

Human Body Mechanics, ergonomics and the Workplace

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Objectives:

- Identify how the human body works and its limitations.
- Understand the dangers associated with lifting heavy loads, uncomfortable or odd positions, repetitive movements and the use of vibrating tools (musculoskeletal disorder).
- Understand the concept of ergonomics.
- Create a comprehensive plan to prevent musculoskeletal disorders.

Activity 1: Icebreaker Muscle strengthening exercises

We will do muscle strengthening exercises with the participants. Between each exercise, the facilitator will throw the ball to a participant who will have to answer a question the facilitator will ask. That participant can then throw the ball to another person and so on. This activity will serve as a pre-test, as well as teach participants how to do muscle strengthening exercises that will help them perform better in their jobs.

Introduction:

Tell participants that many of the aches we feel in our bodies are related to the type of work we do. You can remind them of the body mapping exercise if necessary. Our posture, how we move, overexerting our muscles, the time spend in one position (be it sitting or standing), or being in an awkward position are all factors that cause physical disorders and injuries depending on the type of work we do.

These types of ailments are called musculoskeletal disorders and they can affect the muscles, joints, tendons, ligaments, bones and nerves.

Since most jobs require the use of our arms and hands, the majority of disorders affect the hands, wrists, elbows, neck and shoulders. The use of the legs for work tasks can lead to problems in the legs, the hips, the knees, the ankles and the feet. Problems of the back also can be the result of work.

These types of disorders usually generate little by little, either by the work itself or because of the working conditions. These ailments can also be caused by previous accidents in which you've fractured or dislocated a bone.

Explain to the participants that in order to understand why our body hurts with certain positions and movements, it is important to understand the mechanics of the human body.

Activity 2: Mechanics of the Human Body – The Locomotor System.

Notes for the facilitator: During this activity we will explore the basics of how the body's locomotor system works with the use of a video of the human body and the parts that are affected by work.

The locomotor system is made up of the skeletal system, the muscular system and the nervous system, which are the nerves, muscles, bones and joints.

The bones provide rigidity to the body and protect vital organs.

The joints allow us to flex certain parts of the body.

The muscles help us move.

The nervous system helps us to motivate and control our movements.

Notes for the facilitator: This is the text to the video, which is designed to give participants a visual of the musculoskeletal system so that they can see the parts in their bodies that get hurt.

“There are approximately 206 bones that make up the skeleton in the human body. These have many functions, such as protecting our vital organs and supporting us. At the ends of the bones are highly polished surfaces covered by cartilage, which serve to articulate with neighboring bones. The central part and the ends of the bones are joined by cartilage. The joints are responsible for joining our bones, which allows us to flex and rotate some parts of our body. They are like very tough rubber bands that unite our bones. In addition we have muscles, which are fibers that shrink and stretch to help us have mobility. The nervous system is responsible for the coordination and stimulation of muscles to produce movement.”

Activity 3: How is our movement system damaged?

When our musculoskeletal system is damaged, these injuries are called musculoskeletal disorders (MSDs). They are basically a variety of conditions that affect the muscles, bones, and joints. The severity of MSDs can vary and they occur mainly in the back and the upper and lower extremities.

Let's explore some of the factors that cause musculoskeletal disorders (MSDs). Ask participants if they have ever felt pain during work because of the position in which they perform their tasks, the pressure at work, or the type of work they do. Allow participants time to think about each question and whether they have felt pain, then ask them to raise their hands. Give them time to respond and then explain the factors that can lead to MSDs.

1. The organization at work:

- Pace of work
- Intensity

- Work load
- Time pressure
- Stress
- No pauses and breaks
- Repetitive work

2. Tasks, equipment and tools:

- Apply intense force
- Apply moderate force repeatedly
- Repetition of fast movements
- Short working cycles
- Awkward or forced postures
- Muscle inactivity, immobility and sedentary work
- Poorly designed workspace, or workspace not adapted to the task
- Inadequate tools
- Lack of space
- Messy work areas

3. Work environment conditions:

- Insufficient or excessive ventilation
- Noise
- Illumination
- Vibrations
- Cold weather
- Hot weather

4. Individual characteristics of the worker:

- Age
- Sex
- Physical complexion
- Physiological state
- Right or left-handed
- Absence or insufficiency of training

Many of these disorders are acute and painful while others are chronic and long lasting while also being painful.

These are some of the symptoms:

- Pain in specific parts of your muscles or joints.
- Rigidity occurs with more frequency in the nape of the neck, back and shoulders.
- Sensation of tingling, numbness and stiffness on the limbs.
- Burning sensation.
- Loss of strength.

