

CHAPTER 11

LECTURE OUTLINE

I. INTRODUCTION

- A. The *muscular system* specifically concerns skeletal muscles and associated connective tissue that make individual muscle organs.
- B. This chapter discusses how skeletal muscles produce movement and describes the principal skeletal muscles.

II. HOW SKELETAL MUSCLES PRODUCE MOVEMENT

- A. Muscle Attachment Sites: Origin and Insertion
 1. Skeletal muscles produce movements by exerting force on tendons, which in turn pull on bones or other structures, such as skin.
 2. Most muscles cross at least one joint and are attached to the articulating bones that form the joint (Figure 11.1a).
 3. When such a muscle contracts, it draws one articulating bone toward the other.
 - a. The attachment to the stationary bone is the *origin*.
 - b. The attachment to the movable bone is the *insertion*.
 4. *Tenosynovitis* is an inflammation of the tendons, tendon sheaths, and synovial membranes surrounding certain joints (Clinical Connection).
- B. Lever Systems and Leverage
 1. Bones serve as *levers* and joints serve as *fulcrums*.
 2. The lever is acted on by two different forces: *resistance (load)* and *effort* (Figure 11.1b).
 3. Levers are categorized into three types, according to the position of the fulcrum, effort, and load
 - a. *first-class* (EFL) (Figure 11.2a)-the fulcrum is between the effort and the load. An example is pair of scissors.
 - b. *second-class* (FLE) (Figure 11.2b)- the load is between the fulcrum and effort. An example is a wheelbarrow.
 - c. *third-class* (FEL) (Figure 11.2c)-the effort is between the fulcrum and the load. An example is a pair of forceps.

4. Leverage, the mechanical advantage gained by a lever, is largely responsible for a muscle's strength and range of motion (ROM), i.e., the maximum ability to move the bones of a joint through an arc.

C. Effects of Fascicle Arrangement

1. Skeletal muscle fibers (cells) are arranged within the muscle in bundles called fasciculi.
2. The muscle fibers are arranged in a parallel fashion within each bundle, but the arrangement of the fasciculi with respect to the tendons may take one of four characteristic patterns: parallel, fusiform, pennate, and circular (Table 11.1).
3. Fascicular arrangement is correlated with the power of a muscle and the range of motion.
4. Intramuscular injections have advantages, and disadvantages, over oral or subcutaneous delivery of medications (Clinical Connection)

D. Coordination Within Muscle Groups

1. Most movements are coordinated by several skeletal muscles acting in groups rather than individually, and most skeletal muscles are arranged in opposing (antagonistic) pairs at joints.
2. A muscle that causes a desired action is referred to as the *prime mover* (*agonist*); the *antagonist* produces an opposite action.
3. Most movements also involve muscles called *synergists*, which serve to steady a movement, thus preventing unwanted movements and helping the prime mover function more efficiently.
4. Some synergist muscles in a group also act as *fixators*, which stabilize the origin of the prime mover so that it can act more efficiently.
5. Under different conditions and depending on the movement and which point is fixed, many muscles act, at various times, as prime movers, antagonists, synergists, or fixators.
6. Some of the benefits of stretching (Clinical Connection) include: improved physical performance, decreased risk of injury, reduced muscle soreness, improved posture, increased synovial fluid, and increased neuromuscular coordination.

III. HOW SKELETAL MUSCLES ARE NAMED

A. Muscle naming involves many categories such as (table 11.2):

1. Location
2. Size
3. Number or origins
4. Appearance
5. Direction of fibers
6. Origin and insertion
7. Muscle action
8. Combinations

IV. PRINCIPAL SKELETAL MUSCLES

- A. Exhibits 11.A through 11.T list the principle skeletal muscles in various regions of the body.
- B. Discuss the origin, insertion and action of the major skeletal muscles listed in the PowerPoint**
- C. Muscles of the head that produce facial expressions (figure 11.4)**

- Clinical Connection: Bell's Palsy
 1. Occipitofrontalis
 2. Orbicularis oris
 - a. action: closes and protrudes lips
 - b. origin: surrounding opening of mouth
 - c. insertion: corner of mouth
 3. Zygomaticus major
 4. Zygomaticus minor
 5. Levator labii superioris
 6. Depressor labii inferioris
 7. Depressor anguli oris
 8. Levator anguli oris
 9. Buccinator
 10. Risorius
 11. Mentallis
 12. Platysma
 13. Orbicularis oculi
 14. Corrugator supercilli

D. Muscles of the Head that move the eyeball

1. Superior rectus
2. Inferior rectus
3. Lateral rectus
4. Medial rectus
5. Superior oblique
6. Inferior oblique
7. Levator palpebrae superioris

8. Clinical Connection: Strabismus

E. Muscles that move the mandible and assist in mastication

1. Masseter
 - a. Action: closes the mouth
 - b. Origin: maxilla and zygomatic arch
 - c. Insertion: mandible
2. Temporalis
3. Medial pterygoid
4. Lateral pterygoid
5. **Clinical Connection: Gravity and the mandible**

F. Muscles of the head that move the tongue

1. Genioglossus
2. Styloglossus
3. Hypoglossus
4. Palatoglossus
5. Intubation during anesthesia

G. Muscles of the anterior neck that assist in deglutition and speech

1. Digastric
2. Stylohyoid
3. Mylohyoid
4. Geniohyoid
5. Omohyoid
6. Sternohyoid
7. Thyrohyoid

H. Muscles of the Neck that move the head

1. Sternocleidomastoid

2. Semispinalis capitis
3. Splentus capitis
4. Longissimus capitis
5. Spinalis capitis

I. Muscles of the Abdomen that protect abdominal visceral and move the vertebral column

1. Rectus abdominis
2. External oblique
3. Internal oblique
4. Transversus abdominis
5. Quadratus lumborum
6. **Clinical Connection: Inguinal Hernia**

J. Muscles of the Thorax that assist in breathing

1. Diaphragm
2. External intercostals
3. Internal intercostals

K. Muscles of the pelvic floor that support the pelvic viscera and function as sphincters

1. Levator ani
2. Pubococcygeus
3. Puborectalis
4. Illiococcygeus
5. Ischicoccygeus
6. **Clinical Connection: Injury of levator ani and urinary stress incontinence**

L. Muscles of the perineum

1. Superficial transverse perineal
2. Bulbospongiosus
3. Ischiocavernosus
4. Deep transverse perineal
5. External urethral sphincter
6. Compressor urethrae
7. Sphincter urethrovaginalis
8. External sphincter

M. Muscle of the thorax that move the pectoral girdle

1. Subclavius
2. Pectoralis minor
3. Serratus anterior
4. Trapezius
5. Levator scapulae
6. Rhomboid major
7. Rhomboid minor

N. Muscles of the Thorax and shoulder that move the humerus

1. Pectoralis major
2. Latissimus dorsi
3. Deltoid
4. Subscapularis
5. Supratorator
6. Infraspinatus
7. Teres major
8. Teres minor
9. Coracobrachialis

10. Clinical connection: impingement syndrome

11. Clinical connection: rotator cuff injury

O. Muscles of the arm that move the radius and ulna

1. Biceps brachii
2. Brachialis
3. Brachioradialis
4. Triceps brachii
5. Anconeus
6. Pronator teres
7. Pronator quadratus
8. Supinator

P. Muscles of the forearm that move the wrist, hand, thumb and digits

1. Flexor carpi radialis
2. Palmaris longus
3. Flexor carpi ulnaris
4. Flexor digitorum superficialis

5. Flexor pollicis longus
6. Flexor digitorum profundus
7. **Clinical connection: golfer's elbow**
8. Extensor carpi radialis longus
9. Extensor radialis brevis
10. Extensor digitorum
11. Extensor digiti minimi
12. Extensor carpi ulnaris
13. Abductor pollicis longus
14. Extensor pollicis brevis
15. Extensor pollicis longus
16. Extensor indicis

Q. Muscles of the palm that move the digits-intrinsic muscles of the hand

1. Abductor pollicis brevis
2. Opponens pollicis
3. Flexor pollicis brevis
4. Adductor pollicis
5. Abductor digiti minimi
6. Flexor digiti minimi brevis
7. Opponens digiti minimi
8. Lumbricals
9. Palmar interossei
10. Dorsal interossei

11. Clinical connection: Carpal Tunnel Syndrome

R. Muscles of the neck and back that move the vertebral column

1. Splenius capitis
2. Splenius cervicis
3. Iliocostalis cervicis
4. Iliocostalis thoracis
5. Iliocostalis lumborum
6. Longissimus capitis
7. Longissimus cervicis
8. Longissimus thoracis
9. Spinalis capitis

10. Spinalis cervicis
11. Spinalis thoracis
12. Semispinalis capitis
13. Semispinalis cervicis
14. Simispinalis thoracis
15. Multifidus
16. Rotatores
17. Interspinalies
18. Intertransversarii
19. Anterior scalene
20. Middle scalene
21. Posterior scalene
22. **Clinical connection: Back injuries and heavy lifting**

S. **Muscles of the gluteal region that move the femur**

1. Iliopsoas
2. Iliacus
3. Gluteus maximus
4. Gluteus medius
5. Gluteus minimus
6. Tensor fasciae latae
7. Piriformis
8. Obturator internus
9. Obturator externus
10. Superior gemellus
11. Inferior gemellus
12. Quadratus femoris
13. Adductor longus
14. Adductor brevis
15. Adductor magnus
16. Pectineus
17. **Clinical connection: groin injury**

T. **Muscle of the thigh that move the femur, tibia and fibula**

1. Adductor magnus
2. Adductor longus

3. Adductor brevis pectineus
4. Gracilis
5. Quadriceps femoris
6. Rectus femoris
7. Vastus lateralis
8. Vastus medialis
9. Vastus intermedius
10. Sartorius
11. Biceps femoris
12. Semitendinosus
13. Semimembranosus

U. Muscles of the leg that move the foot and toes

1. Tibialis anterior
2. Extensor hallucis longus
3. Extensor digitorum longus
4. Fibularis tertius
5. Fibularis longus
6. Fibularis brevis
7. **Clinical connection: Shin splint syndrome**
8. Gastrocnemius
9. Soleus
10. Plantaris
11. Popliteus
12. Tibialis posterior
13. Flexor digitorum longus
14. Flexor hallucis longus

V. Intrinsic muscle of the foot that move the toes

1. Extensor hallucis brevis
2. Extensor digitorum brevis
3. Abductor hallucis
4. Flexor digitorum brevis
5. Abductor digiti minimi
6. Quadratus plantae
7. Lumbricals

8. Flexor hallucis brevis
9. Adductor hallucis
10. Flexor digiti minimi brevis
11. Dorsal interossei
12. Planar interossei

V. DISORDERS: HOMEOSTATIC IMBALANCES

A. Running Injuries

1. Most running injuries involve the knee. Other commonly injured sites are the calcaneal (Achilles) tendon, medial aspect of the tibia, hip area, groin area, foot and ankle, and back.
2. Running injuries are frequently related to faulty training techniques.
3. Running injuries can be treated initially (first 2-3 days) with rest, ice, compression, and elevation (*RICE therapy*). Alternating moist heat and ice massage may be used as a follow-up treatment. Sometimes, nonsteroidal anti-inflammatory drugs (NSAIDS) or local injections of corticosteroids are needed; an alternate fitness program is necessary to keep active during the recovery period followed by careful rehabilitative exercise.

B. Compartment Syndrome

1. Skeletal muscles in the limbs are organized in units called *compartments*.
2. In *compartment syndrome*, some external or internal pressure constricts the structures within a compartment, resulting in damaged blood vessels and subsequent reduction of the blood supply to the structures within the compartment.
3. Without intervention, nerves suffer damage, and muscle develop scar tissue that results in permanent shortening of the muscles, a condition called *contracture*.

C. Plantar Fasciitis

1. Painful heel syndrome due to chronic irritation of the plantar at its origin on the heel bone.