

# Body Mechanics and Range of Motion I

**Course**

*Principles of Health Science*

**Unit XIII**

*Promotion of Safety*

**Essential Question**

*How can the health care provider properly apply the principles of body mechanics to minimize personal and client injury?*

**TEKS**

*130.202  
1 H, 10A, 10B, 10C*

**Prior Student Learning**

*Knowledge of communication with clients and OSHA lesson.*

**Estimated time**

*1.5 – 3 hours*

**Rationale**

Health care 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:

- Identify the principles of body mechanics
- Demonstrate the techniques of moving patients
- Perform correct body mechanics

**Engage**

Demonstrate proper use of back braces used to prevent worker back injuries while lifting patients, either with images or with actual braces.

**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. Type and extent of movement is determined by the load or resistance that is moved
    3. Arms and legs are like a machine
    4. Actions 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 a 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
        1. Placement of the fulcrum lies between the pull and the load as in a set of scales
        2. Head being tipped backward on the atlas
        3. Facial portion of the skull is the load; the joint between the skull and atlas is the fulcrum and muscles of

the back produce the pull

b. Second Class Levers

1. The load lies between the fulcrum and the joint at which the pull is exerted
2. Raising of the body on the toes
3. Point of contact between the toes and the ground is the fulcrum, load is located at the ankle and the pull is exerted by the gastrocnemius (the muscle in the calf)

c. Third Class levers

1. Pull is exerted between the fulcrum and resistance or load to be moved
2. Flexing of the forearm at the elbow joint as in lifting a hand weight
3. Load is the weight in the hand, the pull is the biceps brachii muscle and the fulcrum is the elbow
4. This is the most common lever in the body

C. **Proper Posture** ( position of body parts in relation to each other) and **Body Mechanics** (using all body parts efficiently and in a careful way) is necessary in to order to limit stress and strain on the musculoskeletal system

a. Lifting, pushing or pulling increases stresses on musculoskeletal system

b. Principles

1. Use the larger and stronger muscles to perform work (shoulders, upper arms, hip and thighs)
2. Maintain the center of gravity of the body close to the center of the base of support (feet provide a base of support for humans)
3. Keep the combined center of gravity of the Health Care worker and the object or person to be moved centered within the base of support (hold objects to be moved close to you)
4. Have a base of support that is the appropriate size and shape

III. 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 instead of lifting the item

C. Maintain a wide base of support (feet approximately 12 inches apart)

D. Get help if object feels too heavy to lift

E. Lift in a smooth motion to prevent injury

F. Maintain good posture

- G. Avoid twisting the body; turn your whole body ; face the area in which you are working
  - H. Bend knees, keep back straight, spread feet about one foot apart, use leg muscles when lifting
  - I. Keep objects close to your body when lifting, moving or carrying them
  - J. Avoid unnecessary bending and reaching: raise bed or overbed table to your waist level
- IV. When to use Body Mechanics
- A. At all times, that you have to lift, move or carry an item
    - 1. In everyday daily activities, e.g. cleaning, carrying books to school and to class, getting in and out of a car
    - 2. In Health Care setting, e.g. when assisting a patient to a chair, when picking up supplies, when positioning a patient in bed.
- V. 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>)
- VI. Range of Motion: the complete extent of movement of which a joint is capable
- A. Used when doing routine activities such as bathing eating and dressing; uses muscles that keep many joints in effective range of motion
  - B. Purpose of Range of Motion
    - a. To prevent problems caused by a lack of movement
    - b. To prevent problems caused by inactivity
      - 1.contractures: a tightening and shortening of a muscle e.g. footdrop
      - 2.Muscles may atrophy (shrink) when they are not used
      - 3.Joints become stiff
      - 4. Blood clots and decubitus ulcers may develop
  - C. Active Range of Motion: movements performed by the patient without help
  - D. Passive Range of Motion: 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 them

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 so that
9. Repeat each exercise 3-5 times

#### F. 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. Discuss and demonstrate safe ways to use the body as a mechanical tool. See Body Mechanics Procedural Guidelines.
- II. Complete the Body Mechanics Activity.
- III. Complete the Range of Motion Activity.
- IV. Formulate a plan of action to move clients who have conditions that complicate or inhibit movement.
- V. Complete Body Movement Worksheet.

#### Assessment

Body Mechanics Worksheet Key

#### Materials

<http://www.dads.state.tx.us/providers/NF/credentialing/NATCEP/cna.pdf>

Nurse Aide Curriculum

<http://www.osha.gov/SLTC/etools/hospital/hazards/ergo/ergo.html>

E-tool designed by OSHA for ergonomics

[http://www.osha.gov/SLTC/pdf\\_files/achback.pdf](http://www.osha.gov/SLTC/pdf_files/achback.pdf)

Your Aching Back: A Look at Back Strain in the Workplace

**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 develop a care plan for a client at home that needs mobility assistance.

**National and State Education Standards**

National Health Science Cluster Standards

HLC06.01 Safety, Health, and Environmental

Health care workers will understand the existing and potential hazards to clients, co-workers, and self. They will prevent injury or illness through safe work practices and follow health and safety policies and procedures.

**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.

**Texas College and Career Readiness Standards**

English Language Arts

II. B. Understand new vocabulary and concepts and use them accurately in reading writing and speaking.

III. B. Develop effective speaking styles for both group and one on one situations.

IV. A. Apply listening skills as an individual and as a member of a group in a variety of settings.

## PROCEDURAL GUIDELINE – BODY MECHANICS

### A. Purpose

1. To maximize strength
2. To avoid injury to the nurse aide and the resident

### B. General Guidelines and Precautions for Lifting and Moving

1. Wear loose clothing and low heeled, comfortable, non-skid shoes to allow good body mechanics.
2. Always get help from co-workers when needed before lifting heavy objects or residents who are unable to stand.
  - a. Plan the lift ahead of time.
  - b. Lift on signal such as "on the count of three."
3. Elevate the bed to comfortable working height when working at the bedside. Remember to return the bed to the lowest horizontal position when finished for resident safety.
4. Maintain good posture and good body alignment while lifting.
  - a. Keep your back straight.
  - b. Keep your knees bent.
  - c. Keep your weight evenly distributed on both feet.
  - d. Keep your feet at shoulder width (about 12 inches apart) to provide a broad base of support.
5. Use the strongest and largest muscles to do the job. Leg and arm muscles are the strongest. Back and abdominal muscles are the weakest.
6. Bend from the hip and knees--not waist--when lifting objects.
7. Always squat down to lift heavy objects from the floor.
8. Keep objects close to your body when lifting and carrying.
9. Use both hands when lifting or moving heavy objects.
10. Slide, push or pull heavy objects rather than lifting them, when possible.
11. Use the weight of your body to help push or pull objects.
12. Work with smooth, even movements--not quick, jerky motions.
13. Face your work and avoid twisting your body.
14. To change the direction of your work, take short steps and turn your whole body without twisting your back and neck.
15. Avoid unnecessary bending and reaching.

## **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/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/she is facing the student.
3. Give the student a heavy container or book and ask the student to hold it at arms length for several minutes. 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) and place it 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.

## 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 health care setting.

12. The health care 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. position of body parts in relation to each other         |
| _____ 6. Inversion         | f. science of fitting the work to the worker                |
| _____ 7. Range of Motion   | g. movement toward the thumb side                           |
| _____ 8. Body mechanics    | h. complete extent of movement of which a joint is possible |
| _____ 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 vertebrae of the spine
4. The fulcrum is the joint at the atlas and the vertebra, the effort is the contraction of the muscles in the back, the load is the face
5. Raising the body on the toes
6. Point of contact of the foot with the floor is the fulcrum, the effort is the contraction of the gastrocnemius, the load is the foot
7. Flexing the forearm at the elbow
8. Fulcrum is the elbow, effort is the contraction of the biceps, the load is the hand or what is in the hand
9. A 3<sup>rd</sup> 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. L
  15. G