- Loss of ability to grip objects.
- Loss of feeling in the affected area.
- Continuous muscle fatigue.
- Loss of coordination.
- Limited ability to move the affected area.

Let's explore the hazards that cause damage to our movement system:

Notes for the facilitator: Using pictures, explain each of the positions and movements that our bodies have to do at work based on the following descriptions. Then ask participants to respond whether they think the position or movement can hurt the person or not and why.



Manipulation of heavy objects- When we load, lift, push, drag, or hold something we are using too much strength and therefore putting a lot of strain on our muscle tissues and ligaments.

When we manipulate heavy objects for long periods of time, our musculoskeletal system may fail, especially when we do so for several months or years. We need to take into account the duration, frequency, and how much effort is applied to labor activities.

Another common injury is caused by the frequent and repeated manipulation of objects, even if you don't need to use much strength. The damage is caused by the excessive effort to which the parts and fibers of the muscle undergo during long periods of time.

The spine gets too strained when we flex, stretch or twist our torso too much while working, which makes all the muscles work harder. There is more risk for a spinal injury if we bend and turn the torso at the same time.

Working on the knees, crouching or squatting also affects various parts of the musculoskeletal system. Likewise, sitting for a long time or holding the same posture is also bad.

When muscles remain under tension for a long time, it is called static muscular effort. Basically, the muscles remain contracted for a few minutes, without allowing the joints to move. If there are no breaks, the muscles become fatigued and then they begin to hurt.

Notes for the facilitator: The static efforts obstruct the flow of blood through the muscles, it is important that the contraction effort is alternated with the relaxation of the muscle so that the blood flows. When the blood is not flowing appropriately to the muscle, it is possible to notice with the swelling of the arms or legs.

When we don't use our muscles, they lose their physical ability, which is also a factor that causes problems to the locomotor system. When this happens, the muscle is not able to adequately stabilize joints and ligaments, making it difficult to coordinate, there is pain, rare movements, and the joints have to work hard. Repetitive movements, or when moving again and again the same parts of the body, can cause injuries that can be quite painful such as the carpal tunnel syndrome and can also cause numbness, clumsiness, and loss of mobility, flexibility and strength in the area.

When the locomotor system is subjected to vibration, such as when using a drill, it can result in dysfunction of the nerves, abnormal circulation of blood (especially in the fingers), and degenerative disorders of the bones and joints of the arms. When the vibrations affect the entire body, such as when handling heavy machinery and tractors, they can cause degenerative disorders, especially in the lumbar region, such as disorders of the spine, and causing or aggravating injuries of the intervertebral discs.



Environmental conditions may also have an effect on the mechanical effort and increase the risk of locomotor disorders. For example, the risk of damage when using vibrating tools increases if you are working in very cold temperatures. Also, the lighting conditions can be a potential risk; when the light or visibility are insufficient, the muscles suffer more, especially in the shoulders and neck.

Tension and stress are also risk factors, because they accentuate muscle tension, they affect the motor coordination and enhance the physical effort.

Activity 4: What is ergonomics?

Ask participants what they know about ergonomics. Allow time for them to respond. Then explain the following: The ergonomic study of the conditions of work seeks to adapt the products, the tasks, the tools, the spaces and the general environment at work to the capacity and needs of the workers. The ergonomic approach at work consists of designing the products and the tasks so that these adapt to the workers and not the other way around.

How do I apply ergonomics to my work?

Explain to the participants: as always, observing the work place before beginning our task is an effective way of preventing accidents and injuries. Remember to always “observe, judge and act”! When we examine our working conditions and the activities that we do, it is easier to apply the principles of ergonomics, so as to

address or prevent problems. Even minor ergonomic changes at work can help in ensuring the worker is more comfortable, and thus the health, safety and productivity of the worker are secured.

Here are some examples of ergonomic changes:

- For detailed work that requires close inspection of the materials, the workbench must be lower than when performing heavier tasks.
- For the tasks of assembling, the material must be located in such a position that the strongest muscles of the worker do most of the work.
- You have to modify or replace hand tools that cause discomfort or injury. Workers are often the best source of ideas on how to improve a tool to make it more comfortable to handle it. Thus, for example, clips can be straight or curved, as appropriate.
- No task should require workers to adopt unnatural postures; such as having the arms extended all the time or bent for a long time.
- Workers must be trained on the adequate ways to lift heavy loads. Any well-designed task must minimize how much and how often workers should lift heavy objects.
- Tasks that require workers to be standing long periods of time should be minimized because oftentimes it is less strenuous to perform a task sitting than standing.
- The tasks must be rotated to diminish the time that a worker dedicates to a repetitive task because the repetitive tasks require use of the same muscles over and over again.
- