Musculoskeletal System



1

Objectives

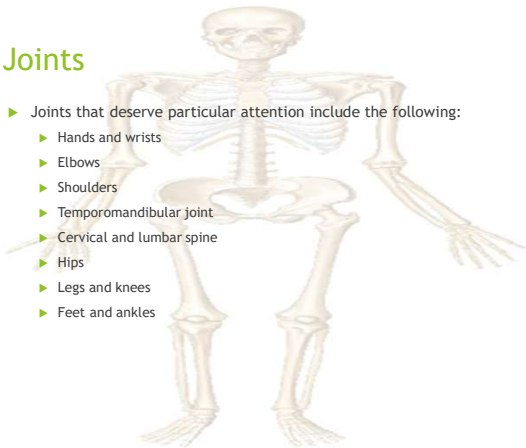
- Accurately perform a full orthopedic exam on a healthy individual
- Interpret abnormal ortho physical exam findings



2

Joints

- Joints that deserve particular attention include the following:
  - Hands and wrists
  - Elbows
  - Shoulders
  - Temporomandibular joint
  - Cervical and lumbar spine
  - Hips
  - Legs and knees
  - Feet and ankles



3

History of Present Illness

- Joint symptoms
  - Aches/Pain
  - Edema
  - Limited range of motion
  - Crepitus/popping
  - Acute injury
  - erythema
  - Medications: NSAIDs, acetaminophen, biological modifiers and other immunosuppressants, corticosteroids, topical analgesics, glucosamine, chondroitin, hyaluronic acid, hormone therapy, calcium, calcitonin, bisphosphonates

4

Family History

- Congenital abnormalities of hip and foot
- Scoliosis and back problems
- Arthritis
- Genetic disorders: osteogenesis imperfecta, skeletal dysplasia, rickets, hypophosphatemia, hypercalciuria

5

Personal and Social History

- Employment - mechanical LBP most work injury
- Exercise
- Functional abilities
- Weight and height changes
- Nutrition
- Tobacco and alcohol use

6

Infants and Children

- Birth history
  - Presentation, large for gestational age, birth injuries (may result in fractures or nerve damage), type of delivery (vaginal vs. cesarean section), use of forceps
  - Low birth weight, premature, resuscitation efforts, required ventilator support (may result in anoxia leading to muscle tone disorders)
- Fine and gross motor developmental milestones, appropriate for chronologic age

7

Infants and Children (Cont'd)

- Overweight or obese
- Quality of movement: spasticity, flaccidity, cog wheel rigidity
- Arm or leg pain
  - Character
  - Onset
  - Participation in organized or competitive sports, weightlifting

8

Pregnant Women

- Muscle cramps
- Back pain
  - Weeks of gestation, associated with multiple pregnancy, efforts to treat
  - Associated symptoms: uterine tightening, nausea, vomiting, fever, malaise (could signify musculoskeletal discomfort if not from another condition)
  - Type of shoes (heels may increase lordosis)

9

Older Adults

- Weakness
  - Onset
  - Associated symptoms
- Increases in minor injuries
- Change in ease of movement
- Nocturnal muscle spasm
- History of injuries or excessive use of a joint or group of joints, claudication, known joint abnormalities
- Previous fractures

10

Examination and Findings

11

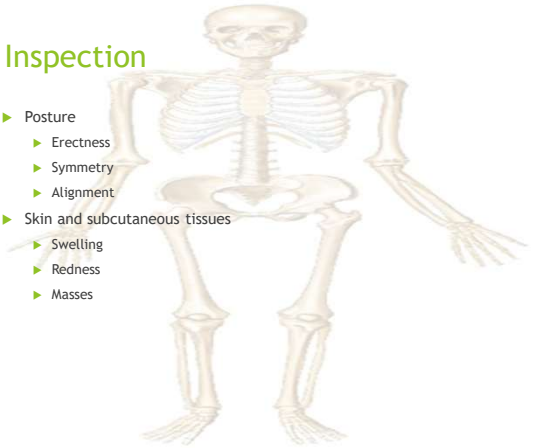
Equipment

- Marking pencil
- Goniometer
- Tape measure
- Reflex hammer



12

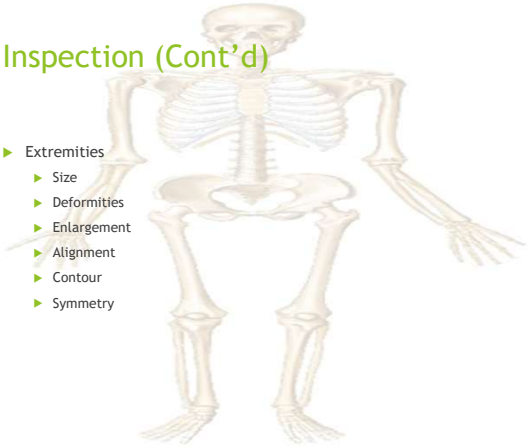
Inspection



- Posture
  - Erectness
  - Symmetry
  - Alignment
- Skin and subcutaneous tissues
  - Swelling
  - Redness
  - Masses

