

Body Mechanics and Range of Motion II

Course

Health Science

Unit V

Safety and
Governmental
Regulations

Essential Question

How does
proper body
movement
protect both the
Health Care
Worker and the
patient?

TEKS

130.204 8A, 8F
11A

Prior Student Learning

The student
should have an
understanding of
healthcare
regulatory
agencies.

Estimated time

3 hours

Rationale

Healthcare providers must know how to properly apply the principles of body mechanics to minimize personal and client injury.

Objectives

Upon completion of this lesson, the student will be able to:

- Explain how muscles, bones, and joints work together to provide movement
- Identify the principles of body mechanics
- Demonstrate proper body mechanics
- Demonstrate Range of Motion of the upper and lower extremities

Engage

The National Safety Council estimates that hospital workers are twice as likely as employees of other service industries to sustain work-related, Musculo-Skeletal injuries. Have students discuss which occupations and what activities are most at risk. Nurses are most at risk, while Physical Therapists are number 2. Activities include:

- Lifting
- Bending
- Twisting

Key Points:

- I. Body Movement
 - A. Accomplished by the musculoskeletal systems
 - B. The main framework of the body is covered with muscle
 1. Allows movement
 2. The type and extent of movement is determined by the load or resistance that is moved.
 3. The arms and legs are like machines.
 4. The action of muscles pulling on a bone are like a machine called a lever.
 5. A lever is a rigid rod able to rotate around a point called a fulcrum.
 - a. In the body the rigid rod is the bone.
 - b. In the body the fulcrum is the joint.
 6. Any force applied to the lever is called the effort.
 7. Any force that resists the motion of the lever is called the load, or resistance.
 - a. In the body, contraction of the muscle is the effort.
 - b. In the body, the part of the body is the resistance or

- load.
8. Types of levers in the body
 - a. First-Class Levers
 - i. The placement of the fulcrum lies between the pull and the load, as in a set of scales.
 - ii. The head being tipped backward on the atlas
 - a) the facial portion of the skull is the load.
 - b) the joint between the skull and the atlas is the fulcrum.
 - c) the muscles of the back produce the pull.
 - b. Second-Class Levers
 - i. The load lies between the fulcrum and the joint, where the pull is exerted.
 - ii. Raising of the body on the toes
 - a) the point of contact between the toes and the ground is the fulcrum.
 - b) the load is located at the ankle.
 - c) the pull is exerted by the gastrocnemius (the muscle in the calf).
 - c. Third-Class levers
 - i. The pull is exerted between the fulcrum and the resistance or load to be moved
 - ii. The flexing of the forearm at the elbow joint, as in lifting a hand weight
 - a) the load is the weight in the hand.
 - b) the pull is the biceps brachii muscle.
 - c) the fulcrum is the elbow.
 - iii. This is the most common lever in the body
 - C. **Proper Posture** (the position of body parts in relation to each other) and **Body Mechanics** (using all body parts efficiently and in a careful way) are necessary in to order to limit stress and strain on the musculoskeletal system.
 1. Lifting, pushing, or pulling increases stress on the musculoskeletal system.
 2. Principles
 - a. Use the larger and stronger muscles to perform work (shoulders, upper arms, hip and thighs).
 - b. Maintain the center of gravity in the body close to the center of the support base (feet provide a support base for humans).
 - c. Keep centered within the support base the combined center of gravity of the HealthCare worker and the object or person to be moved (hold objects to be moved close to you).
 - d. Have a support base that is the appropriate size and shape

- II. Rules for proper body mechanics
 - A. Use stronger, larger muscles to perform tasks which require physical effort.
 - B. When moving a heavy object, try to push or pull it instead of lifting.
 - C. Maintain a wide base of support (feet approximately 12 inches apart).
 - D. Get help if the object feels too heavy to lift.
 - E. Lift in a smooth motion to prevent injury.
 - F. Maintain a good posture.
 - G. Avoid twisting the body; turn your whole body and face the area in which you are working.
 - H. Bend your knees, keep your back straight, spread the feet about one foot apart, and use your leg muscles while lifting.
 - I. Keep objects close to your body when lifting, moving, or carrying them.
 - J. Avoid unnecessary bending and reaching: raise the bed or over bed table to your waist level.

- III. When to use Body Mechanics
 - A. At all times that you have to lift, move, or carry an item
 - 1. In everyday daily activities: for example, while cleaning, carrying books to school and to class, or getting in and out of a car.
 - 2. In Healthcare settings: for example, while assisting a patient to a chair, picking up supplies, or positioning a patient in bed.

