Unit 5
Assessing musculoskeletal function

Chapter Fifteen
Musculoskeletal system

PURPOSE
The musculoskeletal system provides locomotion, an upright posture and protection for the body. It is composed of various forms of connective tissue that include bones, skeletal muscle, cartilage, ligaments, tendons and joints. This chapter will help you learn the structure and function of the various joints in the body and know their normal ranges of motion. You will also become familiar with a musculoskeletal health history format. You will be introduced to how to position the patient comfortably during the examination, to understand the rationale and methods of examining the musculoskeletal system to assess functional ability and how to accurately record the musculoskeletal assessment. At the end of this chapter you should be able to perform a complete assessment of the musculoskeletal system.

KEY CONCEPTS
• Components of the musculoskeletal system
• Structure and function: bones, ligaments, tendons, joints
• Range of motion
• Musculoskeletal health history
• Gait Arms Legs and Spine (GALS) screening and musculoskeletal assessment
  – Temporomandibular joint
  – Cervical spine
  – Upper extremity: shoulders, elbows, wrist and hands
  – Lower extremity: hips, knees, ankles and feet
  – Spine
  – Functional assessment
  – Self-care

While you are completing your reading assignment, ensure you understand each of the key concepts listed above.

READING ASSIGNMENT

GLOSSARY
After reading the corresponding chapter in the text, learn the following terms. You should be able to cover the definition on the right and state the associated definition in your own words.

Abduction………………………… moving a body part away from an axis or the median line
Adduction………………………… moving a body part towards the centre or towards the median line
Ankylosis.................................................immobility, consolidation and fixation of a joint because of disease, injury or surgery; most often due to chronic rheumatoid arthritis
Bulge sign..................................................confirms the presence of swelling in the suprapatellar pouch; occurs with very small amounts of effusion, 4 to 8 mL, from fluid flowing across the joint
Bursa..........................................................closed sac filled with viscous fluid located in joint areas of potential friction
Circumduction.............................................moving the arm in a circle around the shoulder
Compartment syndrome .........................a rise in intracompartmental tissue pressure following major injury to muscles; syndrome is characterised by muscle necrosis called rhabdomyolysis
Crepitation....................................................an audible and palpable crunching or grating that accompanies movement; occurs when the articular surfaces in the joints are roughened
Dorsal..........................................................directed towards or located on the surface
Dupuytren's contracture..............................flexion contractures of the fingers due to chronic hyperplasia of the palmar fascia
Epiphyses (growth plates).........................specialised growth centres; transverse discs located at the ends of long bones
Eversion.......................................................moving the sole of the foot outwards at the ankle
Extension.....................................................straightening a limb at a joint
Flexion.........................................................bending a limb at a joint
Ganglion......................................................round, cystic, nontender nodule overlying a tendon sheath or joint capsule, usually on dorsum of wrist
Hallux valgus..............................................lateral or outwards deviation of the great toe
Inversion.......................................................moving the sole of the foot inwards at the ankle
Kyphosis......................................................outward or convex curvature of the thoracic spine, hunchback
Ligament......................................................fibrous bands running directly from one bone to another bone that strengthen the joint
Lordosis.......................................................inwards or concave curvature of the lumbar spine
Nucleus pulposus..........................................centre of the intervertebral disc
Olecranon process.................................bony projection of the ulna at the elbow
Patella..........................................................kneecap
Phalen's test..............................................a test for carpal tunnel: hold both hands back to back while flexing the wrists 90 degrees; produces numbness and burning in a person with carpal tunnel syndrome
Plantar.........................................................surface of the sole of the foot
Pronation.....................................................turning the forearm so that the palm is down
Protraction...................................................moving a body part forwards and parallel to the ground
Range of motion (ROM)..............................extent or range of movement of a joint
Retraction.....................................................moving a body part backwards and parallel to the ground
Rheumatoid arthritis..............................chronic systemic inflammatory disease of joints and surrounding connective tissue
Rotation......................................................moving the head around a central axis
Sciatica.................................nerve pain along the course of the sciatic nerve that travels down from the back or thigh through the leg and into the foot

