Patient seated with wrists maximally flexed, two versions:
1. Patient places back of hands together in front of body so both wrists are fully flexed & maintains position for up to 1 minute
2. Examiner gently holds involved wrist in sustained flexion position for 1 minute

Interpretation
(+): Numbness or tingling over the distribution of the median nerve,
increased anterior wrist pain or subsequent weakness of thumb opposition → Carpal tunnel syndrome

Clinical notes
Best clinical test for carpal tunnel syndrome, remember there are many other potential sites that may contribute to compression of the median nerve or its roots (pronator teres, scalene muscles, intervertebral foramem - disc or osseous changes) - all of which must be investigated
\(R: 0.79\) \(SN: 10-88\) \(SP: 33-100\) \(LR+: 0.7-41.5\) \(LR-: 0.1-1\)\(^5\)

Pinch Grip Strength

Procedure
Patient pinches index finger & thumb together (tip-to-tip); examiner may apply muscle resistance or have patient squeeze a pinch grip gauge

Interpretation
(+): Muscle weakness or pinch grip that is pad-to-pad (not tip-to-tip) → Anterior interosseous neuropathy (deep branch of median nerve)

Clinical notes
Nerve conduction studies (NCS) should be considered in cases where peripheral neuropathies are suspected

Press Test

Procedure
Patient seated in stable chair with arm rests; examiner instructs patient to hold body in air by pushing off with both hands

Interpretation
(+): Wrist pain when bearing weight → Triangular fibrocartilage (TFC) pathology

Clinical notes
This test may be difficult to perform in patients with decreased upper body strength (elderly & over-weight)
When compared with arthroscopic surgery test demonstrated 100% sensitivity & 79% sensitivity when compared to MRI\(^56\)

--- = may indicate, \(s\) = stabilization, \(\rightarrow\) = examiner force, \(\cdots\) = motion, \(n\) = reliability, \(sn\) = sensitivity, \(sp\) = specificity, \(LR+\), \(LR-\) = positive/negative likelihood
Selected Imaging Types

Radiograph

Indication
- Usually first choice modality
- Should be taken if clinical questions exist & treatment could be altered by findings

Procedure
- Plain film radiation exposure

Advantages
- Cost effective & highly available
- Minimal radiation dose

Disadvantages
- Not sensitive (30-50% bone destruction needed to see many conditions) & no axial images
- Quality dependant upon doctor or technician performing exam

<table>
<thead>
<tr>
<th>X-ray Series</th>
<th>Effective Dose (mSv)</th>
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</thead>
<tbody>
<tr>
<td>Chest (PA film)</td>
<td>0.02</td>
</tr>
<tr>
<td>Head</td>
<td>0.07</td>
</tr>
<tr>
<td>Cervical spine</td>
<td>0.3</td>
</tr>
<tr>
<td>Thoracic spine</td>
<td>1.4</td>
</tr>
<tr>
<td>Lumbar spine</td>
<td>1.8</td>
</tr>
<tr>
<td>Abdomen</td>
<td>0.53</td>
</tr>
<tr>
<td>Pelvis/hip</td>
<td>0.83</td>
</tr>
<tr>
<td>Limbs/joints</td>
<td>0.06</td>
</tr>
<tr>
<td>Screening mammogram</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Computer Aided Tomography

Indication
- Synonym: CT or CAT scan
- Axial views or better bony detail

Procedure
- Radiographic axial sections are taken & manipulated by computer
- Injected contrast can be used to increase detail

Advantages
- Excellent bony detail, good soft tissue detail
- Image contract can be modified to show specific areas
- 3-D image reconstruction is possible (see image lower right)

Disadvantages
- Relatively high radiation dose (many clinicians forget that this is still radiation exposure via x-rays & is carcinogenic)
- More costly

<table>
<thead>
<tr>
<th>CT</th>
<th>Effective Dose (mSv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>2.0</td>
</tr>
<tr>
<td>Abdomen</td>
<td>10.0</td>
</tr>
<tr>
<td>Chest</td>
<td>20-40</td>
</tr>
<tr>
<td>Pulmonary angiography</td>
<td>20-40</td>
</tr>
<tr>
<td>PET - CT</td>
<td>25</td>
</tr>
</tbody>
</table>