ASSISTING IN ORTHOPEDIC MEDICINE

SCENARIO

Kaiwan Tillman became interested in orthopedics before he even knew what the word meant. In the sixth grade, he broke his right femur in a bicycle accident. He spent 2 months in traction in the hospital on an orthopedic floor. On graduation from high school, he attended the local community college and enrolled in a medical assisting program that offered an associate’s degree. Since earning his CMA (AAMA), Kaiwan has worked in a sports medicine clinic. The clinic staff includes three orthopedic surgeons, two physical therapists, and two massage therapists. Kaiwan is very excited about working in the clinic, although he initially was somewhat intimidated. Dr. Steve Alexander is the team physician for a local professional baseball team, and Kaiwan’s responsibilities include assisting Dr. Alexander with treating the team.

While studying this chapter, think about the following questions:

- What are the primary responsibilities of the medical assistant in an orthopedic practice?
- What diagnostic and treatment procedures typically are used in an orthopedic practice?
- What clinical skills are required in this specialty practice?
- What are the common musculoskeletal injuries and disorders that the medical assistant should understand?

LEARNING OBJECTIVES

1. Define, spell, and pronounce the terms listed in the vocabulary.
2. Apply critical thinking skills in performing the patient assessment and patient care.
3. Describe the principal structures of the musculoskeletal system and their functions.
4. Differentiate among tendons, bursae, and ligaments.
5. Summarize the major muscular disorders.
6. Identify and describe the common types of fractures.
7. Explain the difference between osteomalacia and osteoporosis.
8. Classify typical spinal column disorders.
9. Differentiate among the various joint disorders.
10. Summarize the medical assistant’s role in assisting with orthopedic procedures.
11. Explain the common diagnostic procedures used in orthopedics.
12. Compare and contrast therapeutic modalities used in orthopedic medicine.
13. Apply cold therapy to an injury.
15. Properly apply therapeutic ultrasound.
16. Explain the use of common ambulatory devices.
17. Properly fit a patient with crutches and explain the correct mechanics of crutch walking.
18. Prepare for and assist with application of a cast.
19. Prepare for and assist with removal of a cast.
Vocabulary

arthritis Inflammation of a joint.
articulär (är-ti’-kyuh-luhr) Pertaining to a joint.
bursae (bur’s-suh) Fluid-filled, saclike membranes that provide cushioning and allow frictionless motion between two tissues.
cartilage A rubbery, smooth, somewhat elastic connective tissue that covers the ends of bones.
cervical (ser’-vi-kul) Pertaining to the neck region containing seven cervical vertebrae.
corticosteroids Antiinflammatory hormones, natural or synthetic.
crepitation (krep-i-tyu’-shun) A dry, cracking sound or sensation.
diaphysis (di’a-fuhs-suh) The midportion of a long bone; it contains the medullary cavity.
epiphysis (i-pi’-fuhs-suh) The end of a long bone; it contains the growth (epiphyseal) plates.
goniometer An instrument for measuring the degrees of motion in a joint.
inflammation A tissue reaction to trauma or disease that includes redness, heat, swelling, and pain.
kypototic (ki-pot’-tik) Relating to the normal convex curvature of the thoracic spine.
ligaments Tough connective tissue bands that hold joints together by attaching to the bones on either side of the joint.
lordotic (lor-do’-tik) Relating to the normal concave curvature of the cervical and lumbar spines.
lumbar The lower back region that contains the five lumbar vertebrae.
luxation Dislocation of a bone from its normal anatomic location.
malaise (muh-laze”) An indefinite feeling of debility or lack of health, often indicative of or accompanying the onset of an illness.
medullary cavity The inner portion of the diaphysis; it contains the bone marrow.
periosteum The thin, highly innervated, membranous covering of a bone.
prosthesis (praht-the’-suh) An artificial replacement for a body part.
range of motion (ROM) The extent of movement possible in a joint; the degree of motion depends on the type of joint and whether a disease process is present; ROM exercises are applied actively (independently) or passively (with assistance) to prevent or treat joint problems.
reduction The return to correct anatomic position, as in reduction of a fracture.
scoliosis An abnormal lateral curvature of the spine.
synovial fluid A clear fluid found in joint cavities that facilitates smooth movements and nourishes joint structures.
tendons Tough bands of connective tissue that connect muscle to bone.

A physician who specializes in orthopedics diagnoses and treats diseases and disorders of the musculoskeletal system and deals primarily with the bones. Rheumatologists are specialists in treating inflammatory joint disorders. Chiropractors are doctors of chiropractic (DC) but are not medical physicians; they use manual adjusting procedures to correct subluxations or misalignments of the spine to allow maximum nerve function, thus facilitating the body’s ability to maintain homeostasis and prevent disease.

The musculoskeletal system includes all of the skeletal muscles, bones, joints, and supportive connective tissues (cartilage, tendons, and ligaments). The general functions of the musculoskeletal system are:
- Protection of internal organs
- Support for standing erect
- Movement
- Hemopoietic function (production of blood cells in the red bone marrow)
- Storage of the minerals calcium and phosphorus in the bones

Anatomy and Physiology of the Musculoskeletal System

Muscles

More than 600 muscles attach to the human skeleton (Figure 43-1). These muscles account for approximately half of a person’s weight, and they contribute to the body’s distinct shape. This chapter discusses the skeletal muscles that attach to bones and allow movement. The body has two other types of muscle: cardiac muscle, in the heart, and smooth muscle, which lines organs and blood vessel walls. Both of these types are involuntary muscles; that is, the individual cannot control their function. Skeletal muscles are voluntary and can be controlled when they contract or relax. Special fibers in skeletal muscles allow them to shorten (contract) and lengthen (relax), which creates movement (Table 43-1). These muscles are connected to bone with bands of tough, fibrous connective tissues called tendons.

Bones

The human skeleton is composed of more than 200 bones (Figure 43-2). Bones provide a framework that protects vital organs. In general, the size and shape of a bone is related either to how much it moves and how much body weight it must carry, or to its protective function for the underlying organs.

Bones generally are categorized by shape: long, short, flat, rounded, or irregular. A long bone is made up of a diaphysis (shaft) with an expansion at each end called an epiphysis (Figure 43-3). The epiphysis is covered with articular cartilage and is attached by ligaments to the epiphysis of another bone, forming a joint. Articular cartilage reduces the stress of weight bearing and the friction of movement. The thickness of the cartilage depends largely on the amount of stress placed on a particular joint. The medullary cavity, located within the diaphysis, contains yellow bone marrow.
<table>
<thead>
<tr>
<th>MOVEMENT</th>
<th>DEFINITION OR EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>Reduces the angle of the joint and brings the two bones closer together.</td>
</tr>
<tr>
<td>Extension</td>
<td>The opposite of flexion; increases the angle or distance between two bones or parts of the body.</td>
</tr>
<tr>
<td>Hyperextension</td>
<td>Extension &gt;180 degrees; the joint is straightened and the toes are pointed downward.</td>
</tr>
<tr>
<td>Abduction</td>
<td>Moving the body part away from the midline or median plane of the body.</td>
</tr>
<tr>
<td>Adduction</td>
<td>The opposite of abduction; moving the body part toward the midline of the body.</td>
</tr>
<tr>
<td>Rotation</td>
<td>Moving a bone around its central axis; common in ball-and-socket joints.</td>
</tr>
<tr>
<td>Circumduction</td>
<td>Circular movement of a limb; a combination of abduction, adduction, extension, and flexion.</td>
</tr>
<tr>
<td>Dorsiflexion</td>
<td>Moving the instep of the foot up and dorsally, reducing the angle between the foot and the leg.</td>
</tr>
</tbody>
</table>
### TABLE 43-1 Types of Body Movement—cont’d

<table>
<thead>
<tr>
<th>MOVEMENT</th>
<th>DEFINITION OR EXAMPLE</th>
<th>MOVEMENT</th>
<th>DEFINITION OR EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plantar flexion</td>
<td>A toe-down movement of the foot at the ankle; increases the angle of the joint.</td>
<td>Inversion</td>
<td>The opposite of eversion; turning the sole of the foot medially, or inward.</td>
</tr>
<tr>
<td>Eversion</td>
<td>Turning the sole of the foot laterally, or outward.</td>
<td>Pronation</td>
<td>Rotation of the forearm that turns the palm of the hand backward, or posteriorly.</td>
</tr>
<tr>
<td>Supination</td>
<td>The opposite of pronation; rotation of the forearm that turns the palm of the hand forward, or anteriorly.</td>
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</tr>
</tbody>
</table>

Bone is living tissue that is constantly being remodeled in response to stress or injury. It also is a storage location for minerals, including calcium and phosphorus. Red bone marrow produces blood cells and is found in the spongy (cancellous) bone of the proximal epiphyses of the humerus and femur, sternum, ribs, and vertebrae of adults. Bones are covered with a thin, membranous tissue, the periosteum, which contains many sensory nerves.

### CRITICAL THINKING APPLICATION 43-1

In what way does Kaiwan benefit by being familiar with the names and locations of the major bones of the extremities? How might this knowledge make his job at Sports Medicine Associates more interesting?

### Joints

Bones are connected to each other at junctions known as joints. The two main kinds of joints are nonsynovial joints and synovial joints. In nonsynovial joints, the bones are joined with fibrous cartilage and are immovable (e.g., the sutures of the skull) or only slightly moveable (e.g., the vertebrae). Synovial joints are freely moveable, because the adjacent ends of two bones are covered with cartilage and are enclosed in a joint cavity that contains a viscous, slippery fluid called synovial fluid, which is an excellent lubricant. Synovial joints such as the elbow and the knee are hinge joints, which allow movement in only one plane (Figure 43-4). Other synovial joints, such as the hip and shoulder, allow movement in many planes, which permits a wider range of motion (ROM) than a hinge joint.

### Types of Joints

Joints are classified by the way they are shaped or by their ability to move. The joints of the skull are known as sutures. Sutures permit the skull to grow with the child but have very limited flexibility. As mentioned, the hinge joints of the elbow and knee allow for movement in one plane, such as bending back and forth. A gliding joint, as in the wrist and foot, is made up of two flat-surfaces bones that slide over each other, allowing limited movement. Ball-and-socket joints, as in the shoulder and hip, allow for the greatest ROM by permitting the joint to rotate in a complete circle. Artificial joints have been successfully implanted to replace joints that have been damaged by disease or trauma, including the joints of the hip, knee, ankle, shoulder, elbow, wrist, and finger.

### Ligaments, Tendons, and Bursae

Ligaments are powerful, strong, fibrous bands of connective tissue that connect bone to bone at the joint and encase the joint capsule. Ligaments allow purposeful joint movement and prevent excessive movement in any particular joint. Ligaments may be oblique or parallel to the joint, as in the knee, or may surround the joint, as in the hip.

A tendon is a strong bundle of connective tissue that attaches muscle to bone. Tendons can be flat or round and can pass...
between muscles, between bones, or through specialized openings between bones.

Bursae are fibrous sacs that lie between tendons and bones; they are lined with synovial membranes that secrete synovial fluid and act as cushions between a bone and a tendon or between a tendon and a ligament. Bursae reduce friction and help muscles and tendons glide smoothly over bone.

**Musculoskeletal Diseases and Disorders**

Musculoskeletal diseases and conditions can affect any of the muscles, bones, or joints. These problems are common and have a tremendous impact on an individual’s quality of life. Brittle or deformed bones that are prone to fracture often mark bone disorders such as osteoporosis and osteomalacia. Joint disorders, such as osteoarthritis (OA), rheumatoid arthritis (RA), and gout, can lead to painful, swollen, or inflamed joints. Muscle problems, such as sprains and spasms, can bring on sudden pain or cause stiffness (Table 43-2).

Trauma to the musculoskeletal system can quickly lead to inflammation in the area of injury. This type of injury is one of the leading causes of time lost from work and for visits to primary care physicians and emergency departments. As soon as possible after injury, even before a patient is seen by a physician, treatment involving rest, ice, compression, and elevation (RICE therapy) should be started. The combination of these measures can help reduce swelling and inflammation and enhance healing.

To maintain musculoskeletal health, a person must have a significant dietary intake of foods rich in calcium and vitamin D, avoid smoking, and include weight-bearing exercises (e.g., walking) in the daily routine. In addition to these lifestyle measures, medications sometimes are required for conditions that impair normal functioning of this system. The conditions discussed in the following sections are typically seen in an orthopedic practice.
Although the cause remains unknown, fibromyalgia can be triggered by an automobile accident or a bacterial or viral infection, or it can follow the diagnosis of other medical conditions, such as RA, lupus, or hypothyroidism. It is aggravated by changes in the weather or temperature, monthly hormonal variations, stress, anxiety, and depression. The diagnosis is made by eliminating any other cause for the symptoms and by finding 11 of 18 specific points to be extremely tender to palpation (Figure 43-5). Treatment goals include reducing pain, enhancing sleep, and reducing anxiety and stress. Pregabalin (Lyrica), an antiepileptic medication, is the first drug that has been approved by the U.S. Food and Drug Administration (FDA) to treat fibromyalgia. Prescription sleeping pills, such as zolpidem (Ambien), are prescribed only for the short term, because the body eventually becomes tolerant to the medication, rendering it ineffective. Fibromyalgia has no known cure.

Myasthenia Gravis

Myasthenia gravis is a chronic autoimmune neuromuscular disease of unknown origin that affects voluntary muscle contraction. It can occur at any age but most frequently affects young adult women (under age 40) and older men (over age 60). Often the patient experiences a sudden onset of weakness in the muscles that control eye and eyelid movement, facial expression, and swallowing. Symptoms vary in type and severity and may include drooping of one or both eyelids (ptosis); blurred or double vision (diplopia) as a result of weakness of the muscles that control eye movements; an unstable or waddling gait; weakness in the arms, hands, fingers, legs, and neck; altered facial expressions; difficulty swallowing; shortness of breath; and impaired speech (dysarthria).

Myasthenia gravis is caused by a defect in the transmission of nerve impulses to muscles. It occurs when a nervous stimulus is unable to stimulate a muscle at the neuromuscular junction, the place where nerve cells connect with the muscles they control. Normally, when impulses travel down the nerve, the nerve
<table>
<thead>
<tr>
<th>DISEASE</th>
<th>SYMPTOMS AND SIGNS</th>
<th>DIAGNOSTIC PROCEDURES</th>
<th>LABORATORY TESTS</th>
<th>TREATMENT AND MEDICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bursitis and tendonitis</td>
<td>Painful joint with reduced ROM</td>
<td>History, physical examination, x-ray studies to rule out fracture</td>
<td>CBC to rule out infectious arthritis</td>
<td>RICE, temporary immobilization, NSAIDs</td>
</tr>
<tr>
<td>Carpal tunnel syndrome</td>
<td>Hand and finger pain, numbness, tingling, difficulty grasping or holding objects, especially in the morning</td>
<td>History, physical examination, compression test</td>
<td>None</td>
<td>Rest, splint, forearm extensor strengthening exercises, surgical decompression in severe cases</td>
</tr>
<tr>
<td>Dislocation</td>
<td>Painful joint that is out of place and has severely reduced ROM</td>
<td>History of trauma, physical examination, x-ray studies</td>
<td>None</td>
<td>Reduce and temporarily immobilize joint</td>
</tr>
<tr>
<td>Fibromyalgia</td>
<td>Chronic, severe musculoskeletal pain, generalized weakness</td>
<td>History, physical examination to rule out other causes</td>
<td>As appropriate to rule out other conditions</td>
<td>NSAIDs, rest, reduce stress, muscle relaxants (Flexeril) and tricyclics (Elavil and Thorazine), SSRIs (Celexa, Paxil, Zoloft)</td>
</tr>
<tr>
<td>Fractures</td>
<td>Severe pain, swelling, reduced ROM</td>
<td>History, physical examination, x-ray studies</td>
<td>None</td>
<td>Reduction, immobilization, analgesics, NSAIDs</td>
</tr>
<tr>
<td>Gout</td>
<td>Painful joint inflammation, often affects great toe, very sensitive to touch and movement</td>
<td>History, physical examination, microscopic synovial fluid examination for uric acid crystals</td>
<td>Serum uric acid test</td>
<td>Analgesics, NSAIDs</td>
</tr>
<tr>
<td>Herniated disk</td>
<td>Depend on location and severity of herniation; back pain, extremity pain or weakness</td>
<td>History, physical examination, CT, MRI</td>
<td>None</td>
<td>Immobility, physical therapy, traction, muscle relaxants, surgical laminectomy in severe cases</td>
</tr>
<tr>
<td>Infectious arthritis</td>
<td>Severely inflamed joint</td>
<td>History, physical examination, microscopic synovial fluid examination for cell count and presence of bacteria</td>
<td>CBC, culture of joint fluid</td>
<td>NSAIDs, corticosteroids, appropriate antibiotic or antiviral agents</td>
</tr>
<tr>
<td>Lupus</td>
<td>Widely disparate presentations of symptoms with no known cause; very difficult to diagnose</td>
<td>Very careful history and physical examination to rule out possible causes of presenting symptoms; frequently a diagnosis of exclusion</td>
<td>Diagnostic tests as needed to rule out possible symptom causes</td>
<td>Symptomatic relief</td>
</tr>
<tr>
<td>Lyme disease</td>
<td>General malaise, fatigue, fever, headaches, myalgias, polyarthralgias</td>
<td>Careful history; physical examination to check for tick bite</td>
<td>CBC and perhaps other blood studies</td>
<td>Antibiotics and symptomatic relief</td>
</tr>
<tr>
<td>Myasthenia gravis</td>
<td>Profound muscular weakness, frequently starting with facial muscles; can involve any voluntary muscles</td>
<td>History, neurologic examination, EMG</td>
<td>Anti-AChR antibody test</td>
<td>Cholinesterase inhibitors, NSAIDs, steroids, immune inhibitors, thymectomy, plasmapheresis</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>Gradually increasing joint pain, gradually decreasing ROM in affected joint</td>
<td>History, physical examination, x-ray studies, possibly CT</td>
<td>RA latex test to rule out rheumatoid arthritis, CBC to rule out infectious arthritis</td>
<td>NSAIDs, physical therapy, analgesics, ambulatory support</td>
</tr>
</tbody>
</table>
### TABLE 43-2 Common Musculoskeletal Conditions—cont’d

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>SYMPTOMS AND SIGNS</th>
<th>DIAGNOSTIC PROCEDURES</th>
<th>LABORATORY TESTS</th>
<th>TREATMENT AND MEDICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteomalacia</td>
<td>Fractures, muscle weakness, bone pain</td>
<td>History, physical examination, x-ray studies, bone scan</td>
<td>Serum vitamin D, serum calcium, serum alkaline phosphatase, PTH level, occasionally bone biopsy</td>
<td>Vitamin D and calcium supplementation</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>Frequent fractures, exaggerated thoracic kyphosis, reduced height, back pain</td>
<td>History, physical examination, x-ray studies, bone density studies</td>
<td>DEXA scan, blood calcium level</td>
<td>Weight-bearing exercise, calcium supplementation, pharmaceutical treatment with alendronate (Fosamax), etidronate (Didronel), calcitonin-salmon (Miacalcin), or raloxifene (Evista).</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>Severe joint pain and joint deformity</td>
<td>History, physical examination, x-ray studies</td>
<td>RA latex test</td>
<td>NSAIDs, analgesics, joint replacement in severe cases</td>
</tr>
<tr>
<td>Scoliosis</td>
<td>Lateral spinal deformity accompanied by back pain</td>
<td>Physical examination, radiographic studies</td>
<td>None</td>
<td>Braces, casts, surgery</td>
</tr>
<tr>
<td>Sprain, strain, spasm</td>
<td>Cardinal signs: inflammation, redness, heat, swelling, pain, reduced ROM</td>
<td>History, physical examination, including active and passive ROM, x-ray studies to rule out fracture</td>
<td>None</td>
<td>RICE and NSAIDs</td>
</tr>
</tbody>
</table>

CBC, Complete blood count; CT, computed tomography; DEXA, dual energy x-ray absorptiometry; EKG, electromyography; MRI, magnetic resonance imaging; NSAIDs, nonsteroidal antiinflammatory drugs; PTH, parathyroid hormone; RA, rheumatoid arthritis; RICE, rest, ice, compression, elevation; ROM, range of motion; SSRIs, selective serotonin reuptake inhibitors.

Endings release acetylcholine (ACh), a neurotransmitter that activates muscular contraction. In myasthenia gravis, antibodies block, alter, or destroy the receptors for ACh at the neuromuscular junction, which prevents the muscle contraction. The primary treatment is a medication that inhibits acetylcholinesterase, the enzyme that normally breaks down ACh. This allows ACh to remain at the neuromuscular junction longer than usual so that more of the remaining receptor sites can be activated. Surgical removal of the thymus gland (thymectomy) reduces symptoms in most patients and may cure some individuals. Spontaneous improvement and remissions can occur.

### Sprains, Strains, and Spurs

A sprain is a wrenching or twisting of a joint in an abnormal plane of motion or beyond its normal ROM that results in stretching and/or tearing of a ligament. Concurrent damage to area blood vessels, muscles, tendons, and nerves may occur. Probably the most common sprain is the ankle sprain (Figure 43-6), which can occur when a person steps off a curb or into a small depression and twists the ankle. Severe sprains are so painful the joint cannot be used, and they are accompanied by swelling and reddish to bluish discoloration because of ruptured blood vessels in the area.

A strain may be a simple overstretching of a muscle or tendon, or it can be caused by a partial or complete tear of the tissue away from the bone.

These soft tissue injuries are diagnosed by a comprehensive history and physical examination. Usually x-ray films are taken to rule out fractures. Treatment includes RICE: rest of the injured joint with no weight bearing to prevent further damage; cold application for 20 minutes at a time, four to eight times a day, during the first 24 to 48 hours to reduce pain and swelling; compression with an elastic wrap or air cast to reduce swelling; and elevation of the injured part. The physician also may recommend the use of over-the-counter (OTC) antiinflammatory drugs such as aspirin or ibuprofen to help reduce pain and inflammation at the site. If severe soft tissue injury occurs, immobilization by casting, surgical repair, or both may be required.

Treatment of a sprain or strain may also include rehabilitative exercises. The physician typically prescribes an exercise program designed to prevent stiffness, improve the joint's ROM, and restore normal flexibility and strength. Some patients may also be referred to physical therapy for complete return of function after the initial pain and swelling have subsided.

### TELEPHONE SCREENING OF JOINT INJURIES

The following factors can help the medical assistant determine the need for an appointment when a patient calls to report a joint injury:

- Presence of severe pain and inability to put any weight on the injured joint
- Crooked appearance of injured area or unusual lumps and bumps
- Inability to move the injured joint
- Inability to walk more than four steps without significant pain
Figure 43-5: Tender points seen in fibromyalgia.

Figure 43-6: Ankle sprain. (From Frazier MS, Drzymkowski JW: Essentials of human diseases and conditions, ed 3, Philadelphia, 2004, Saunders.)

**Critical Thinking Application 43-3**

A patient comes into the clinic hopping on one foot and holding the other in the air. She says she thinks she broke her ankle when she stepped off the curb wrong and fell. What is the first thing Kaivan should do for this patient? What tests will Dr. Alexander most likely order? Why?

Muscle spasms occur spontaneously and may persist for hours. They typically are caused by heavy exercise and muscle fatigue, but they also can be caused by dehydration, hypothyroidism, lack of calcium or magnesium, kidney failure, and alcoholism. Muscle spasms can be quite painful. Treatment includes massage, direct pressure, ultrasound therapy, stress reduction, stretching exercises, and muscle relaxants in some cases.

**Restless Leg Syndrome**

A patient with restless leg syndrome (RLS) reports unpleasant sensations, such as tingling, aching, and twitching of the legs, during periods of inactivity, especially at night. The individual feels an overwhelming urge to move the affected leg (or legs) to relieve these abnormal feelings. Patients with nighttime leg twitching are diagnosed with periodic limb movements of sleep (PLMS), which causes involuntary flexion and extension of the legs during sleep. Most people with this disorder have difficulty getting to sleep or staying asleep.

Initial treatment plans include lifestyle changes, such as relaxation exercises, soaking in a warm bath, cutting back on caffeine, and moderate exercise. If these methods do not relieve the symptoms, patients may be prescribed medications, including anticonvulsants, muscle relaxants, and medications used to treat Parkinson's disease.

**Skeletal Disorders**

**Fractures**

A fracture is a break or crack in a bone that generally is the result of trauma or disease. Many different types of fractures occur, and each produces its own set of problems (Table 43-3). The common symptom of all fractures is pain. Other symptoms may include swelling, bleeding, inability to move, misalignment of the bone, and discoloration of the immediate area.

When a patient with a suspected fracture comes into the office, you should make the person as comfortable as possible. First aid includes RICE: positioning the patient to prevent stress on the injured area; elevating the injured extremity if possible; and controlling any bleeding but never applying pressure over a suspected fracture. Do not attempt to straighten the fracture or move it in any way. If the patient must be moved, either apply a splint or support the joints above and below the suspected fracture before and while moving the patient. The fracture must be confirmed by x-ray examination as soon as possible.
<table>
<thead>
<tr>
<th>Fracture</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed, or simple</td>
<td>Broken bone is contained within intact skin.</td>
</tr>
<tr>
<td>Open, or compound</td>
<td>Skin is broken above the fracture, which therefore is open to the external environment, creating the potential for infection.</td>
</tr>
<tr>
<td>Longitudinal</td>
<td>Fracture extends along the length of the bone.</td>
</tr>
<tr>
<td>Transverse</td>
<td>Break is caused by direct force applied perpendicular to a bone; fracture runs across the bone.</td>
</tr>
<tr>
<td>Oblique</td>
<td>Break is caused by a twisting force with an upward thrust; fracture ends are short and run at an oblique angle across the bone.</td>
</tr>
<tr>
<td>Green stick</td>
<td>Break is caused by compression or angulation forces in the long bones of children under age 10; because of its softness, the zone is cracked on one side and intact on the other side.</td>
</tr>
<tr>
<td>Comminuted</td>
<td>Break is caused by severe, direct force, which creates a fracture with multiple fragments.</td>
</tr>
<tr>
<td>Impacted</td>
<td>Break is caused by strong forces that drive bone fragments firmly together.</td>
</tr>
<tr>
<td>Pathologic</td>
<td>Break results from weakening of the bones by disease, as in osteoporosis or sarcomas.</td>
</tr>
<tr>
<td>Nondisplaced</td>
<td>Bone ends remain in alignment.</td>
</tr>
<tr>
<td>Displaced</td>
<td>Bone ends are moved out of alignment.</td>
</tr>
<tr>
<td>Spiral</td>
<td>Break is caused by a twisting or rotary force, which results in long, sharp, pointed bone ends; suspicious as a child abuse injury.</td>
</tr>
</tbody>
</table>
Treatment includes reduction, if necessary, and immobilization. Reduction places the fractured bone back into its correct anatomic alignment. Reduction may be closed or open. In a closed reduction, the physician manipulates the bone into its correct position. If this is not possible or if the fractured bones have pierced the skin, an open reduction is required, which is surgical realignment of the bone. During an open reduction, the orthopedic surgeon may have to install metal pins, plates, or screws to facilitate and maintain correct bone alignment. These metal implants may be temporary or permanent, depending on the extent of injury (Figure 43-7). After the fracture has been reduced, it must be immobilized by splinting, casting, taping, or wrapping the area to prevent movement of the fracture site and thereby facilitate healing.

Osteomalacia
The term *osteomalacia* literally means “softening of the bones.” Osteomalacia is a metabolic disease in which inadequate calcium or phosphorus (or both) is available for building new bone during growth or remodeling. It is caused by either a lack of Vitamin D or problems with its metabolism. The skeleton gradually loses calcium, and the bones soften and become more flexible. Weight bearing gradually changes the shape of the softened bones. Symptoms can include reduced endurance, easy fatigability, malaise, and generalized bone tenderness and pain. Osteomalacia in children is called rickets.

Osteomalacia may be caused by a fat absorption problem in the gastrointestinal tract that prevents adequate absorption of dietary fats, resulting in steatorrhea and vitamin D deficiency. Vitamin D promotes the body’s absorption of calcium, which is essential for normal development and maintenance of healthy teeth and bones. Vitamin D can be produced by the body with adequate sun exposure, and nearly all milk sold in the United States is fortified with vitamin D. Osteomalacia can occur in individuals who use very strong sunscreen, have limited exposure to sunlight, experience short days of sunlight, live in a smoggy environment, or do not drink milk because of lactose intolerance. The condition is treated with vitamin D, calcium, and phosphorus supplements.

Osteoporosis
Osteoporosis is a disease in which calcium deposits in the bone gradually decline, and bones become increasingly weak and brittle so that even small stressors, such as bending over or coughing, can cause fractures. Bone strength depends on the size and density of the bone structure and the amount of calcium, phosphorus, and other materials deposited and maintained in the bone. Bones are constantly changing through a process called remodeling, or bone turnover. This process allows bones to grow and heal. As we age, remodeling breaks down bone more quickly than it forms new bone. Peak bone mass is reached by the middle 30s, so a person’s risk of developing osteoporosis depends on the bone mass collected by age 25 to 35 and how rapidly bone tissue is lost after that. Lack of vitamin D and calcium in the diet results in a lower peak bone mass and a more rapid onset of bone loss later. People over age 50 are particularly at risk, and women are four times more likely to develop osteoporosis than men. Osteo-
Osteoporosis is a major public health threat in the United States, affecting more than 40 million individuals.

Osteoporosis often is called the “silent disease,” because the progressive loss of bone density occurs without any symptoms. Osteopenia is mild bone loss that is not severe enough to be called osteoporosis but that increases the risk of osteoporosis. By the time fractures occur, the disease is quite advanced. Patients with osteoporosis complain of back pain because of a fractured or collapsed vertebra; loss of height over time, with stooped posture (kyphosis, or “dowager’s hump”); and fractures typically of the vertebrae, wrists, and hips. Risk factors include being a postmenopausal woman over age 50; a slight build with a family history of osteoporosis; a history of amenorrhea; a low dietary calcium intake; an excessive intake of caffeine; soda; an inactive lifestyle; smoking; alcohol abuse; hyperthyroidism; a reduced lifetime exposure to estrogen; and long-term treatment with certain medications, including antiseizure drugs, corticosteroids, and heparin. Men over age 50 with low testosterone levels also are at risk. Osteoporosis occurs in all races but is slightly more common in Caucasian and Asian individuals.

The diagnosis is made by a specialized form of x-ray evaluation that specifically measures bone density. This study allows the diagnosis of osteoporosis before a fracture occurs and thus intervention to prevent fractures. Readings are repeated annually to determine the rate of bone loss and to monitor the effectiveness of treatment. Intervention and treatment include increasing dietary intake of calcium and vitamin D; increasing weight-bearing exercise; and pharmaceutical treatment with bisphosphonates (alendronate [Fosamax], etidronate [Didronel], and risedronate [Actonel]), raloxifene (Evista), and calcitonin-salmon (Miacalcin). The best screening test is a dual energy x-ray absorptiometry (DEXA) scan, which measures the bone density of the spine, hip, and wrist. Other tests that can accurately measure bone density include ultrasound and quantitative computed tomography (QCT) scanning.

The National Osteoporosis Foundation recommends that all women have a bone density test if they are not receiving estrogen replacement therapy and are in any of the following categories:

- Undergoing long-term treatment with medications that can cause osteoporosis, such as prednisone
- Have diabetes type 1, liver disease, kidney disease, or a family history of osteoporosis
- Experienced early menopause (in the early 40s)
- Are postmenopausal, over age 50, and have at least one risk factor for osteoporosis
- Are postmenopausal, over age 65, and have never had a bone density test

**Spinal Column Disorders**

**Abnormal Spinal Curvatures**

When the medical assistant looks at a patient’s back, the spine should be vertically straight. Any abnormal deviation or curvature to the right or left is called **scoliosis**. Mild scoliosis generally causes no problems and is usually not even noticeable. When scoliosis is severe, it can cause significant back pain and possibly heart or lung problems because of the diminished space in the thoracic cavity on one side.

**Herniated Disk**

A herniated disk occurs when the soft nucleus of an intervertebral disk protrudes through a tear or weakened area in its tough outer cartilaginous covering (Figure 43-10). This condition occurs most often in the lumbar region, frequently in the cervical region, and rarely in the thoracic region of the spine. In children and young adults, disks have a high water content. As people age, this water content declines, and the structures begin to shrink and become less flexible. This causes the spaces between the vertebrae to narrow. Factors that can weaken intervertebral disks include improper lifting; smoking; excessive body weight that places
added stress on the disks of the lower back; sudden, possible slight pressure; and repetitive strenuous activities. Herniation may also occur gradually over time as a result of a progressive deterioration of the disks.

Symptoms depend on the location and extent of the protrusion of the nucleus beyond its normal location. If the herniation occurs in the lumbar region, it usually causes severe low back pain that can radiate down the leg and cause difficulty walking. If the herniated disk is in the cervical region, the person usually has a burning pain in the neck that can radiate down the arms to the fingers.

The diagnosis is made from a careful history, physical examination, either magnetic resonance imaging (MRI) or CT scans to confirm which disk is injured, or electromyography (EMG), which measures the nervous stimulation of affected muscles. Treatment depends on the severity of the herniation and the symptoms. Conservative treatments include chiropractic adjustment, physical therapy mobilization, and applications of cold until muscle spasms stop, then the use of heat. Traction of the affected area, especially of the neck, may help relieve pressure on affected nerves. Muscle relaxants, such as carisoprodol (Soma) and cyclobenzaprine (Flexeril), and/or analgesics may be given. If these measures are ineffective and the patient has recurring pain, numbness, and progressive weakness, surgery may be necessary.

**Joint Disorders**

**Dislocation**

Dislocation of a joint is also called a luxation, a condition in which two bones of a joint are no longer in approximation (Figure 43-11). A subluxation is an incomplete dislocation of a joint, meaning that the bones are only slightly out of proper alignment and location. It is possible to have a congenital dislocation, especially of the hip. Common dislocations occur in the
Gout, which may also be called gouty arthritis, is a metabolic disease involving overproduction or improper elimination of uric acid. Uric acid is a waste product formed from the breakdown of purines, which are found naturally in the body as well as in certain foods, including organ meats (liver, brains, and kidney), anchovies, herring, asparagus, mushrooms, cold cuts, sausage, and alcohol. Uric acid should dissolve in the blood so that it can be excreted as it passes through the kidneys. However, with gout, uric acid is not effectively excreted, and needlelike crystals of uric acid collect in the synovial fluid of the affected joint, causing extreme sensitivity to touch, pronounced inflammation, and severe pain. The most frequently affected area is the great toe (Figure 43-12). Risk factors include consumption of alcohol, obesity, untreated hypertension, diabetes, hypercholesterolemia, and a family history of the disease. Men are more likely to experience gout than women, but women become increasingly susceptible to gout after menopause.

In general, keeping uric acid levels within a normal range is the key to preventing future episodes of gout. Therefore, long-range treatment includes dietary modifications to eliminate foods containing purine. For treatment of an acute onset of inflammation, the patient may take nonsteroidal antiinflammatory drugs (NSAIDs), such as ibuprofen and naproxen (Aleve) for pain and joint inflammation. In severe cases the physician may prescribe prednisone. Pharmaceutical treatment to reduce the risk or lessen the severity of future episodes includes allopurinol (Zyloprim, Aloprim) and probenecid (Benemid). Taken daily, these drugs slow the rate of uric acid production and enhance its elimination from the body.

Lupus

The three main types of lupus are systemic lupus erythematosus (SLE), discoid lupus erythematosus, and drug-induced lupus. Of these, SLE is the most common and serious form of the disease. SLE is an autoimmune disease of unknown cause. It occurs primarily in women 20 to 50 years of age, although it can occur in both younger and older individuals. Other risk factors include recurrent infections from the Epstein-Barr virus, a family history of the disease, and being an African-American.

SLE is difficult to diagnose and entirely unpredictable. The patient develops autoantibodies (antibodies to self) that can attack any tissue or organ in the body, which may result in severe inflammation with tissue changes and destruction. The progression and severity of the disease varies widely among patients. Furthermore, problems associated with SLE change over time and overlap with those of many other disorders. For these reasons, doctors may not initially consider lupus until the signs and symptoms become more obvious. At times the disease may become severe, and at other times it may subside completely. There is no known cure; the therapeutic goal is to maintain patient function as much as possible. The type of pharmaceutical treatment prescribed depends on which parts of the body are affected by the disease and the severity of the symptoms. Some medications used to treat SLE include NSAIDs, such as naproxen sodium and ibuprofen, to reduce joint pain and inflammation; antimalarials, such as hydroxychloroquine (Plaquenil), to treat skin and joint problems and the ulcers that some people develop in the mouth or nose; corticosteroids (prednisone) during acute inflammatory processes; and immunosuppressive medications, such as azathioprine (Imuran) and cyclophosphamide (Cytoxan) to suppress the immune system. The kidneys may fail even with treatment, which may necessitate either kidney dialysis or a kidney transplant.

**DIAGNOSIS OF LUPUS**

According to the American Rheumatism Association, the diagnosis and classification of lupus requires four of the following 10 clinical and laboratory criteria:

- Malar rash (a butterfly-shaped rash that covers the bridge of the nose and spreads across the cheeks)
Infectious Arthritis

Infectious arthritis usually occurs after some type of systemic or local infection in some other part of the body, or after a joint has been violated by trauma or surgery. The infection can be caused by bacteria, fungi, or viruses. The joint usually shows signs of severe inflammation and significantly reduced ROM. To determine the diagnosis, the physician may order an x-ray evaluation and bone scan and may withdraw synovial fluid for microscopic examination and culture. The goals of treatment are to reduce inflammation, increase ROM, and treat the causative organism with the appropriate medication.

Lyme Disease

Lyme disease is an infection caused by the bacteria *Borrelia burgdorferi*. It is transmitted to humans by a bite from ticks of the *Ixodes* family. The disease is named after Lyme, Connecticut, where it was first identified in 1975 in a cluster of children who showed signs of what was thought to be rheumatoid arthritis. Eventually, epidemiologists traced the cause of the problem to a bacterial infection. Signs and symptoms may include a “bull’s-eye” lesion, called *erythema migrans*, surrounding the area of the tick bite which appears within a few days, even up to a month, after exposure. The rash can last several days to several weeks and occurs in as many as 80% of people infected with Lyme disease. Additional indicators of the disease include flu-like symptoms, such as fever, chills, fatigue, body aches, and headache. If the infection remains untreated, the patient complains of pain in multiple joints. Late-stage symptoms of Lyme disease include meningitis, Bell’s palsy, numbness or weakness of the limbs, memory loss, difficulty concentrating, and changes in mood or sleep habits.

The diagnosis is made by taking a careful history, including the patient’s level of outdoor exposure, locating the tick bite, and ruling out other causes for presenting symptoms. Laboratory tests to identify antibodies to the bacterium are used to help confirm the diagnosis. These tests are most reliable a few weeks after an infection, because it takes some time for antibodies to develop. The blood test most often used to screen for Lyme disease is the enzyme-linked immunosorbent assay (ELISA), which detects antibodies to *B. burgdorferi*. If the ELISA test result is positive, the Western Blot test is performed to confirm the diagnosis. Antibiotics, such as doxycycline (Doryx, Monodox) or amoxicillin (Amoxil, Trimox), are the standard treatment for Lyme disease in its early stages. If the disease has progressed to a later stage, the patient may be hospitalized for treatment with intravenous (IV) ceftriaxone (Rocephin).

**PATIENT EDUCATION FOR PREVENTING LYME DISEASE**

- Wear pants tucked into socks and long-sleeved shirts when walking in wooded or grassy areas.
- Use insect repellents that contain DEET.
- Tick-proof your yard by clearing brush and leaves where ticks live.
- Check yourself, your children, and your pets for ticks; deer ticks are no bigger than the head of a pin or a grain of pepper; shower immediately after returning from wooded areas, because ticks can remain on the skin for hours before attaching themselves.
- Do not assume you are immune; Lyme disease can occur in the same person more than once.
- Remove a tick with tweezers by gently grasping it near the head or mouth; do not squeeze or crush the tick, but pull it out carefully and steadily. After removal, apply antiseptic to the bite area.

**Osteoarthritis**

OA, also called degenerative joint disease (DJD), is marked by significant thinning and degeneration of the articular cartilage of synovial joints. The symptoms range from mild to severe, depending on the amount of degeneration. As the articular cartilage disintegrates and wears away, the roughened surface of the bone is exposed, leaving bone rubbing against bone, with resultant pain and stiffness of the involved joint. Commonly involved joints include the fingers, the spine, and the weight-bearing joints of the hips, knees, and feet. Diagnosis frequently includes x-ray films, which show degenerative changes in the joint surfaces and asymmetric joint space narrowing.

Treatment goals include relieving pain, maintaining normal motion in the joint, and attempting to prevent crippling deformities. Medications may include analgesics, NSAIDS, and intra-articular steroid injections. Using a walker or cane may be helpful for maintaining mobility. Severe cases require surgery to remove the affected joint and replace it with a joint prosthesis.

**Rheumatoid Arthritis**

RA is an autoimmune inflammatory condition that involves an immune system response to the synovial membranes, causing synovitis. Proteins are released at the site of the joint inflammation, eventually resulting in thickening of the synovium and damage to the cartilage, bone, tendons, and ligaments of the affected joint. Gradually the joint loses its shape and alignment, causing deformity and pain. Researchers suspect RA is triggered by an infection in people with an inherited susceptibility to the disease.

Early symptoms include malaise, fever, weight loss, and morning stiffness of the affected joints. One or more joints may become painful and inflamed. Usually, bouts of arthritis increase in frequency and severity over time. As this occurs, the joints
become damaged, and joint swelling and deformity occur. The patient ultimately loses the ability to move the affected joints, and a pronounced loss of strength occurs in the muscles attached to the inflamed joints. Small lumps, called rheumatoid nodules, may form at pressure points in the elbows, hands, feet, Achilles tendons, knees, and posterior scalp, and even in the lungs. Patients with RA may appear undernourished and chronically ill because of the formation of degenerative lesions in the collagen (connective tissues) in the lungs, heart, blood vessels, and pleura (Figure 43-13). Periods of increased disease activity, called flare-ups, alternate with periods of relative remission, during which the swelling, pain, difficulty sleeping, and weakness fade or disappear. X-ray findings show uniform joint space narrowing, which is different from the degenerative changes seen in OA.

Rest and exercise seem to be the key elements in treating RA. Therapeutic exercises are designed to prevent and correct deformities, control pain, strengthen weakened muscles, and improve joint function. The most frequently prescribed medications are NSAIDs, including aspirin (acetylsalicylic acid), indomethacin (Indocin), diclofenac (Voltaren), naproxen (Naprosyn), and ibuprofen (Motrin). Corticosteroids (prednisone and Medrol) may be prescribed for severe flare-ups. To limit the extent of joint damage early in the disease, the physician prescribes disease-modifying antirheumatic drugs (DMARDs), such as hydroxychloroquine (Plaquinil), the gold compound auranofin (Ridaura), and infliximab (Remicade). In severe cases, surgical joint replacement may be necessary.

**CRITICAL THINKING APPLICATION 43-5**

An 80-year-old male patient with arthritis comes into the office complaining of severe pain in his knees, hips, and lower back. The pain makes it impossible for him to get up onto the examination table. What should Katrina do? Is this patient required to get onto the examination table? Why or why not?

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**Tendonitis and Bursitis**

Tendonitis is one of the most common causes of pain in the shoulder and elbow. Inflammation of tendons may be associated with calcium deposits in the bursae around the joint, causing concurrent bursitis. The diagnosis is made if the patient has increased severity of pain when abducting the arm beyond 50 degrees. Treatment includes pain relief and reducing the localized inflammation to make exercise possible and to prevent shoulder immobility, called frozen shoulder. Medications might include analgesics, NSAIDs, and injections of long-acting corticosteroids. Cold applications are helpful in relieving pain; heat applications are contraindicated because they tend to aggravate calcium tendonitis.

Bursitis is a painful inflammation of a joint bursa that most commonly follows a repetitive movement or prolonged pressure on a joint. The pain is increased with movement of the affected joint. It also can occur from staphylococcal or tubercular infections and with some joint diseases, including gout and arthritis. Treatment includes preventing the activity that caused the bursitis and protecting the affected site from excessive pressure and movement. NSAIDs may provide pain relief, but corticosteroid antiinflammatory agents may be needed in severe cases.

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**THE MEDICAL ASSISTANT’S ROLE IN ASSISTING WITH ORTHOPEDIC PROCEDURES**

The role of the medical assistant begins with accurately recording the patient's description of the circumstances surrounding the onset of the problem, what measures were undertaken to alleviate the problem, and the patient's current concerns. Record the exact location of pain or discomfort and ask the patient to quantify the intensity of the pain on a scale of 1 to 10; also ask about medications taken, including the names of drugs, the dose and frequency, and the date and time of the last dose.

Offer assistance when escorting the patient to the examination room. Use a wheelchair if necessary. Assist the patient into a comfortable position in the examination room by offering a pillow or folded blanket to support the painful or injured body part. The patient may have limited mobility because of pain, so you may need to provide assistance with disrobing and getting into an examination gown. Make sure the patient is warm enough by offering an additional sheet or blanket. Explain clearly what is happening and what the patient can expect. Notify the physician as soon as the patient is ready for the examination.
Assisting with the Examination

The physician may use inspection, palpation, ROM testing, and muscle testing to examine the major skeletal muscles and joints. Much of the examination involves comparing muscles and joints on the affected side with those on the contralateral side for size, position, and strength. When the patient needs to assume a certain position, demonstrating the position or movement desired may be helpful. Watch the patient during the manipulative and palpatory portion of the examination for a facial grimace or physical jerk or jump, which may indicate pain.

As a general rule, the unaffected side is examined first, then the affected side, and the two are compared. You may be responsible for taking notes during the examination. Keep the patient properly draped and assist the physician by handing the equipment as needed. Most examinations require the use of a measuring tape, goniometer, blood pressure cuff, stethoscope, and felt-tipped washable marker. Be alert and ready to prevent the patient from falling during the examination, because some of the requested movements and positions may place the injured patient off balance.

The physician performs a gait analysis by watching the patient walk in a straight line with or without the patient knowing he or she is being observed. In addition to being associated with disorders of the musculoskeletal system, gait abnormalities may be caused by an associated neurologic condition.

SPECIALIZED DIAGNOSTIC PROCEDURES IN ORTHOPEDICS

Range-of-Motion Evaluation

Often orthopedic injuries severely affect the normal ROM of a joint. Measuring the ROM of specific joints is an objective measure of both the seriousness of an injury and the recovery progress. When the ROM of a particular joint is evaluated, usually both active and passive ROM results are measured and recorded.

The joint movement in a single plane is measured with a goniometer. A goniometer has two arms that are fixed together with a hinge joint at one end (Figure 43-14). Each of the arms is lined up with a bone on each side of the joint being tested. The degrees of motion are indicated on a scale on the hinged center of the instrument. To determine the active ROM of a joint, the patient is asked to move the joint as far as possible. For evaluation of passive ROM, the patient is asked to relax and the physician moves the joint as far as possible. All ROMs are measured in degrees. During these examinations, you may be asked to record the degrees of motion for active and/or passive ROM for specific joints and to note any pain, tenderness, or crepitus during the examination.

CRITICAL THINKING APPLICATION 43-6

How can Kaiwan best assist Dr. Alexander in testing upper extremity ROM in a new patient? What equipment should Kaiwan have ready? What patient position would best facilitate this examination? Why?

Muscle Strength Evaluation

During the ROM evaluation, the physician also assesses each muscle group for strength. Normal muscle strength allows for complete voluntary ROM despite resistance. This resistance can be gravity, as when rising from sitting to a standing position, or physical, as in pulling, pushing, or lifting an object. Muscle strength is bilaterally equal in normal conditions. The evaluation compares like muscles in each hemisphere of the body, such as using a blood pressure cuff to compare the grip of the right hand with the grip of the left hand (Figure 43-15).

ASSESSMENT OF GRIP STRENGTH USING A BLOOD PRESSURE CUFF

1. Roll up an aneroid blood pressure cuff and have the patient hold it in one hand.
2. Inflate the cuff to 20 mm Hg of pressure.
3. Ask the patient to squeeze the cuff as tightly as possible.
4. Note the increase in pressure on the dial (a normal grip registers above 150 mm Hg).
5. Record the hand tested and the results of the test.
6. Repeat on the other hand.

Radiology

Radiology and diagnostic imaging frequently are used to help diagnose orthopedic conditions (Figure 43-16). X-ray evaluation is necessary to diagnose fractures, dislocations, and bone and joint diseases accurately. X-ray films also can be used to track the
healing of a fracture to determine when it has healed sufficiently to allow removal of a cast.

**Critical Thinking Application 43-7**

A patient who has just undergone x-ray studies stops Kaiwan and wants to see his x-ray films. How should Kaiwan handle this situation? If a patient is in an examination room with her own x-ray film on the view box and she asks Kaiwan to show her where the break is, how should he respond to this request?

When one of these diagnostic tests is necessary, you should explain the procedure to the patient. Your explanation should include what will be done, how it is done, where it will take place, and approximately how long it will take. Patients always are concerned about whether the procedure will hurt. Tell the truth. If the procedure is painful, let the patient know so that he or she can prepare for it. Most painful procedures are performed only after the patient has been given a mild sedative. Discuss the procedure in a professional yet empathetic manner. If the patient wants to talk with the physician about the test, make sure this happens.

**Specialized Imaging Techniques Used in Orthopedics**

- Arthograms—to visualize the joints.
- Bone scans—to evaluate areas of bone growth, bone density, and bone tumors, as well as other bone disease patterns.
- Computed tomography (CT) scans—to visualize soft tissue such as tumors, lesions, or some spinal injuries.
- Electromyography and nerve conduction velocity studies—to evaluate muscle response to stimulus.
- Biopsies of bone and muscle—to identify cancerous tumors and other neoplasms and pathogens.

**Therapeutic Modalities**

Physical treatment methods called modalities often are used in orthopedic, chiropractic, and physical therapy offices to treat orthopedic conditions. These can include the application of cold, heat, baths, electric currents, therapeutic ultrasonography, massage, and therapeutic exercises. Cold applications are recommended for the first 48 hours after an injury to help control pain and swelling. Heat application is used after this to help improve circulation, reduce pain, and maintain muscle and joint function (Table 43-4). Diathermy is a technique for creating deep tissue heat through the use of a high-frequency current, ultrasonic waves, or microwave radiation. As is surface heating, deep heat is used to reduce pain, relieve muscle spasms, resolve inflammation, and promote healing. Deep heat may be used to treat chronic arthritis, bursitis, fractures, and other musculoskeletal problems.

**General Principles of Cold Application**

Cold applications, such as ice packs and cold compresses, act as vasoconstrictors and also cause contraction of the involuntary muscles of the skin (“goose bumps”). These two actions reduce the blood supply to the area and exert a numbing effect on the sensory nerve endings. Cold applications can help control bleeding, prevent further swelling and inflammation, and reduce pain. Disposable, reusable, or homemade ice packs most commonly are used for cold application (Procedure 43-1).

**Heat Modalities**

Heat produces local vasodilation, which increases circulation. This accelerates the inflammatory process, promotes local drainage, reduces swelling, relaxes muscles, and repairs tissues and cells. The effects of external heat application depend on the type of heat used, the length of time it is applied, the frequency with which it is applied, the patient's general condition, and the size of the area treated. Heat application is an excellent therapeutic modality, but it must be used with caution to prevent overheating and burning of surface tissues. Special care must be taken in patients who have reduced sensation, because they may not sense a burn occurring. Therefore, heat application is contraindicated in the following circumstances:

- With acute inflammatory conditions, particularly during the first 48 hours
- In individuals with severe circulatory problems of any kind
- In those with diminished or abnormal sensation
- Over areas with encapsulated pus
- On blisters from previous burns
- Over scar tissue, because it does not have a normal blood supply and easily overheats
- In body areas with cancerous tumors
- Over inflamed skin, because the initial erythema caused by a burn cannot be detected
- Over any metal jewelry or any area with metal implants

Body parts may safely be heated to 110° F (44° C) without any tissue damage. Redness appears because the skin capillaries become congested at the skin’s surface. Heat modalities may be either wet or dry and can produce either superficial or deep effects. Dry heat therapies include heating pads, infrared radiation lamps, ultraviolet radiation, and hot water bottles. More penetrating methods of dry heat application include diathermy and ultrasound. Moist heat modalities include soaks, whirlpool treatments, hot moist compresses (Figure 43-17), and paraffin baths.

**Paraffin Bath**
A paraffin bath is especially useful for treating chronic joint inflammation. A mixture of seven parts paraffin and one part mineral oil is melted and heated to approximately 125° F (52° C). The body part (usually a hand, an elbow, or a foot) is dipped into the warm paraffin mixture and removed immediately, leaving a thin coating on the skin. This dipping is repeated numerous times until a thick coating of paraffin remains on the body part (Figure 43-18). The part is then wrapped with plastic and a towel to allow the heat to penetrate the tissues. The paraffin is kept on for 30 minutes and then is peeled off. The process leaves the skin soft, warm, moisturized, and pliable, with slight erythema.

### TABLE 43-4 Effects of Heat and Cold Application

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>CAUSES</th>
<th>TISSUE RESPONSE</th>
<th>THERAPEUTIC EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>Vasodilation</td>
<td>Increased blood flow</td>
<td>Increased nutrients to site</td>
</tr>
<tr>
<td></td>
<td>Muscle relaxation</td>
<td>More white blood cells to area</td>
<td>Faster removal of wastes</td>
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<tr>
<td></td>
<td>Increased metabolism</td>
<td>Reduced muscle spasm</td>
<td>Phagocytosis</td>
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<tr>
<td></td>
<td>Local warmth</td>
<td>Decreased pain</td>
<td>Faster tissue repair</td>
</tr>
<tr>
<td>Cold</td>
<td>Vasoconstriction</td>
<td>Reduced blood flow</td>
<td>Inhibition of swelling</td>
</tr>
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<td></td>
<td>Numbness of nerve endings</td>
<td>Local anesthesia</td>
<td>Reduced inflammation</td>
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<tr>
<td></td>
<td>Reduced metabolism</td>
<td>Reduced oxygen need</td>
<td>Reduced pain</td>
</tr>
<tr>
<td></td>
<td>Increased blood viscosity</td>
<td>Faster blood clotting</td>
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</tbody>
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### PROCEDURE 43-1

**Assist the Physician with Patient Care: Assist with Cold Application**

**GOAL:** To apply a cold compress to a body area to reduce pain, prevent further swelling, and/or reduce inflammation.

**EQUIPMENT and SUPPLIES**
- Small ice cubes or ice chips
- Ice bag or closeable disposable plastic kitchen food bag
- Towel
- Patient’s record

**PROCEDURAL STEPS**

1. Sanitize your hands.
2. Explain the procedure to the patient and answer any questions.
3. Check the bag for leaks.
4. Fill the bag with small cubes or chips of ice until it is about two thirds full.
   **PURPOSE:** Small chips conform more easily to the shape of the body.
5. Push down on the top of the bag to expel excess air and put on the cap or seal the plastic bag.
   **PURPOSE:** To remove as much air as possible from the bag, because air is a poor conductor of cold.
6. Dry the outside of the bag and cover it with one or two towel layers.
7. Help the patient position the ice bag on the injured area.
8. Advise the patient to leave the ice bag in place for about 20 to 30 minutes or until the area feels numb, whichever comes first.
   **PURPOSE:** Leaving the ice in place for longer than 20 to 30 minutes may cause tissue damage.
9. Check the skin for color, feeling, and pain.
   **PURPOSE:** If the treated area becomes very painful, remains numb, or is pale or cyanotic, the ice bag should be removed and the physician notified.
10. Record the procedure in the patient’s chart.
    **PURPOSE:** A procedure is not considered done until it is recorded.

8/27/00 1:45 PM Ice pack applied to left knee for 20 min. No c/o discomfort. Pt instructed to continue ice application at home for 3 hr while awake for 24 hr at 20-min intervals. Call physician if edema persists or pain increases. K. Tillmon, CMA (AAMA)
CRITICAL THINKING APPLICATION 43-B

Kaiwan is helping a 56-year-old patient with RA who is receiving a paraffin bath treatment for both hands. He did not check the temperature before having the patient put her hands in the bath, and when she puts her hands in, she immediately pulls them out and complains that it is too hot. How should Kaiwan handle this situation? What should he say to the patient? What steps should he take to prevent this from occurring with another patient?

Hot Water Bottle

Hot water bottles often are used at home without any concern for correct technique. Patients should be cautioned to keep the water temperature below 125° F (52° C). The hot water bottle usually can be left in place until it becomes cold. If the patient is a child, the temperature should be kept below 115° F (46° C) to prevent burns. Generally a hot water bottle should not be applied to a child for longer than 15 minutes without a physician’s instruction. A hot water bottle that is less than half full conforms better to the body surface and is more comfortable (Procedure 43-2).

SAFETY ALERT

To prevent burns, electric heating pads should be left in place no longer than 30 minutes.

PATIENT INSTRUCTIONS FOR APPLYING A HOT COMPRESS AT HOME

1. Moisten a clean hand towel with warm water; it should be warm, not hot.
2. Wring it out and fold it to the appropriate size.
3. Place the folded warm moist compress directly on the skin.
4. Cover the towel with plastic to keep in the moist heat.
5. Cover the plastic with a dry towel to help maintain the heat.
6. Apply for as long and as often as the physician orders, usually 20 to 30 minutes at a time.

Therapeutic Ultrasonography

Ultrasound is the energy carried by very-high-frequency sound waves. Audible sounds are the result of sound waves vibrating from 100 to 12,000 hertz (Hz; cycles per second). Ultrasonic waves vibrate at a rate of up to 1 million Hz and cannot be heard by the human ear. The ultrasound transducer contains a quartz crystal that vibrates very rapidly when an electric current is passed through it. It is placed in contact with the body, and the vibrations are passed into the tissues. Because these waves do not travel through air, complete contact with the body must be maintained during treatment by using a coupling agent (a water-soluble gel) between the ultrasound transducer and the skin.

The ultrasound waves cause the tissue to vibrate, generating heat as they penetrate superficial tissues and speeding up circulation to the area. This increases the metabolism in the local area, which has a beneficial effect on the body’s healing process. Because ultrasound waves travel best through water, they penetrate deeper into body tissues with a high water content, such as muscles. Ultrasonography may reduce pain and increase the rate of collagen synthesis, which promotes healing. Bone tissue contains almost no water, therefore ultrasonography must be used very carefully around bony areas, because the waves may concentrate and cause damage (Procedure 43-3).

Massage and Exercise

Massage is the systematic, therapeutic stroking or kneading of the body or a body part, which can effectively relieve or significantly reduce both localized and referred pain. Medical assistants are not usually asked to perform therapeutic massage on patients, but you should be familiar with the terminology.

A growing branch of healthcare uses exercise to aid muscle relaxation, promote healing, and provide relief from tension and pain caused by stress or a wide variety of physical disorders. Exercise also can be used to restore mobility, coordination, and strength. If the motion in a joint is restricted even for a short time, the joint tissues become dense, hard, and shortened. These changes can begin to occur in as little as 4 days. This
**PROCEDURE 43-2**

**Assist the Physician with Patient Care: Assist with Moist Heat Application**

**GOAL:** To apply moist heat to a body area to increase circulation, increase metabolism, and relax muscles.

**EQUIPMENT and SUPPLIES**

- Commercial hot moist heat packs
- Towel
- Patient’s record

**PROCEDURAL STEPS**

1. Sanitize your hands.
2. Explain the procedure to the patient and answer any questions.
3. Ask the patient to remove all jewelry from the area to be treated.
   **PURPOSE:** To prevent trauma to the area and the collection of heat at the jewelry site.
4. Place one or two towel layers over the area to be treated.
   **PURPOSE:** To prevent trauma and a burn in the area.
5. Apply the commercial moist heat packs (Figure 1).
6. Cover with the remaining portion of the towel.
7. Advise the patient to leave the heat pack in place no longer than 20 to 30 minutes, oft for the same amount of time, and then repeat if needed.
   **CAUTION:** Monitor the patient for complaints of discomfort or signs of a burn, including erythema and blister formation.

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9/2/XX 8:35 AM Commercial moist heat pack applied to cervical/thoracic region as ordered for 20 min. Pt states muscle cramps relieved. Instructed to continue moist heat packs at home q 2 hr for 20 min for relief of muscular pain. Cautioned pt about danger of accidental burn to the area. To return to office 9/6/XX for F/U. K. Tillman, CMA (AAMA)

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**FIGURE 1**

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**AMBULATORY DEVICES**

**Crutches**

Axillary crutches are made of wood or aluminum and must be measured to fit the patient as described in Procedure 43-4 and Figure 43-20. It is very important to fit the crutches properly and to make sure the patient understands the importance of not bearing weight in the axillary region. If the crutch is too long or the handgrips are too low or if the patient leans forward bearing weight on the arm pit, serious injury can occur to the nerves in the brachial plexus. Patient guidelines for the correct use of crutches include the following:

- Wear flat shoes with nonskid soles to prevent accidents.
- Bear weight on your hands and the handgrips, not on your armpits.
- Report any numbness or tingling of the upper body or arms to the physician; this may indicate nerve damage from axillary weight bearing.
- Keep your elbows close to your body so that the crutches are against the side of the chest.
- Place the crutch tips about 2 inches to the side of each foot so that you do not trip over them.
- Keep your elbows slightly bent when doing crutch walking.
- Keep your head up; do not look at your feet when using your crutches.
- Make sure the crutch tips, handgrip pads, and axillary pads on your crutches are in good condition at all times.
PROCEDURE 43-3

Assist the Physician with Patient Care: Assist with Therapeutic Ultrasonography

**GOAL:** To apply ultra-high-frequency sound waves to deep tissues for therapy. (This is done only under the supervision of the physician or a physical therapist.)

**EQUIPMENT and SUPPLIES**
- Ultrasound machine
- Ultrasound gel or lotion
- Paper towels
- Patient's record

**PROCEDURAL STEPS**

1. Prepare the equipment and sanitize your hands.
2. Confirm the patient's identity.
3. Explain the procedure and tell the patient to notify you of any discomfort during the procedure.
   **PURPOSE:** To ensure that the patient does not experience any pain or injury.
4. Ask the patient about the presence of any internal or external metal objects.
   **PURPOSE:** Metal objects must be avoided during the ultrasound procedure.
5. Position the patient comfortably, with the area to be treated exposed.
6. Apply a warmed ultrasound gel liberally over the area to be treated and to the applicator head.
   **PURPOSE:** To transmit the sound waves effectively through a water-based medium.
7. Begin the treatment with the intensity control at the lowest setting.
8. Set the timer on the machine to the ordered time.
   **PURPOSE:** The timer starts the machine.
9. Slowly increase the intensity control to the ordered amount.
10. Hold the applicator with the head firmly and completely against the patient's skin over the ultrasound gel in the treatment area (Figure 1).
11. Work the applicator over the area to be treated by moving it continuously in a circular fashion at a speed of 2 inches per second or as directed by the physician.
12. Keep the applicator head in contact with the patient's skin at all times while the machine is on and keep it moving continuously during the treatment time.
   **PURPOSE:** The applicator head becomes overheated when not in contact with the body and may burn the patient. Constant motion prevents hot spots from occurring as a result of the accumulation of excessive ultrasonic waves in one area.
13. When the timer sounds, the machine shuts off automatically. You then can safely lift the applicator head away from the patient.
14. Return the intensity control to zero.
15. Remove the ultrasound gel from the patient's skin and from the applicator head with a tissue or paper towel. Sanitize your hands.
16. Help the patient to dress if necessary.
17. Record the procedure in the patient's chart, including the date, area treated, intensity setting, duration of treatment, and any unusual reactions that may have occurred during treatment. If none occurred, indicate that also.
   **PURPOSE:** A procedure is not considered done until it is recorded.

9/6/XX 4:33 pm Ultrasound Rx applied to C shoulder @ 3 watts x 6 min. Pt derived discomfort during procedure. Pt states pain relieved, increased muscle relaxation. K. Tillman, CMA (AAMA)

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- Remove all throw rugs to keep from tripping or sliding.
- To stand up from a chair: Place both crutches on the injured side, tilt forward and push off with the arm on your uninjured side while bearing weight on the uninjured leg.
- To sit down: Place both crutches on the uninjured side, ease yourself down onto the chair while bearing weight with the uninjured arm and leg.
- To get into and out of a car: Make sure the front seat is moved back as much as possible. Back up toward the seat until you feel its edge; hold both crutches on the side of the body closest to the car door; grab the seat's head rest, tilt your head forward so that you do not bump it, and sit down. Place the heel of your uninjured leg on the car frame and push yourself back into the seat until you can swing the injured leg into the car.
Walkers

Walkers are used primarily by geriatric patients to help with balance and support. A walker’s wide base helps stabilize the gait of weakened patients and can support up to 50% of the patient’s body weight. Walkers are made of aluminum and can easily be adjusted to fit an individual. They are lightweight, can fold flat for storage and traveling, and can be equipped with a front pack to carry personal items or supplies. They also can be fitted with a fold-down seat. The disadvantage of a walker is that it cannot be used in small, cramped quarters.

To adjust the height of a walker, have the patient stand by the examination table. The top of the walker should be just below the patient’s waist at the same height as the top of the hip bone. If the walker has been correctly adjusted to the patient, the patient’s elbows will bend about 30 degrees while he or she uses

PROCEDURE 43-4

Assist the Physician with Patient Care: Teach the Patient Crutch Walking and the Swing-Through Gait

GOAL: To fit crutches accurately and to teach the patient to use the crutches properly in three-point walking.

EQUIPMENT and SUPPLIES

- Crutches with arm pads and foam handgrips
- Patient’s record

PROCEDURAL STEPS

1. Fit the crutches to the patient so that they are 1 to 1 ½ inches (2 fingerwidths) below the armpits when they are standing up straight. The handgrips should be even with the top of the hip line.
2. Make sure all wing nuts are tight.
3. Make sure the foam pads of the armgrips and around the handgrips are comfortable.
4. Instruct the patient to keep the injured leg as relaxed as possible and slightly bent at the knee.
5. The patient’s elbow should be bent approximately 30 degrees when holding the handgrip.
6. Place the crutch tips about 2 inches in front of each foot and approximately 6 inches to the side of each foot before beginning crutch walking.
7. Ask the patient to push down on the crutches and lift the body slightly, nearly straightening the arms. The patient should hold the top of the crutches tightly to the sides and use the hands to absorb the weight. Do not let the tops of the crutches press into the armpits.
   PURPOSE: To prevent injury to the muscles and nerves of the axillary region.
8. Have the patient swing the body forward about 12 inches (see Figure 43-20, C).
   PURPOSE: The swing-through gait is one of the fastest crutch gaits that can be used, but it requires a great deal of energy and upper body strength.
9. Instruct the patient to stand on the good leg, then move the crutches just ahead of the good foot, and repeat.
10. Additional crutch gait patterns can be taught as needed:
   - **Two-point crutch gait:** Move the left crutch and the right foot together, then the right crutch and the left foot together. Repeat. This gait is used if both legs are weak; it can be a challenge for the patient to learn the pattern (see Figure 43-20, A).
   - **Three-point crutch gait:** Move both crutches and the affected leg forward, then bear weight down through the crutches and move the unaffected leg forward. Repeat. This gait is used if the patient is unable to bear weight on one leg (see Figure 43-20, B).
   - **Four-point crutch gait:** Move the right crutch forward, then the left foot, followed by the left crutch and then the right foot. This gait provides the best stability but is slow; it can be helpful if both legs are weak (see Figure 43-20, D).
11. Stairs: Face the steps, hold the handrail with one hand, and tuck both crutches under the armpit on the other side. To go up the steps, start with the uninjured side, keeping the injured side raised behind. When going down, hold the injured foot up in front and hop down each stair on the good foot. If the stairway does not have handrails, use the crutches under both arms and hop up or down each step on the uninjured leg. If necessary, the patient can sit on the stairs and move up or down each step.
   PURPOSE: A procedure not recorded is considered not to have been done.

9/7/XX 3:17 PM Pt instructed in crutch walking using 3-point gait on steps and floor. Pt understands need to avoid weight bearing on OD leg. Pt demonstrated technique’s difficulty. K. Tillman, CMA (AAMA)
the walker (Figure 43-21). Patient guidelines for walker use include the following:
- Lift the walker and place it about an arm's length in front of you.
- Take your first step with the weaker leg, using the walker for support. If both legs are weak or you are using the walker for general support, start with either leg.
- Take smaller, slower steps than usual; if you step too close to the front of the walker, you can lose your balance.
- Hold your head up and look straight ahead.

To sit down, back up with the walker until you feel the back of the chair against your legs; let go of the walker and reach back for the chair; slowly lower yourself into the chair.

### Canes
Canes are available in a variety of designs (Figure 43-22). The single-tipped cane with a curved handgrip is indicated for individuals who need only minimal assistance with walking. Another type is the legged cane, which has a tripod or quad base. This base provides greater stability for the patient than does a
single-tipped cane. It is heavier and is recommended for patients who need greater support.

To fit a cane properly, have the patient stand up straight and measure the distance from the wrist crease to the floor. If the patient is age 70 or older or finds that extra length would feel more comfortable, up to 2 inches can be added to the previous measurement. This is the total length of the cane fitted to the patient. The patient's elbow should be bent to approximately 20 to 30 degrees if the cane has been correctly adjusted.

Canes typically are used to help a patient with balance problems, to widen the base of support so that falls are less likely, and to reduce weight bearing on an affected leg. To walk safely with a cane, the patient needs to be taught the following steps:

- Always use the cane on the side opposite the affected leg so that it can provide additional support as you walk through the step.
- The cane and the injured or weak leg should be advanced at the same time so that the cane and the leg are hitting the ground at the same time.
- Start by positioning the cane one small stride ahead on the strong side and step off with the injured leg, finishing the step with the stronger leg.
- Bear weight with the arm holding the cane as needed.
- The unaffected leg should bear the weight through the step.

**SAFETY ALERT**

Always set the brakes on a wheelchair before transferring the patient into or out of the chair.

**ASSISTING WITH CASTING**

When a cast is to be used to immobilize a fracture or sprain, the medical assistant must know the type of cast to be applied (Procedures 43-5 and 43-6). Possibilities for casting material include plaster of paris, fiberglass or plastic, synthetic material, or air casts. Plaster of paris is the oldest casting material. It is formed by briefly soaking rolls of casting material that have been impregnated with calcium sulfate (i.e., plaster of paris) in warm water, then rolling them around the fracture site. This forms a wet bandage that easily conforms to the extremity; the surface is rubbed smooth and then allowed to dry and harden. Fiberglass casting material has fiber or resin impregnated in the roller gauze and is applied in a similar fashion. A fiberglass cast is stronger, weighs less, and is relatively waterproof.

Before any type of cast is applied, the area first is wrapped with cotton padding to protect the skin. To immobilize the
PROCEDURE 43-5

Assist the Physician with Patient Care: Assist with Application of a Cast

GOAL: To assist the physician in applying a fiberglass cast.

EQUIPMENT and SUPPLIES
- Rolls of fiberglass
- Basin casting material
- Bandage
- Stockinettes
- Gloves for physician and medical assistant
- Sheet wadding and/or spongy padding
- Stand to support foot (lower extremity)
- Tape
- Scissors
- Water
- Patient's record

PROCEDURAL STEPS
1. Sanitize your hands.
2. Identify the patient.
3. Explain the procedure for applying a cast and answer any questions.
   PURPOSE: Knowing what to expect reassures the patient. Questions about the injury should be directed to the physician.
4. Assemble the necessary equipment.
5. Seat the patient comfortably, as directed by the physician. If the cast is being applied to the lower extremity, the toes must be supported by a stand.
   PURPOSE: The amount of flexion of the ankle can be controlled by supporting the toes so that the patient can more easily maintain the desired position without fatigue.
6. Clean the area that the cast will cover. Note any objective signs and ask about subjective symptoms (chart them at the end of the procedure).
   PURPOSE: The condition of the area under the cast must be noted before the cast is applied, so that it can be compared with the site when the cast is removed. Clean the area with a mild soap solution or as directed. Dry thoroughly.
7. Cut the stockinettes to fit the area the cast will cover.
8. Apply the stockinettes smoothly to the area the cast will cover. Leave 1 or 2 inches of excess stockinettes above and below the cast area to finish the cast (Figure 1).
9. Excess stockinettes may be cut away where wrinkles form, such as at the front of the ankle (Figure 2).
   PURPOSE: Stockinettes must lie smoothly and cannot be too bulky or wrinkled, because this may cause a pressure wound.
10. Apply sheet wadding along the length of the cast using a spiral bandage turn. Extra padding may be used over bony prominences, such as the bones of the elbow or ankle (Figure 3).
    PURPOSE: Padding the cast helps reduce pressure against bony prominences, which could cause skin breakdown.
11. Put on gloves.
12. With lukewarm water in the basin, wet the fiberglass tape as directed by the physician (Figure 4).
    PURPOSE: Immerse the roll of fiberglass tape in water begins the chemical reaction that will cause the cast to harden. The cast can be shaped while wet and will harden in the shape that is formed.
13. Assist as directed as the physician applies the inner layer of fiberglass tape (shown in the photograph as beige). A length of 1 to 2 inches of stockinettes is rolled over the inner layer of the cast to form a smooth edge when the outer layer is applied (Figure 5).
PROCEDURE 43-5—cont’d

14. Assist as directed by the physician to open and apply an outer layer of fiberglass tape (shown in the photograph as blue) (Figure 6).

15. Help shape the cast as directed. All contours must be smooth (Figure 7).
   **PURPOSE:** If flat or dented areas develop on the cast, they may cause pressure on the skin below.

16. Discard the water and excess materials. Remove your gloves and wash your hands.

17. Reassure the patient, review cast care verbally, and provide written instructions.

   **PURPOSE:** A procedure is not considered done until it is recorded in the patient’s chart.

9/8/XX 3 PM Assisted with application of knee to toe cast to @ left leg. Skin under cast dry and intact. Pt given written instructions on cast care. Material reviewed 5 questions. Instructed to call physician if there is numbness, tingling, swelling of toes, blue discoloration. K. Tillman, CMA (AAAMA)

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Injured area, the splint or cast must cover the joints above and below the fracture. If the site is edematous, a splint may be used until the swelling subsides, at which time a full cast is applied. In some cases a cast may have to be replaced as the swelling diminishes if the patient reports that the cast is too big. As a fracture heals, the physician may decide to remove the cast and apply a splint until the fracture has mended completely. A patient may call the office complaining that the splint or cast feels tight. Swelling typically occurs in the first 48 to 72 hours after the injury. The patient should be told to elevate the injured part above the heart to help collect fluid drain from the site; to gently move the fingers or toes at the affected area to improve circulation; and to apply ice around the splint or cast in a plastic bag at the level of the injury to help reduce swelling.

If the patient needs to wear a cast only when using the limb, synthetic casts are available in the shape of a boot or sleeve with Velcro fasteners that fit like a sandwich over the fracture to immobilize the area. An air cast is a temporary cast that is inflated around the limb to immobilize it. The type of cast used depends on the location and severity of the injury, the patient’s age and occupation, and the physician’s preference.
PROCEDURE 43-6
Assist the Physician with Patient Care: Assist with Cast Removal

GOAL: To remove a cast.

EQUIPMENT and SUPPLIES
- Cast cutter
- Cast spreader
- Large bandage scissors
- Basin of warm water
- Mild soap
- Towel
- Skin lotion
- Patient’s record

PROCEDURAL STEPS

1. Explain the procedure to the patient.
   PURPOSE: To allay the patient’s anxiety and ensure cooperation.
2. Provide adequate support for the limb throughout the procedure.
   PURPOSE: To ensure the patient’s comfort.
3. Make a cut on the medial and lateral sides of the long axis of the cast (Figure 1).
4. Pry the two halves apart using the cast spreader (Figure 2).
5. Carefully remove the two parts of the cast.
6. Use large bandage scissors to cut away the stockinette and padding remaining.
7. Gently wash the area that was covered by the cast with mild soap and warm water.
   PURPOSE: To ensure the patient’s comfort.
8. Dry the area and apply a gentle skin lotion.
   PURPOSE: To ensure the patient’s comfort.
9. Give the patient appropriate instructions about exercising and using the limb, as directed by the physician.
   PURPOSE: To enhance continued healing, restore lost strength, and prevent injury.
10. Record the procedure in the patient’s medical record.
    PURPOSE: A procedure is not considered done until it is recorded.

![Figure 1](image1.png)

![Figure 2](image2.png)

WARNING SIGNS AFTER APPLICATION OF A SPLINT OR CAST

The patient should be told to contact the physician’s office if any of the following occurs after the application of a splint or cast:
- Increased pain and/or a feeling that the splint or cast is too tight
- Numbness and tingling in the affected hand or foot, indicating pressure on the nerves
- Burning and stinging because of pressure on the skin
- Excessive swelling below the cast, which may mean the cast is slowing circulation
- Loss of active movement of toes or fingers (this requires an urgent evaluation by the physician)

CRITICAL THINKING APPLICATION 43-9
Kaiwon has just finished helping Dr. Alexander put a cast on the arm of a 6-year-old girl who fell out of her neighbor’s tree house and fractured her radius. Her mother wants to take her home immediately. Should the patient be allowed to leave immediately? Why? What might happen?

CLOSING COMMENTS

Patient Education

An informed patient is better prepared to continue with home care. Musculoskeletal conditions, particularly arthritis, can be so painful and debilitating that these patients may be easy prey for
mystery drug promotions. It is important for you to recognize the need for patient education about the condition and to work diligently with the patient and family to encourage participation in effective care programs. When you work with the physician and the physical therapist in helping the patient, you become an important member of the healthcare team. This type of involvement leads to patient satisfaction, as well as personal satisfaction and achievement.

### Legal and Ethical Issues

Working with orthopedic patients may involve assisting with assessments and performing procedures that directly involve the patient's recovery plan. Many of the procedures in this chapter are not the basic procedures you will be required to perform when you are first hired as a medical assistant. These techniques all involve additional on the job training and practice. Before performing any of the described procedures, you should check with your local and state medical assistant organizations about the laws in your state. Whenever you perform the procedures and techniques described in this chapter, you are responsible for them. The following steps are all required before you perform any procedure on a patient:

- You must have a written order before performing a procedure.
- You must follow the procedure precisely as it is ordered, without variation.
- Never advise the patient without permission.
- Make sure you know what instructions the physician gave the patient.
- Reinforce the instructions the physician gave the patient.
- If you have any concerns about a procedure, discuss them with the physician privately before proceeding.
- Do not perform a procedure if you are uncomfortable; get someone to help you.

Always remember: You are the assistant, and this is the physician's patient. The physician ultimately is responsible for every aspect of the patient's care. If you feel uncertain or unsure of any order the physician has written for a patient, you must get it clarified before you proceed. Always stay within the legal and ethical guidelines of the medical assisting profession in your state.

### SUMMARY OF SCENARIO

Kaiwan is becoming more and more comfortable in his position as an orthopedic medical assistant at the Sports Medicine Clinic. His enthusiasm is contagious. Patients consistently comment on his positive, upbeat manner. Kaiwan is motivated to learn new methods of better assisting the physicians with routine procedures. He always seeks answers to questions that occur with new patients. He has gained a great deal of confidence and now remembers always to check the temperature of the paraffin bath before starting a treatment. One of the most enjoyable aspects of his job continues to be assisting Dr. Alexander with treating the team members. Kaiwan has attended two continuing education seminars in sports medicine with Dr. Alexander. He now is thinking about continuing his education part time to become an athletic trainer while still working at the clinic. Kaiwan recognizes the importance of continuing education in maintaining orthopedic skills.

### SUMMARY OF LEARNING OBJECTIVES

1. Define, spell, and pronounce the terms listed in the vocabulary.
   Spelling and pronouncing medical terms correctly bolster the medical assistant's credibility. Knowing the definitions of these terms promotes confidence in communication with patients and co-workers.

2. Apply critical thinking skills in performing the patient assessment and patient care.
   Completing the Critical Thinking Application exercises throughout the chapter can help the student medical assistant become more adept at critical analysis of real-life situations.
3. Describe the principal structures of the musculoskeletal system and their functions.

The main structures of the musculoskeletal system are the skeletal muscles, which provide movement; tendons, which connect muscles to bones; bones, which provide support, protection, mineral storage, and blood cell development; and ligaments, which connect bone to bone.

4. Differentiate among tendons, bursae, and ligaments.

Tendons are the tough bands that connect muscles to bones; ligaments provide support by connecting bone to bone and preventing a joint from moving beyond its normal ROM. Bursae prevent friction between different tissues in the musculoskeletal system.

5. Summarize the major muscular disorders.

Fibromyalgia is a condition of unknown origin that causes widespread connective tissue and muscular pain, along with sleep disorders and extreme fatigue. Myasthenia gravis is an autoimmune disorder that affects the use of ACh at the neuromuscular junction, resulting in muscular weakness, especially in the face and eyes. A spasm is the tearing of ligaments and a strain is the overstretching or tearing of a muscle or tendon.

6. Identify and describe the common types of fractures.

The common types of fractures are explained in Table 43-3.

7. Explain the difference between osteomalacia and osteoporosis.

Osteomalacia is softening of the bones, which occurs because of a problem with the metabolism or absorption of vitamin D, calcium, and phosphorus; in children the condition is called rickets. Osteoporosis is a reduction in bone density, which can be caused by many factors, including lack of dietary calcium early in life; it leads to brittle bones that fracture easily.

8. Classify typical spinal column disorders.

Spinal column disorders are related to the shape of the spine; scoliosis is a lateral deviation, lordosis (swayback) is a pronounced curve of the lower back, and kyphosis is a pronounced cervical curve, or hunchback.

9. Differentiate among the various joint disorders.

Joint disorders include dislocations, in which the two bones of the joint are no longer approximated; gout, which is a form of arthritis caused by the collection of uric acid crystals, most commonly in the synovial membrane of the great toe; SLE, which is a widespread autoimmune disorder that can affect any organ system in the body; Lyme disease, a form of infectious arthritis caused by bacteria transmitted via a tick bite, can cause extensive joint and neurologic problems if left untreated; OA, caused by degeneration of the articular cartilage of synovial joints; RA, an autoimmune disorder that causes crippling pain and deformity of the joints; and tendonitis and bursitis, which are inflammatory reactions of supportive tissue typically caused overuse of a joint.

10. Summarize the medical assistant's role in assisting with orthopedic procedures.

The medical assistant is responsible for gathering and recording a detailed history of the patient's presenting problem; providing the patient with assistance as needed; and assisting with the orthopedic examination.

11. Explain the common diagnostic procedures used in orthopedics.

Common diagnostic procedures routinely performed in the orthopedic office include ROM evaluation, inspection, palpation, percussion, muscle strength evaluation, and x-ray studies. Other diagnostic tools include arthrograms, myelograms, bone scans, CT, MRI, electromyography, biopsies, and diagnostic ultrasonography.

12. Compare and contrast therapeutic modalities used in orthopedic medicine.

Therapeutic modalities include the application of cold and heat; paraffin baths; hot water bottles and moist heat packs; therapeutic ultrasonography; massage and therapeutic exercise; and electric muscle stimulation.

13. Apply cold therapy to an injury.

Cold should be used immediately after an injury to help reduce inflammation, inhibit additional swelling, and help relieve pain. The ice pack should remain in place for 20 minutes at a time, several times a day, and the area should be checked for feeling and color after each application (see Procedure 43-1).

14. Assist with hot moist heat application to an orthopedic injury.

Procedure 43-2 lists the steps for the application of heat. Heat should be used on injuries after 48 hours to promote circulation and healing, reduce swelling, and promote soft tissue relaxation in the affected area. Care must be taken to prevent burns.

15. Properly apply therapeutic ultrasound.

Therapeutic ultrasound applies deep tissue heat to an injured area (see Procedure 43-3). It is important to keep the applicator head constantly moving in a circular fashion over the injured site during the treatment.

16. Explain the use of common ambulatory devices.

The most common ambulatory assistive devices are canes, crutches, walkers, and wheelchairs. The most important aspects of using these assistive devices in an orthopedic practice are to fit them properly to the patient and to instruct the patient adequately in how to use the device properly and safely.

17. Properly fit a patient with crutches and explain the correct mechanics of crutch walking.

Procedure 43-4 presents the steps for properly fitting a patient with crutches and explaining the correct mechanics of crutch walking.

18. Prepare for and assist with application of a cast.

Preparing for and assisting with application of a cast are detailed in Procedure 43-5. The tissue beneath the cast must be safeguarded by applying a stockinette and sheet wadding. The casting material then is immersed in water and carefully rolled around the limb.

19. Prepare for and assist with removal of a cast.

Procedure 43-6 presents the steps for preparing for and assisting with cast removal.
CONNECTIONS

Study Guide Connection: Go to the Chapter 43 Study Guide. Read and complete the activities.

Evolve Connection: Go to the Chapter 43 link at evolve.elsevier.com/kirk to complete the Chapter Review and Chapter Quiz. Peruse other resources listed for this chapter to increase your knowledge of Assisting in Orthopedic Medicine.