Scoliosis.................................S-shaped curvature of the thoracic spine

Supination.................................turning the forearm so that the palm is up

Talipes equinovarus...................(clubfoot) congenital deformity of the foot in which it is plantar flexed and inverted

Tendon.................................strong fibrous cord that attaches a skeletal muscle to a bone

Tinel's sign.................................in carpal tunnel syndrome, percussion of the median nerve produces burning and tingling along its distribution

PREPARATION FOR YOUR LABORATORY SESSION

Prior to your clinical lab when you will be performing the GALS screening assessment, you may want to view a simple video to help you understand the process. One such video may be found at http://www.arthritisresearchuk.org/videos/remsvideo/remsgals_screen.aspx

This is one of many on the internet and is quick and easy to follow.

STUDY GUIDE

After completing the reading assignment, you should be able to answer the following questions in the spaces provided.

1. List the functions of the musculoskeletal system.

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2. Define bone, and explain the processes of remodelling in the maintenance of bony structures.

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3. Define cartilage and describe the function of the 3 types of cartilage.

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4. State 1 major difference between ligaments and tendons.

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5. Fill in the gaps.
   a. Skeletal muscles are innervated by the _______ nerve fibres of _______ nerves.
   b. Conscious and subconscious contractions of muscles affect _______ and _______ and also generate _______.
   c. The human body contains over 400 skeletal muscles representing _______ of total body weight.
   d. Skeletal muscle fibres have an abundant _______ and _______ supply.
   e. These are bundled together in a compartment wrapped in a tough fibrous connective tissue called _______.

6. Define rhabdomyolysis and explain associated complications.

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7. For each of the following joint types, identify their classification by range of motion, explain their structure and provide examples of each.
   fibrous (synarthrotic) joints
   cartilaginous (amphiarthrotic) joints
8. Fill in the labels indicated on the following illustrations.

9. The temporomandibular joint (TMJ) permits jaw function for speaking and chewing. Describe each of the 3 movements it performs.
10. Briefly explain the technique used to identify the 7 cervical, 12 thoracic, 5 lumbar, 5 sacral and 3 or 4 coccygeal vertebrae.

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11. Identify the 4 spinal curves and state their purpose.

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12. Describe the structure and function of intervertebral discs.

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13. For each of the following joints, state the movements they allow.
   a. vertebral column
   b. elbow
   c. radius and ulnar
   d. wrist or radiocarpal joint
   e. metacarpophalangeal and the interphalangeal joints
   f. ankle

14. Explain the function of the ligaments of the knee

___________________________________________________________________________________________________

___________________________________________________________________________________________________
15. Match the curvature of the spine in Column A with the approximate age in Column B.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>birth</td>
<td>1. anterior curve in the cervical neck region</td>
</tr>
<tr>
<td>3 to 4 months</td>
<td>2. anterior curve in the lumbar region</td>
</tr>
<tr>
<td>1 year to 18 months</td>
<td>3. single C-shaped curve</td>
</tr>
</tbody>
</table>

16. List the 3 core questions used to gather the subjective patient history using the GALS screening tool. What should be done if there is a positive response to any of the questions?

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17. List 4 signs that suggest acute inflammation in a joint.

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18. Explain why it is important to screen ADLs when performing a musculoskeletal health history.

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19. Why is a medication history a vital part of musculoskeletal health history?

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20. Explain the systematic approach to musculoskeletal assessment.

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21. Define each of the following:
- dislocation
- subluxation
- contracture
- ankylosis
- effusion

22. State when the goniometer would be used, then describe the correct method for its use.

23. Differentiate between the testing of active range of motion versus passive range of motion and state the grades that are used.

24. State the expected range of degrees of flexion and extension of the following joints.
- elbow
- wrist
- fingers (at metacarpophalangeal joints)
- hip
- knee
- ankle

25. Circle True or False to answer the following statements regarding shoulder pain. If the answer is false, state the correct answer:
   a. Swelling of subacromial bursa is localised under deltoid muscle and may be accentuated when the person tries to abduct the arm.  True False
   b. Shoulder pain may be from local causes or it may be referred pain from a hiatus hernia or a cardiac or pleural condition.  True False
   c. A dislocated shoulder loses the normal rounded shape and looks flattened anteriorly.  True False
   d. Pain from a local cause is reproducible during the examination by palpation or motion.  True False
26. Explain why LaSegue's test would be used.

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27. Explain the assessment of an infant’s foot to identify the presence of a true or a positional deformity.

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28. Briefly describe each of the following:
   sydactyly ____________________________________________
   polydactyly ________________________________________
   simian crease _____________________________________

REVIEW QUESTIONS
This test is for you to check your own mastery of the content. Answers are provided in Appendix A.

1. During an assessment of the spine, the patient would be asked to:
   a. adduct and extend
   b. supinate, evert and retract
   c. extend, adduct, invert and rotate
   d. flex, extend, abduct and rotate

2. Pronation and supination of the hand and forearm are the result of the articulation of the:
   a. scapula and clavicle
   b. radius and ulna
   c. patella and condyle of fibula
   d. femur and acetabulum

3. Anterior and posterior stability is provided to the knee joint by the:
   a. medial and lateral menisci
   b. patellar tendon and ligament
   c. medial collateral ligament and quadriceps muscle
   d. anterior and posterior cruciate ligaments

4. A 70-year-old woman has come for a health examination. Which of the following is a common age-related change in the curvature of the spinal column?
   a. lordosis
   b. scoliosis
   c. kyphosis
   d. lateral scoliosis

5. The timing of joint pain may assist the nurse in determining the cause. The joint pain associated with rheumatic fever would:
   a. be worse in the morning
   b. be worse later in the day
   c. be worse in the morning but improve during the day
   d. occur 10 to 14 days after an untreated sore throat
6. Examination of the shoulder includes 4 motions. These are:
   a. forward flexion, internal rotation, abduction and external rotation
   b. abduction, adduction, pronation and supination
   c. circumduction, inversion, eversion and rotation
   d. elevation, retraction, protraction and circumduction

7. The bulge sign is a test for:
   a. swelling in the suprapatellar pouch
   b. carpal tunnel syndrome
   c. Heberden's nodes
   d. olecranon bursa inflammation

8. The examiner is going to measure the patient’s legs for length discrepancy. The normal finding would be:
   a. no difference in measurements
   b. 0.5 cm difference
   c. within 1 cm of each other
   d. 2 cm difference

9. A 2-year-old child has been brought to the clinic for a health examination. A common finding would be:
   a. kyphosis
   b. lordosis
   c. scoliosis
   d. no deviation is normal

10. Many disorders can impact bone health. Which of the following disorders would not be included:
    a. hyperthyroidism
    b. diabetes
    c. renal disease
    d. cardiac disease
    e. malabsorption syndromes

11. Which of the following surface landmarks would not be used to identify vertebral levels/orient you to the levels:
    a. the spinous processes of C7 and T1 prominent at the base of the neck
    b. the inferior angle of the scapula normally at the level of the interspace between T7 and T8
    c. an imaginary line connecting the 10th ribs
    d. an imaginary line connecting the highest point on each iliac crest crosses L4
    e. an imaginary line joining the two symmetric dimples that overlie the posterior superior iliac spines crosses the sacrum

12. Spina bifida would be suspected in the infant who had which of the following:
    a. a small dimple in the midline, anywhere from the head to the coccyx
    b. a tuft of hair over a dimple in the midline
    c. a dimple in the gluteal fold
    d. a positive Allis sign

13. Circle True or False to answer the following statements concerning joints and associated disease processes. If the answer is false, state the correct answer:
    a. Rheumatoid arthritis (RA) involves symmetrical joints. True False
    b. Chronic pain is not associated with degenerative musculoskeletal disorders. True False
    c. Pain related to acute inflammation is often described as exquisitely tender. True False
    d. Osteoarthritis pain is worse in morning when arising; RA is worse later in the day. True False
    e. Most joint pain is mechanical except in RA, when deformities restrict movement. True False
    f. Joint pain 10 to 14 days after an untreated strep throat suggests rheumatic fever. True False
14. Match column A with column B.

<table>
<thead>
<tr>
<th>Column A—Movement</th>
<th>Column B—Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>flexion</td>
<td>a. turning the forearm so that the palm is up</td>
</tr>
<tr>
<td>extension</td>
<td>b. bending a limb at a joint</td>
</tr>
<tr>
<td>abduction</td>
<td>c. lowering a body part</td>
</tr>
<tr>
<td>adduction</td>
<td>d. turning the forearm so that the palm is down</td>
</tr>
<tr>
<td>pronation</td>
<td>e. straightening a limb at a joint</td>
</tr>
<tr>
<td>supination</td>
<td>f. raising a body part</td>
</tr>
<tr>
<td>circumduction</td>
<td>g. moving a limb away from the midline of the body</td>
</tr>
<tr>
<td>inversion</td>
<td>h. moving a body part backwards and parallel to the ground</td>
</tr>
<tr>
<td>eversion</td>
<td>i. moving a limb towards the midline of the body</td>
</tr>
<tr>
<td>rotation</td>
<td>j. moving the arm in a circle around the shoulder</td>
</tr>
<tr>
<td>protraction</td>
<td>k. moving the sole of the foot outwards at the ankle</td>
</tr>
<tr>
<td>retraction</td>
<td>l. moving a body part forwards and parallel to the ground</td>
</tr>
<tr>
<td>elevation</td>
<td>m. moving the sole of the foot inwards at the ankle</td>
</tr>
<tr>
<td>depression</td>
<td>n. moving the head around a central axis</td>
</tr>
</tbody>
</table>

**PRACTICAL SKILLS IN THE LABORATORY/Clinical Setting**

The purpose of the musculoskeletal examination is to assess patterns of pain, joint abnormalities and the impact these have on the person’s activities of daily living (ADLs) and psychosocial functioning. It is essential to identify painful joints during the history to ensure these are examined last. A comprehensive musculoskeletal assessment should be integrated into a patient’s health assessment as numerous general health issues and prescribed medications affect this system.

The assessment process involves a thorough history of the impact of their joint dysfunction and pain on their lives as this will assist in identifying the nature of the musculoskeletal problem. It is important to ask about previous complementary therapies, non-prescription medications and remedies as well as a current medication history.

A current medical history is an essential part of musculoskeletal assessment as a number of disorders, nutritional conditions and medications can impact on bone health. As there is a strong genetic link associated with musculoskeletal health the patient should be asked about any family history of fractures or arthritis.

The musculoskeletal system is closely linked with the neurological system (Ch 22) and acute pain and chronic pain (Ch 10) often accompany musculoskeletal disorders; you should refer to these chapters when needed.

Having completed the readings, study guide and review questions you should now be ready for the clinical component of examining the musculoskeletal system. The purpose of the clinical component is to obtain a musculoskeletal history and practise GALS screening and the regional musculoskeletal examination on a peer in the skills laboratory or a patient in the clinical setting.

**PROFESSIONAL PRACTICE NOTE**

You need to ensure the privacy and comfort of the patient during musculoskeletal assessment. Ensure you have enough drapes available and that your patient is in a suitable hospital gown, to prevent exposure.
CLINICAL OBJECTIVES

At the completion of the clinical laboratory session, with further practice and self-directed learning you should be able to:

1. collect a health history related to the presenting musculoskeletal signs and symptoms
2. demonstrate knowledge of symptoms related to the musculoskeletal system by obtaining a musculoskeletal health history
3. administer the subjective GALS screening and decide the need for further objective screening using the complete GALS screening tool
4. assess the ability to carry out functional activities of daily living
5. record the health history and GALS screening examination findings accurately, reach an assessment about the musculoskeletal health state, and develop a plan of care.

INSTRUCTIONS

1. Form pairs.
2. Gather your equipment.
3. Wash your hands.
4. Gain consent to perform the examination from either your peer or the patient.
5. Practise the musculoskeletal health history and steps of the examination (including the GALS screening) on a peer or a patient in the clinical setting, providing appropriate instructions as you proceed, and maintaining the safety of the person during movement.
6. Record your findings using the regional write-up worksheet.
7. Swap roles and repeat steps 2–6.
8. Discuss your assessment techniques, findings and performance with your peer to develop a complete understanding of the process.
9. Document your findings using the SOAP format.

NOTES
REGIONAL WRITE-UP WORKSHEET—MUSCULOSKELETAL SYSTEM ASSESSMENT

Date ________________________________

Interview conducted by ________________________________

Designation ________________________________

Patient __________________________________________ Age ______ Gender ______

Occupation __________________________________________ Medical Record Number ______

I. Health history

1. Joints
   1. Joint problems? One side or both sides?
   2. Any swelling, heat, redness?
   3. Any limitation of movement? Which joint/s?
   4. Which activities give you problems?
   5. Any pain?
   6. Describe the pain: aching, stiff, sharp or dull, shooting?
   7. How severe?
   8. When did pain start?
   9. What time of day does the pain occur? How long does it last?
   10. How often does it occur?
   11. Any stiffness?
   12. Aggravated by? movement, rest, position, weather?
   13. Relieved by? rest, medications, application of heat or ice?
   14. Is the pain associated with chills, fever, recent sore throat, trauma and repetitive activity?

2. Muscles
   1. Muscle problems, pain or cramping? Which muscles?
      If calf muscles: is the pain with walking? Does it go away with rest?
   2. Muscle aches associated with fever, chills, the "flu"?
   3. Any weakness in muscles? Where? How long?
   4. Do the muscles look different there?

3. Bones
   1. Bone pain? Affected by movement?
   2. Any deformity of any bone or joint?
   3. Deformity due to injury or trauma? Does the deformity affect ROM?
   4. Any accidents or trauma to bones or joints: fractures, joint strain, sprain, dislocation?
      Which ones?
   5. When? Treatment? Any problems or limitations?
   6. Any back pain? In which part of your back?
      Is pain felt elsewhere? Describe it.
   7. How long have you had this pain?
   8. Any numbness and tingling? Any limping?

4. Functional assessment (ADLs)
   Joint problems creating limitations on ADLs? Which ones?
   a. Bathing ________________________________  
   b. Toileting ________________________________
   c. Dressing ________________________________
   d. Grooming ________________________________
   e. Eating ________________________________
   f. Mobility ________________________________
   g. Communicating ________________________________
5. Self-care behaviours.
   1. Any occupational hazards? ____________________________________________
   2. Work involve heavy lifting? ____________________________________________
   3. Repetitive motion or chronic stress to joints in your work? ______________
   4. Any measures take to alleviate? _______________________________________
   5. Exercise program? ________ Type? ________ Frequency? ________ Warm-up? __
   7. Weight changed recently? __________ Usual daily diet? __________________
   8. Medications for musculoskeletal system? ________________________________
      Aspirin, anti-inflammatory, muscle relaxant, pain reliever? ________________
      Are you taking any herbal supplements, vitamins or other ‘natural remedies’? __
   9. If chronic disability and/or severe musculoskeletal dysfunction:
      How have these symptoms/illness affected:
      a. your interaction with family and friends ________________________________
      b. your employment and leisure activities ________________________________
      c. the way you view yourself ____________________________________________
      d. how you manage your health __________________________________________
      e. the impact on your social life __________________________________________
      f. the impact on your stress levels and coping ability ______________________

NOTES
GALS SCREENING EXAMINATION

Date _____________________________________________

Interview conducted by ______________________________________

Designation _________________________________________

Patient ____________________________________________ Age ______ Gender ______

Occupation __________________________________________ Medical Record Number ______

GALS Subjective Screening Assessment Questions

1. ‘Have you any pain or stiffness in your muscles, joints, or back?’ ____________________________

2. ‘Can you dress yourself completely without any difficulty?’ _________________________________

3. ‘Can you walk up and down stairs without any difficulty?’ _________________________________

If there is a positive answer to any of these questions a complete musculoskeletal assessment should be undertaken.

GALS Objective Screening Examination

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gait</strong></td>
<td></td>
</tr>
<tr>
<td>• Observe the person walking, turning, then walking back.</td>
<td></td>
</tr>
<tr>
<td>• Observe for symmetry and smoothness of gait.</td>
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</tr>
<tr>
<td>• Does the patient limp?</td>
<td></td>
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<tr>
<td>• Observe for any reduced muscle bulk in the gluteals.</td>
<td></td>
</tr>
<tr>
<td>• Can the person turn quickly?</td>
<td></td>
</tr>
<tr>
<td><strong>Arms</strong></td>
<td></td>
</tr>
<tr>
<td><em>Shoulder movements</em></td>
<td></td>
</tr>
<tr>
<td>• Ask the patient to place their hands behind their head, with their elbows back.</td>
<td></td>
</tr>
<tr>
<td>This movement assesses abduction, external rotation of the shoulder and elbow flexion.</td>
<td></td>
</tr>
<tr>
<td><em>Palpate each shoulder for rotator cuff problems</em></td>
<td></td>
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<tr>
<td><em>Elbow movements and hands</em></td>
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<tr>
<td>• Ask the patient to extend their arms fully and turn their hands over so palms are down.</td>
<td></td>
</tr>
<tr>
<td>Following this ask the patient to turn their hands over.</td>
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<tr>
<td>• Observe the elbow and hands for any joint/tissue swelling or deformities.</td>
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<tr>
<td><em>Grip strength</em></td>
<td></td>
</tr>
<tr>
<td>• Ask the patient to make a fist. Observe the hand and finger movements.</td>
<td></td>
</tr>
<tr>
<td>• Ask the patient to grip your fingers and assess the degree of grip strength.</td>
<td></td>
</tr>
<tr>
<td>• Squeeze across the second to fifth metacarpal. Observe for pain.</td>
<td></td>
</tr>
</tbody>
</table>
### Legs
- Patient is lying down with upper torso covered.

#### Hip movement
- Hold the knee and hip flexed to 90 degrees. Assess the degree of internal rotation in each hip.

#### Knee
- Observe for any reduced muscle bulk especially in quadriceps.
- Assess: ask patient to flex and extend both knees.
- Palpate the knee for crepitus and warmth.

#### Patellar tap test
- Perform a patellar tap in each knee for the presence of an effusion.

#### Inspection of feet
- Inspect the feet for any swelling, deformity or any callosities.
- Look at patient’s shoes for unequal wear.

### Spine
- Inspect the spinal column for any abnormalities including kyphosis, scoliosis or lordosis.
- Observe for symmetry of legs and pelvis.

#### Cervical spine
- Ask the patient to bring their ear towards their shoulder—assesses lateral cervical flexion.

#### Thoracolumbar spine
- Hold the patient’s pelvis from behind and ask them to turn from side to side—assesses thoracolumbar rotation.
- Ask the patient to touch their toes. Palpate for the range of lumbar movement. Place two fingers over the lumbar vertebra. Your fingers should move apart as the patient bends forwards—assesses lumbar spine movement.

Record your findings to the GALS screening examination on this table.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip movement</td>
<td></td>
</tr>
<tr>
<td>Knee</td>
<td></td>
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<tr>
<td>Patellar tap</td>
<td></td>
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<tr>
<td>Inspection of</td>
<td></td>
</tr>
<tr>
<td>Spine</td>
<td></td>
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<tr>
<td>Cervical spine</td>
<td></td>
</tr>
<tr>
<td>Thoracolumbar</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gait</td>
<td></td>
</tr>
<tr>
<td>Arms</td>
<td></td>
</tr>
<tr>
<td>Legs</td>
<td></td>
</tr>
<tr>
<td>Spine</td>
<td></td>
</tr>
</tbody>
</table>
REGIONAL WRITE-UP WORKSHEET—MUSCULOSKELETAL SYSTEM

Summarise your findings using the SOAP format.

**Subjective** (Reason for seeking care, health history)

**Objective** (Physical exam findings)

**Assessment** (Assessment of health state or problem, diagnosis)

**Plan** (Diagnostic evaluation, follow-up care, patient teaching)