13

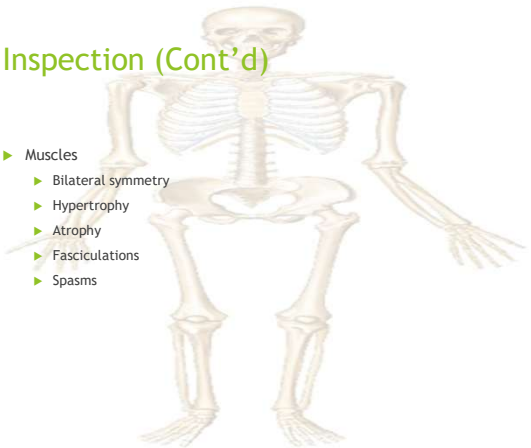
Inspection (Cont'd)



- Extremities
  - Size
  - Deformities
  - Enlargement
  - Alignment
  - Contour
  - Symmetry

14

Inspection (Cont'd)



- Muscles
  - Bilateral symmetry
  - Hypertrophy
  - Atrophy
  - Fasciculations
  - Spasms

15

Palpation

- Palpate bones, joints, and surrounding muscles for the following:
  - Heat
  - Tenderness
  - Swelling
  - Fluctuation
  - Crepitus
  - Resistance to pressure
  - Muscle tone

16

Range of Motion

- Active ROM and passive ROM for each joint and related muscle group
- Note
  - Pain
  - Limited or spastic movement
  - Joint instability
  - Deformity
  - Contracture
- Measure with goniometer

17

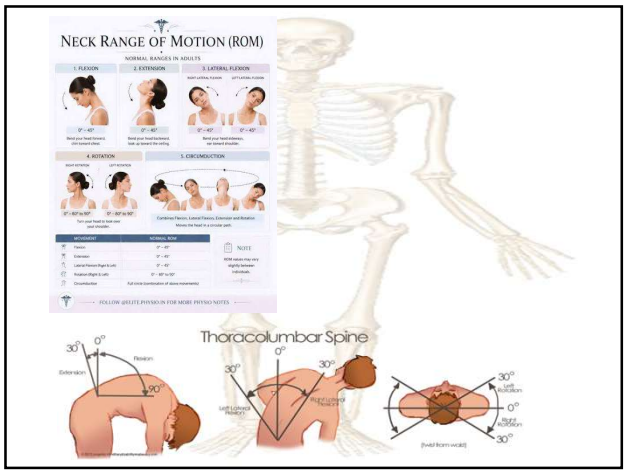
GONIOMETRY

NORMAL RANGE OF MOTION

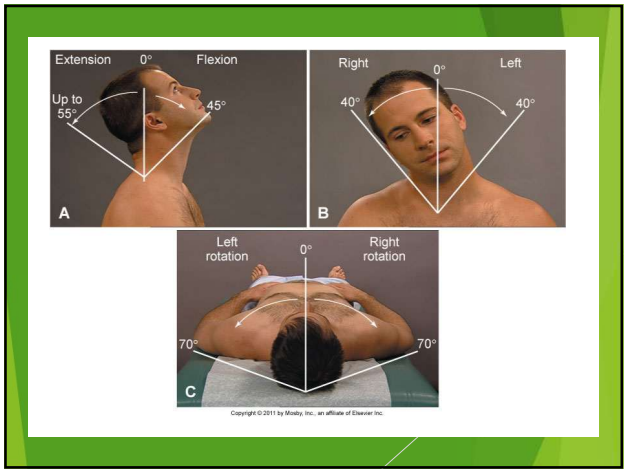
JOINT	MOVEMENT	NORMAL RANGE	HOW IT'S MEASURED
SHOULDER	Flexion Extension Abduction Adduction External rotation Internal rotation	0° – 180° 0° – 60° 0° – 180° 0° – 45° 0° – 90° 0° – 70°	Axis over greater tubercle. Stationary arm parallel to mid-axillary line.
ELBOW	Flexion Extension	0° – 150° 150° – 0°	Axis over lateral epicondyle. Stationary arm parallel to humerus.
WRIST	Flexion Extension Radial deviation Ulnar deviation	0° – 80° 0° – 70° 0° – 20° 0° – 30°	Axis over radial styloid process. Stationary arm along forearm.
HIP	Flexion Extension Abduction Adduction Internal rotation External rotation	0° – 120° 0° – 30° 0° – 45° 0° – 30° 0° – 40° 0° – 45°	Axis over greater trochanter. Stationary arm parallel to mid-axillary line.
KNEE	Flexion Extension	0° – 135° 135° – 0°	Axis over lateral epicondyle. Stationary arm parallel to fibula.
ANKLE	Dorsiflexion Plantarflexion Inversion Eversion	0° – 20° 0° – 50° 0° – 30° 0° – 20°	Axis over lateral malleolus. Stationary arm along lateral aspect of leg.

PHYSICALTHERAPYNEED

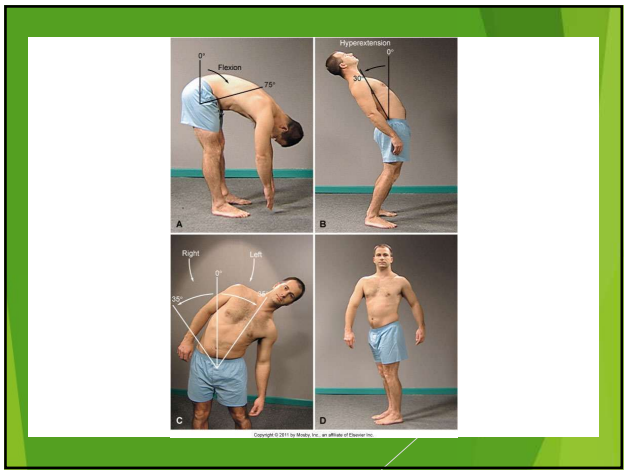
18


NECK RANGE OF MOTION (ROM)
NORMAL RANGES IN ADULTS
1. FLEXION
2. EXTENSION
3. LATERAL FLEXION
4. ROTATION
5. CIRCUMDUCTION
MOVEMENT
NORMAL ROM
NOTE
FOLLOW @ELITE.PHYSIO.IN FOR MORE PHYSIO NOTES
Thoracolumbar Spine
Extension
Flexion
Left Lateral Flexion
Right Lateral Flexion
Left Rotation
Right Rotation
(hold from waist)

19


Extension
0°
Flexion
Up to 55°
45°
A
Right
0°
Left
40°
40°
B
Left rotation
0°
Right rotation
70°
70°
C
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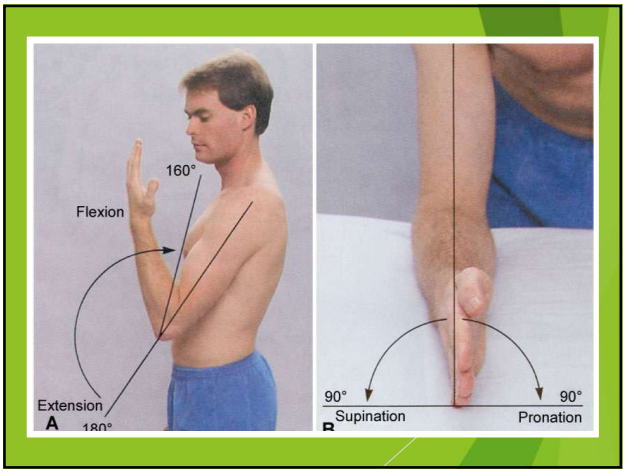
20


0°
Flexion
75°
A
Hyperextension
0°
30°
B
Right
Left
0°
25°
C
D
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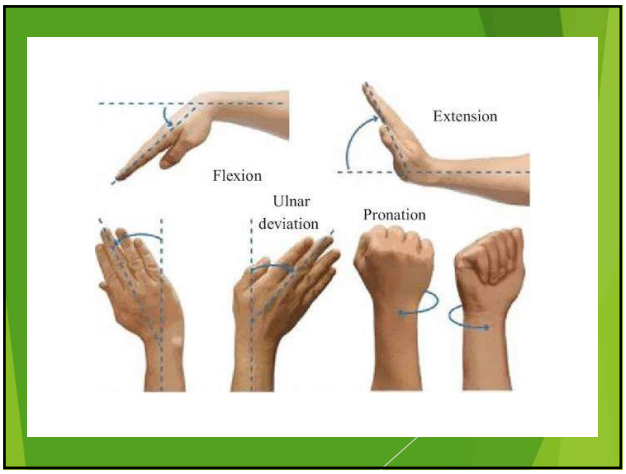
21


180°
Forward flexion
Up to 60°
Hyperextension
0°
A
180°
Abduction
50°
Adduction
B
90°
90°
C
D
E
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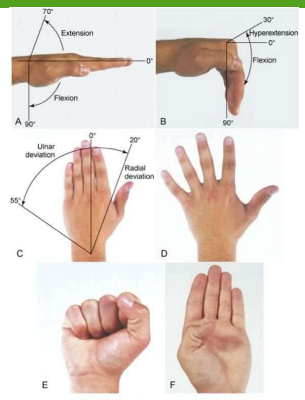
22


160°
Flexion
Extension
A
180°
90°
Supination
90°
Pronation
B

23


Flexion
Extension
Ulnar deviation
Pronation

24


70°
Extension
0°
Flexion
60°
A
30°
Hyperextension
0°
Flexion
60°
B
0°
20°
Ulnar deviation
Radial deviation
55°
C
D
E
F

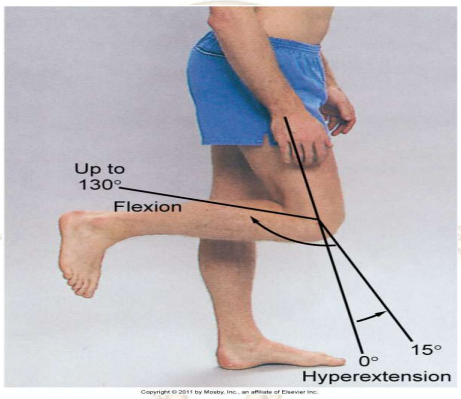
25


Flexion, knee extended
Up to 30°
0°
B
Up to 90°
Hyperextension, knee extended
0°
A
45°
Internal rotation
E
45°
F

26


HIP RANGE OF MOTION
Movement • Function • Mobility
1. HIP FLEXION
2. HIP EXTENSION
3. HIP ABDUCTION
4. HIP ADDUCTION
5. HIP INTERNAL ROTATION
6. HIP EXTERNAL ROTATION
7. HIP CIRCUMDUCTION
8. HIP FLEXION (KNEE FLEXED)
9. HIP EXTENSION (KNEE FLEXED)

27



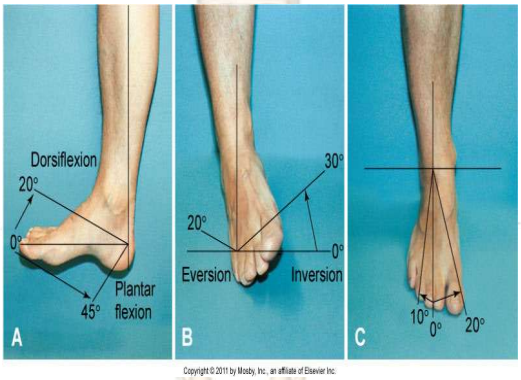
28

Muscle Strength

- Compare bilateral muscles
  - Strength
  - Symmetry
  - Equality
  - Resistance
- Grade 0-5+
  - 0 = paralysis
  - 1 = flicker of contraction
  - 2 = contraction only when gravity is removed
  - 3 = contraction against gravity only
  - 4 = contraction with slight resistance
  - 5 = contraction with full resistance

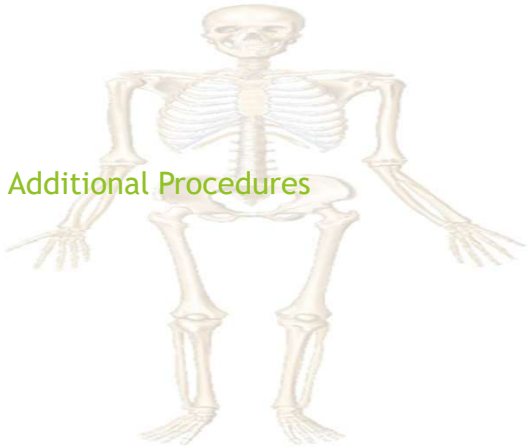


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30

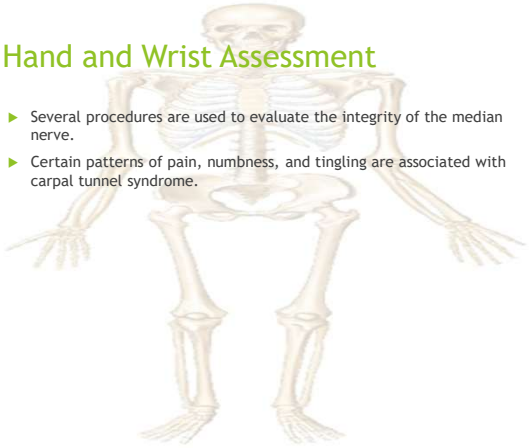
Additional Procedures



31

Hand and Wrist Assessment

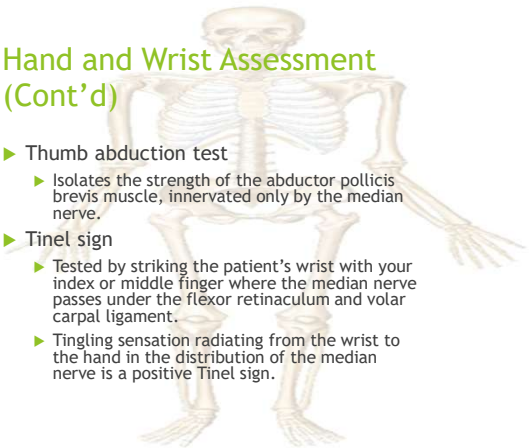
- Several procedures are used to evaluate the integrity of the median nerve.
- Certain patterns of pain, numbness, and tingling are associated with carpal tunnel syndrome.



32

Hand and Wrist Assessment (Cont'd)

- Thumb abduction test
  - Isolates the strength of the abductor pollicis brevis muscle, innervated only by the median nerve.
- Tinel sign
  - Tested by striking the patient's wrist with your index or middle finger where the median nerve passes under the flexor retinaculum and volar carpal ligament.
  - Tingling sensation radiating from the wrist to the hand in the distribution of the median nerve is a positive Tinel sign.



33

Hand and Wrist Assessment (Cont'd)

- Phalen test
  - Patient holds both wrists in a fully palmarflexed position with the dorsal surfaces pressed together for 1 minute.
  - Numbness and paresthesia in the distribution of the median nerve are suggestive of carpal tunnel syndrome.

34

Thumb Abduction Test



35

Tinel Test



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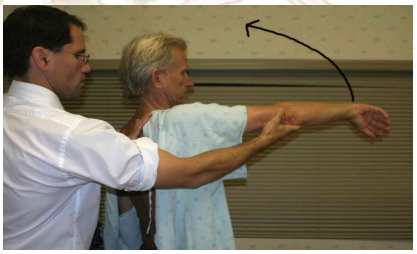
Phalen Test



37

Shoulder Assessment

- Neer test
  - Tests for shoulder impingement
  - Internally rotate and forward flex arm at the shoulder: presses supraspinatus muscle against anteroinferior acromion
  - Positive findings is pain in the anterior-lateral aspect of the shoulder



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Shoulder Assessment (Cont'd)

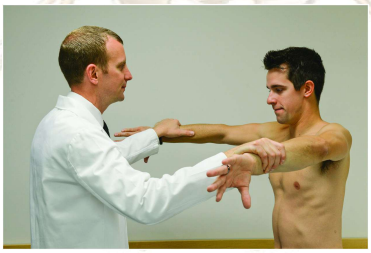
- Hawkins test
  - Tests for impingement
  - Forward flexing shoulder to 90 degrees, flexing elbow to 90 degrees, and then internally rotating arm
  - Positive findings is pain in the superior-lateral aspect of the shoulder



39

Empty Can Test

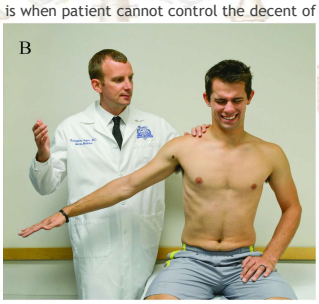
- To test for possible rotator cuff tear
- Patient is to internally rotated, abducted to 90 degrees, and 30 degrees of flexion.
- Patient instructed to resist downward pressure
- Positive if patient cannot resist pressure



40

Drop Arm Test (Codman's Sign

- Possible rotator cuff tear
- Passively abduct to maximum point
- Have patient actively lower arm
- Positive findings is when patient cannot control the decent of the arm and it drops



41

Lower Spine Assessment

- Straight leg raising test
  - Used to test for nerve root irritation or lumbar disc herniation at the L4, L5, and S1 levels.
  - Have the patient lie supine with the neck slightly flexed.
  - Ask the patient to raise the leg, keeping the knee extended.
  - No pain should be felt below the knee with leg raising.
  - Radicular pain below the knee in a dermatome pattern may be associated with disc herniation.