- IV. Ergonomics: – the science of work. The science of fitting the work to the user instead of forcing the user to fit the work. (OSHA has put emphasis on developing a policy of no lifting in Long Term Care Facilities and other high-risk areas. The training program can be found at <http://www.osha.gov/SLTC/etools/nursinghome/index.html>)

- V. Range of Motion: – the complete extent of movement which a joint is capable of
 - A. Used when doing routine activities such as bathing, eating, and dressing; uses muscles that keep many joints in effective range of motion
 - B. The purpose of Range of Motion
 - 1. To prevent problems caused by a lack of movement
 - 2. To prevent problems caused by inactivity
 - a. Contractures: the tightening and shortening of a muscle: for example, foot drop
 - b. Muscles may atrophy (shrink) when they are not used.

- c. Joints become stiff
- d. Blood clots and decubitus ulcers may develop.
- C. Active Range of Motion – those movements performed by the patient without help
- D. Passive Range of Motion – a movement cannot be performed by the patient and the health care worker moves each joint through its range of motion.
- E. Active Assistive Range of Motion – the patient does the exercises with some assistance from another person.
- F. General rules for Range of Motion
 1. Use good body mechanics; raise the bed to your waist level if the patient is in bed.
 2. Expose only the body part being exercised.
 3. Explain to the patient what you are going to do, and teach the patient how to do it.
 4. Support the extremity being exercised (place hands under the extremity, supporting the joint above and the joint below the one you are exercising).
 5. Move each joint until there is resistance but not pain.
 6. Move each joint slowly, smoothly, and gently.
 7. Return the joint to a neutral position after the movement.
 8. Keep friction to a minimum.
 9. Repeat each exercise 3-5 times.
- G. Joint Movement
 1. Abduction – moving a body part away from the midline
 2. Adduction – moving a body part toward the midline
 3. Flexion – bending a body part
 4. Extension – straightening a body part
 5. Hyperextension – excessive straightening of a body part
 6. Rotation – moving in a circle at a joint
 7. Pronation – turning a body part downward
 8. Supination – turning a body part upward
 9. Inversion – turning a body part inward
 10. Eversion – turning a body part outward
 11. Dorsiflexion – bending backward
 12. Plantar Flexion – bending forward
 13. Radial deviation – moving toward the thumb side
 14. Ulnar deviation – moving toward the little finger side

Activity

- I. Complete the Body Mechanics Activity.
- II. Complete the Range of Motion Activity.
- III. Demonstrate principles of proper body mechanics. See the Body Mechanics Checklist. If you have a lab with beds, moving the patient up

in bed is good. If you do not have a lab with beds, have students transfer a patient (another student) from one chair to another. The instructor should demonstrate the procedure first.

IV. Demonstrate Range of Motion. See the Range of Motion Checklist.

V. Complete the Body Movement Worksheet.

Assessment

Body Mechanics Check Sheet

Range of Motion Check Sheet

Body Movement Worksheet

Materials

Bed and linens

Chair or wheelchair

Gait belt

Accommodations for Learning Differences

For reinforcement, students who cannot lift, move, or transfer clients will make posters to illustrate proper body mechanics.

For enrichment, students will plan care to minimize injury for an 87-year-old patient who has had a stroke and is confined to bed.

National and State Education Standards

National Health Science Cluster Standards

HLC10.01 Technical Skills

3 Demonstrate safety procedures to protect clients, co-workers and self.

TEKS

130.202(c)(1)(H) Identify and analyze the principles of body mechanics and movement such as forces and the effects of movement, torque, tension and elasticity on the human body;

130.202(c)(10)(A) Identify governing regulatory agencies such as the World Health Organization, Centers for Disease Control, Occupational Safety and Health Administration, Food and Drug Administration and National Institute for Occupational safety and Health;

130.202(c)(10)(B) Relate industry safety standards such as standard precautions, fire prevention, safety practices in all aspects of the health science industry; and

130.202(c)(10)(C) Identify safety practices in all aspects of the health science industry.

130.204(c)(8)(A) comply with specific industry standards related to safety and substance abuse;

130.204(c)(8)(F) demonstrate skills related to activities of daily living in rehabilitation care such as range of motion, positioning and ambulation according to the health science industry standards regulatory agency standards and professional guidelines; and
130.204(c)(11)(A) Conform to government regulations and guidelines from entities such as the World Health Organization Centers for Disease Control, Occupational Safety and Health Administration, Food and Drug Administration and National Institute for Occupational safety and Health.

Texas College and Career Readiness Standards

English/Language Arts Standards

- A. Understand new vocabulary and concepts and use them accurately in reading, speaking and writing

Cross Disciplinary Standards

- B. Problem Solving
 - 1. Analyze a situation to identify a problem to be solved
 - 2. Develop and apply multiple strategies to solving a problem

Body Mechanics Activity

This gives the student an opportunity to practice some of the principles of Body Mechanics and Range of Motion before they actually work with each other.

1. Place a box or book on the floor. Ask the student to pick up the item. Make sure that the student bends his or her knees, keeping the back straight, and does not bend from the waist.
2. Give the student a container or book and ask the student to pass it to the student behind them. Make sure that the student does not twist to hand the object to the other student, but walks until he or she is facing the student.
3. Give the student a heavy container or book and ask the student to hold it at arm's length for 60 seconds. Then have the student hold it close to them for several minutes and ask them which is easier.
4. Ask students to stand with their feet together for several minutes then have them stand with their feet about 12 inches apart. Which one is easier to maintain?
5. Place a heavy container (one that is too difficult to lift) on a table or the floor. Ask the student to move it to the other end of the table or to a different spot on the floor. Make sure that the student pushes the object rather than lifting it.

Range of Motion Activity

Have each student perform the movement while you tell them what to do. This does not need to be done in a bed. It can be done at their desks or standing up.

Arm

Abduction – with an arm at your side, bring the arm away from the body.

Adduction – with an arm out to the side, return it to the body.

Flexion – bend the elbow.

Extension – straighten the arm.

Supination – turn the hand so the palm is up.

Pronation – turn the hand so the palm is down.

Rotation (Internal and External) – raise the arm at your side until it is in line with the shoulder; bend the elbow at a 90 degree angle and move the forearm upward and downward.

Radial Deviation and Ulnar Deviation – move the hand from side to side at the wrist (there is not much movement).

Opposition – touch each finger to the thumb.

Leg

Abduction – lift the leg laterally away from the body.

Adduction – return the leg toward the other leg.

Flexion – with the leg extended, lift upward.

Extension – return the leg to its original position.

Rotation (Internal and External) – turn the foot and leg toward the other leg, and then turn it out away from the other leg.

Dorsiflexion – move the foot up and back until the toes are upright.

Plantar Flexion – move the foot with the toes pointing downward.

Inversion – turn the sole of the foot toward the middle.

Eversion – turn the sole of the foot outward.

Body Mechanics Checklist

Moving a helpless patient up in bed using a drawsheet

S U

- ___ ___ 1. Ask a co-worker to help you move patient.
- ___ ___ 2. Identify the patient and address him or her by name as you explain what you are doing.
- ___ ___ 3. Introduce yourself and the one who is helping.
- ___ ___ 4. Wash your hands.
- ___ ___ 5. Provide privacy with a closed door, screen, or curtain.
- ___ ___ 6. Check that the bed is securely locked and lock the wheels if necessary.
- ___ ___ 7. Raise bed to its working height if possible.
- ___ ___ 8. Flatten the head of the bed if the patient's condition allows for that.
- ___ ___ 9. Move the pillow from under the patient's head and position it at the head of the bed.
- ___ ___ 10. Position your worker or assistant on the other side of the bed, opposite you.
- ___ ___ 11. Lower the side rails.
- ___ ___ 12. Loosen the drawsheet on each side of the bed.
- ___ ___ 13. Roll the drawsheet toward the patient (students should hold the drawsheet at the hip and shoulder of the patient).
- ___ ___ 14. Ask the patient for help if he or she is able to.
- ___ ___ 15. Place your feet about 12 inches apart, with one foot pointed toward the head of the bed and the other foot pointed toward the side of the bed. Bend your knees and keep your back straight.
- ___ ___ 16. On the count of three, shift your weight from your back foot to the front foot together with your partner, and move the patient to the head of the bed. Students should stay low and not jerk their bodies upward to lift, but should support the patient and "slide" rather than lift.

Body Mechanics Checklist

Transferring a patient from one chair to another

S U

- ___ ___ 1. Identify the patient and address him or her by name as you explain what you are doing.
- ___ ___ 2. Introduce yourself.
- ___ ___ 3. Wash your hands.
- ___ ___ 4. Provide privacy with a closed door or screen.
- ___ ___ 5. Place the chair the patient will be transferred into against a wall, or have a student hold the chair so that it will not slide. If a wheelchair is used, make sure that the wheelchair is locked and the footrests are up.
- ___ ___ 6. Position the chair so that it is at a right angle to the place where the patient is sitting.
- ___ ___ 7. a. If no gait belt is available: Place your hands around the patient's waist and ask the patient to push with their hands on the arms of their chair, or the seat if the chair has no arms. On the count of three, bend your knees and assist the patient to a standing position; pivot with the patient until the patient can feel the new chair against his or her legs; and lower the patient into the new chair as you bend your knees, keeping your back straight.
- ___ ___ 7. b. If a gait belt is available, apply the gait belt around the patient's waist, making sure the buckle is to the side of the patient. Grasp the gait belt on each side; ask the patient to push with their hands on the arms of their chair, or the seat if the chair has no arms. On the count of three, bend your knees and assist the patient to a standing position; pivot with the patient until the patient can feel the new chair against their legs; and lower the patient into the new chair as you bend your knees, keeping your back straight.
- ___ ___ 8. Make sure the patient is comfortable with their hips against the back of the chair, their knees at right angles to the floor, and their feet on the floor.
- ___ ___ 9. Cover the patient's lap with a sheet or bath blanket

Performing Upper Range of Motion Checklist

The patient may be sitting in a chair or laying in a bed; each exercise is repeated 3-5 times. This is done on one side, and can be done on the other side after the first arm is finished.

S U

- ___ ___ 1. Introduce yourself, identify the patient, and explain what you will be doing.
- ___ ___ 2. Provide privacy and lock the wheels of the bed, if a bed is being used.
- ___ ___ 3. Wash your hands.
- ___ ___ 4. Start with the shoulder nearest to you.
 - ___ ___ a. Support the patient's arm by placing one hand at the elbow and the other at the wrist.
 - ___ ___ b. Flex the shoulder by raising the arm in front of the body, and then above the head.
 - ___ ___ c. Extend the shoulder by bringing the arm back down to the side.
 - ___ ___ d. Abduct the shoulder by moving the arm straight out to the side.
 - ___ ___ e. Adduct the shoulder by moving the arm back to the body.
- ___ ___ 5. Exercise the elbow nearest to you.
 - ___ ___ a. Support the patient's arm by placing one hand at the elbow and the other at the wrist.
 - ___ ___ b. Flex the elbow by bending the forearm and hand up to the shoulder.
 - ___ ___ c. Extend the elbow by moving the forearm and hand down to the side.
 - ___ ___ d. Pronate by turning the palm of the hand down.
 - ___ ___ e. Supinate by turning the forearm and hand so the palm is up.
- ___ ___ 6. Exercise the wrist nearest to you.
 - ___ ___ a. Support the patient's wrist by placing one hand above it and the other hand below it.
 - ___ ___ b. Flex the wrist by bending the hand down toward the forearm.
 - ___ ___ c. Extend the wrist by straightening the hand.
 - ___ ___ d. Hyperextend the wrist by bending the top of the hand back toward the forearm.
 - ___ ___ e. Move the hand at the wrist toward the thumb side (radial deviation).
 - ___ ___ f. Move the hand at the wrist toward the little finger side (ulnar deviation).
- ___ ___ 7. Exercise the fingers and thumb on the hand nearest you.
 - ___ ___ a. Support the patient's hand by placing one hand at the wrist.
 - ___ ___ b. Flex the fingers to form a fist.
 - ___ ___ c. Extend the fingers to straighten them.
 - ___ ___ d. Perform opposition by touching the thumb to the tip of each finger.

Performing Lower Range of Motion Checklist

The patient must be lying down to do this. This is done on one side of the body and can be done on the opposite side after the first leg is finished.

S U

- ___ ___ 1. Introduce yourself, identify the patient, and explain what you will be doing.
- ___ ___ 2. Provide privacy and lock the wheels of the bed.
- ___ ___ 3. Wash your hands.
- ___ ___ 4. Uncover the leg nearest you and exercise the hip.
 - ___ ___ a. Support the patient's leg by placing one hand under the knee and the other hand under the ankle.
 - ___ ___ b. Abduct the hip by moving the entire leg out to the side.
 - ___ ___ c. Adduct the hip by moving the leg back toward the body.
 - ___ ___ d. Flex the hip by bending the knee and moving the leg toward the abdomen.
 - ___ ___ e. Extend the hip by straightening the knee and moving the leg back to the bed.
 - ___ ___ f. Medially rotate the hip by turning the leg toward the midline.
 - ___ ___ g. Laterally rotate the hip by turning the leg toward the side.
- ___ ___ 5. Exercise the knee nearest to you.
 - ___ ___ a. Support the patient's leg by placing one hand under the knee and the other hand under the ankle.
 - ___ ___ b. Flex the knee by moving the lower leg back toward the thigh.
 - ___ ___ c. Extend the knee by straightening the leg.
- ___ ___ 6. Exercise the ankle nearest you.
 - ___ ___ a. Support the patient's foot by placing one hand under the foot and the other hand behind the ankle.
 - ___ ___ b. Dorsiflex the ankle by moving the toes and foot up toward the knee.
 - ___ ___ c. Plantar flex the ankle by moving the toes and foot down away from the knee.
 - ___ ___ d. Rotate the ankle clockwise and then rotate the ankle counterclockwise.
- ___ ___ 7. Exercise the toes on the foot nearest you.
 - ___ ___ a. Rest the patient's leg and foot on the bed.
 - ___ ___ b. Abduct the toes by moving them away from each other.
 - ___ ___ c. Adduct the toes by moving them together.
 - ___ ___ d. Flex the toes by curling them down toward the bottom of the foot.
 - ___ ___ e. Extend the toes by straightening them.

Movement of the Body Worksheet

1. The movement in the body is accomplished by the _____ System.
2. The arms and legs are like a machine called a _____.
3. An example of a first-class lever is _____.
4. Draw a picture or diagram of a first class-lever. Label the fulcrum, the effort, and the load.

5. An example of a second-class lever is _____.
6. Draw a picture or diagram of a second-class lever. Label the fulcrum, the effort, and the load.

7. An example of a third-class lever is _____.
8. Draw a picture of a third-class lever. Label the fulcrum, the effort, and the load.

9. The most common lever in the body is _____.
10. What is the importance of using correct body mechanics?

11. List 5 rules of body mechanics and give an example of when each could be used in a healthcare setting.

12. The healthcare worker should use the muscles of the arms and legs to lift, and not the muscles of the back. Briefly explain why.

13. Match the terms on the left with the correct definition on the right.

- | | | |
|-------|----------------------|----------------------------------------------------------------|
| _____ | 1. Abduction | a. shrink (as a muscle) |
| _____ | 2. Pronation | b. the feet |
| _____ | 3. Posture | c. movement toward the midline |
| _____ | 4. Flexion | d. moving in a circle |
| _____ | 5. Atrophy | e. the position of body parts in relation to each other |
| _____ | 6. Inversion | f. the science of fitting the work to the worker |
| _____ | 7. Range of Motion | g. movement toward the thumb side |
| _____ | 8. Body mechanics | h. the complete extent of movement of which a joint is capable |
| _____ | 9. Adduction | i. turning a body part downward |
| _____ | 10. Base of support | j. bending at a joint |
| _____ | 11. Supination | k. straightening a joint |
| _____ | 12. Ergonomics | l. turning a body part inward |
| _____ | 13. Extension | m. moving a body part upward |
| _____ | 14. Rotation | n. movement away from the midline |
| _____ | 15. Radial deviation | o. using the body in a careful and efficient way |

Key to worksheet

1. The Musculoskeletal System
2. A lever
3. The joint between the skull and the atlas of the spinal column
4. The fulcrum is the joint at the atlas and the vertebra, the effort is the contraction of the muscles in the back, and the load is the head
5. Raising the body on the toes
6. The point of contact of the foot with the floor is the fulcrum, the effort is the contraction of the gastrocnemius, and the load is the foot
7. Flexing the forearm at the elbow
8. The fulcrum is the elbow, the effort is the contraction of the biceps, and the load is the hand or its contents
9. A 3rd class lever
10. To protect yourself from being injured especially musculoskeletal injury and to protect the patient from injury
11. Any five of the principles listed in the key points – examples will vary
12. The strongest muscles are in the arms and legs; the back muscles are not as strong
13. Matching
 1. n
 2. i
 3. e
 4. j
 5. a
 6. l
 7. h
 8. o
 9. c
 10. b
 11. m
 12. f
 13. k
 14. d
 15. g