42

Acute Low Back Pain Assessment

Nerve root	L4	L5	S1
Pain			
Numbness			
Motor weakness	Extension of quadriceps	Dorsiflexion of great toe and foot	Plantar flexion of great toe and foot
Screening examination	Squat and rise	Heel walking	Walking on toes
Reflexes	Knee jerk diminished	None reliable	Ankle jerk diminished

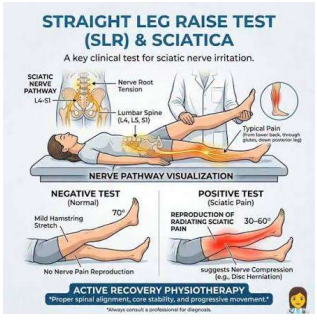
(From Thompson et al. 1997.)

43

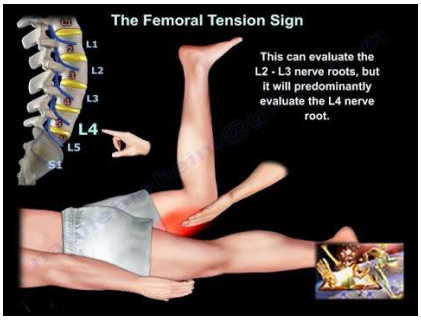
Lower Spine Assessment (Cont'd)

- Femoral stretch test
  - Used to detect inflammation of the nerve root at the L1, L2, L3, and sometimes L4 level.
  - Have the patient lie prone and extend the hip.
  - No pain is expected.
  - The presence of pain on extension is a positive sign of nerve root irritation.

44



45



46

Hip Assessment

- Thomas test
  - Detect flexion contractures of hip masked by excessive lumbar lordosis.
  - Have the patient lie supine.
  - Fully extend one leg flat on the examining table and flex the other leg with the knee to the chest.
  - Observe the patient's ability to keep the extended leg flat on the examining table.
  - Lifting the extended leg off the examining table indicates a hip flexion contracture in the extended leg.

47

Thomas test



48

Hip Assessment (Cont'd)

- Trendelenburg test
  - Detect weak hip abductor muscle.
  - Patient stands and balances first on one foot and then the other.
  - Observing from behind, note any asymmetry or change in the level of the iliac crests.
  - When the iliac crest drops on the side of the lifted leg, the hip abductor muscles on the weight-bearing side are weak.

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Trendelenburg Test



50

Knee Assessment

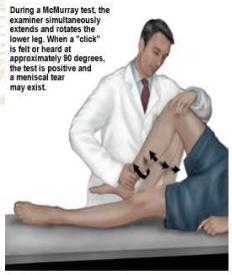
- Ballottement: excess fluid or effusion
- Bulge sign: excess fluid
- McMurray test: torn medial or lateral meniscus
  - Patient lies supine and flexes one knee
  - Palpable or audible click, pain, grinding, or lack of extension during outward (valgus) and inward (varus) stress during flexion of knee is a positive sign.

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Bulge Sign



McMurray Test



52

Knee Assessment (Cont'd)

- Anterior and posterior drawer test: instability of cruciate ligaments
  - Patient lies supine and flexes the knee 45 to 90 degrees, placing the foot flat on the table.
  - Draw the tibia forward and backward, forcing the tibia to slide forward of the femur.
  - Anterior or posterior movement of the knee greater than 5 mm in either direction is an unexpected finding.

53


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Knee Assessment (Cont'd)

- Lachman test: anterior cruciate ligament integrity
- Varus and valgus stress test: instability of lateral and medial collateral ligaments

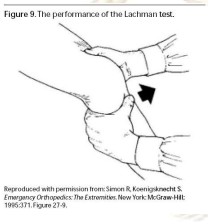


Figure 9. The performance of the Lachman test.

Reproduced with permission from: Simon R, Koenigsknecht S. *Emergency Orthopedics: The Extremities*. New York: McGraw-Hill; 1995:371, Figure 27-9.



55

Limb Measurement

- Performed when difference is suspected
- Measure bilateral
  - Circumference
  - Length
- Should be no more than 1-cm difference in length and circumference between matching extremities

56

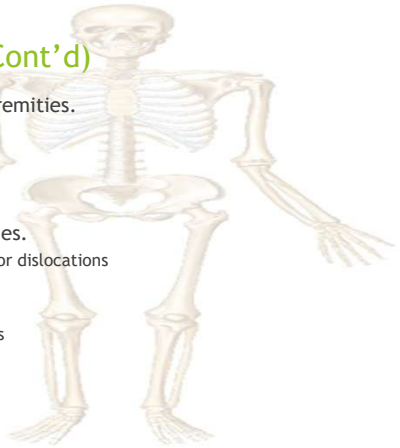
Infants

- Inspect general
  - Posture
  - Spontaneous generalized movements
- Inspect back.
  - Hair tufts and dimples
  - Discolorations
  - Cysts or masses near spine
  - Curvature of spine

57

Infants (Cont'd)

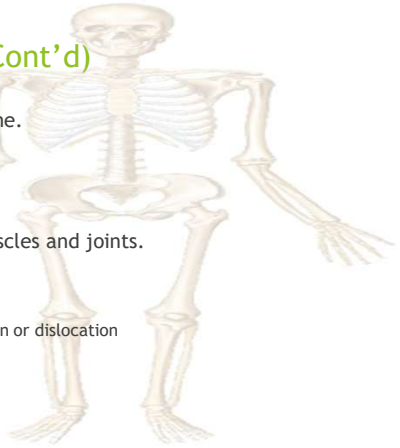
- Inspect extremities.
  - Symmetry
  - Movement
  - Equality
  - Deformity
- Palpate bones.
  - Fractures or dislocations
  - Crepitus
  - Masses
  - Tenderness



58

Infants (Cont'd)

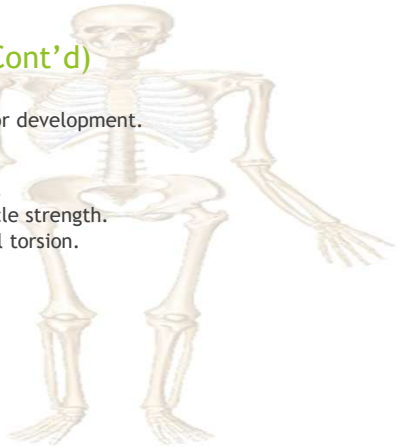
- Palpate spine.
  - Shape
  - Formation
  - Splitting
- Palpate muscles and joints.
  - Tone
  - Mobility
  - Subluxation or dislocation



59

Infants (Cont'd)

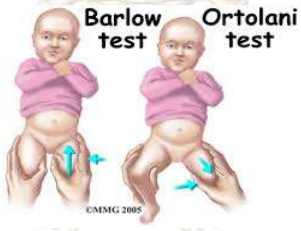
- Assess motor development.
  - Fine
  - Gross
- Assess ROM.
- Assess muscle strength.
- Assess tibial torsion.



60

Infants (Cont'd)

- *Barlow-Ortolani maneuver* to detect hip dislocation or subluxation should be performed each time you examine the infant during the first year of life.



61

Infants (Cont'd)

- *Barlow maneuver*
  - Position yourself at the supine infant's feet, and flex the hip and knee to 90 degrees.
  - Grasp the leg with your thumb on the inside of the thigh, the base of the thumb on the knee, and your fingers gripping the outer thigh with fingertips resting on the greater trochanter.
  - Adduct the thigh and gently apply downward pressure on the femur in an attempt to disengage the femoral head from the acetabulum.
  - A positive sign is when a clunk or sensation is felt as the femoral head exits the acetabulum posteriorly.

62

Infants (Cont'd)

- *Ortolani maneuver*
  - Slowly abduct the thigh while maintaining axial pressure.
  - Fingertips on the greater trochanter, exert a lever movement in the opposite direction so that your fingertips press the head of the femur back toward the acetabulum center.
  - If the head of the femur slips back into the acetabulum with a palpable clunk when pressure is exerted, suspect hip subluxation or dislocation.

63

Children

- Assess motor development.
  - Fine
  - Gross
- Assess ROM.
- Inspect:
  - Spine curvature
  - Sitting posture
  - Foot arch
  - Alignment of feet and legs

64

Children (Cont'd)

- Evaluate for the following:
  - Bowlegs (genu varum)
  - Knock-knees (genu valgum)
- Palpate bones, muscles, and joints.
- Evaluate rising from seated position.

65

Adolescents

- Same examination procedures as for adult
- Note presence of scoliosis.
- Note slight kyphosis or rounded shoulders.

66

Older Adults

- Assessment of activities of daily living for fine and gross motor skills
- Osteoporosis Risk Assessment Instrument to screen for osteoporosis
- Inspect:
  - Dorsal kyphosis
  - Base of support broader (feet more widely spaced)
  - Reduction in total muscle mass
- Palpate muscle for the following:
  - Tone
  - Atrophy
- Assess muscle strength and ROM

67

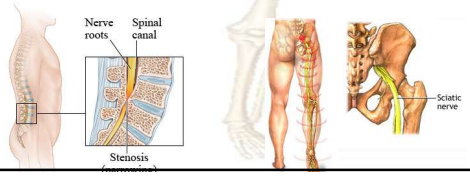
Abnormalities

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Abnormalities



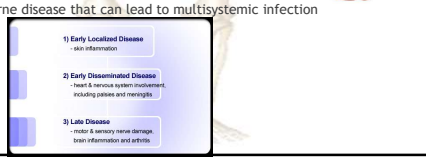
- Ankylosing spondylitis
  - Hereditary, chronic inflammatory disease
  - Initially affects the lumbar spine and sacroiliac joints
- Lumbosacral radiculopathy
  - Herniated lumbar disc that irritates the corresponding nerve root
- Lumbar stenosis
  - Hypertrophy of the ligamentum flavum and facet joints that results in narrowing of the spinal canal



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Abnormalities (Cont'd)

- Carpal tunnel syndrome
  - Compression on the median nerve
- Gout
  - Disorder of purine metabolism that results from an elevated serum uric acid level
  - Form of arthritis
- Lyme disease
  - Tickborne disease that can lead to multisystemic infection





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Abnormalities (Cont'd)

- TMJ syndrome
  - Painful jaw movement
- Osteomyelitis
  - Infection in the bone
- Bursitis
  - Inflammation of the bursa
- Paget disease (osteitis deformans)
  - Focal metabolic disorder of the bone

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Abnormalities (Cont'd)

- Fibromyalgia
  - Painful, nonarticular condition that leads to diffuse musculoskeletal discomfort
- Osteoarthritis
  - Deterioration of the articular cartilage covering the ends of bone in synovial joints
- Rheumatoid arthritis
  - Chronic systemic inflammatory disorder of the synovial tissue surrounding the joints

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Sports Injuries

- Muscle strain
  - Can be due to excessive stretching or forceful contraction beyond the muscles functional capacity
- Dislocation
  - Complete separation of the contact between two bones in a joint
- Fracture
  - Partial or complete break in the continuity of a bone

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Sports Injuries (Cont'd)

- Tenosynovitis (tendonitis)
  - Inflammation of the synovium-lined sheath around a tendon
- Rotator cuff tear
  - Microtrauma and tearing of the rotator cuff muscles; most often the supraspinatus

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Infants and Children

- Clubfoot (talipes equinovarus)
  - Fixed congenital defect of the ankle and foot
- Metatarsus adductus
  - Most common congenital foot deformity
  - Metatarsus adductus can be either fixed or flexible.
- Legg-Calvé-Perthes disease
  - Avascular necrosis of the femoral head

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Club Foot Adductus



Metatarsus

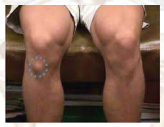




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Infants and Children (Cont'd)

- Osgood-Schlatter disease
  - Traction apophysitis (inflammation of a bony outgrowth) of the anterior aspect of the tibial tubercle





- Slipped capital femoral epiphysis
  - Disorder in which the capital femoral epiphysis slips over the neck of the femur



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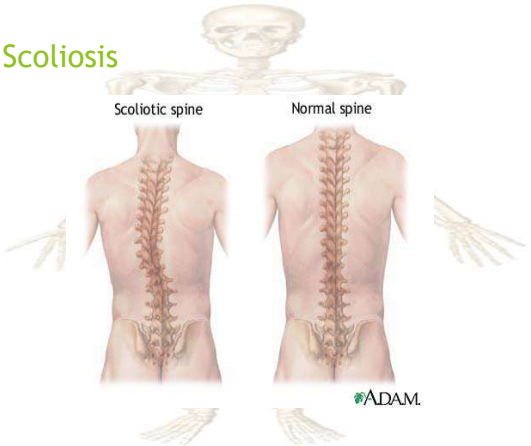
Infants and Children (Cont'd)

- Muscular dystrophy
  - Group of genetic disorders involving gradual degeneration of the muscle fibers
- Scoliosis
  - Concave curvature of the anterior vertebral bodies, convex posterior curves, and lateral rotation of the thoracic spine
- Radial head subluxation
  - Known as nursemaid's elbow, this is a dislocation injury.



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Scoliosis



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Older Adults

- Osteoporosis
  - Disease in which a decrease in bone mass occurs because bone resorption is more rapid than bone deposition
- Dupuytren contracture
  - Contractures involving the flexor hand tendons



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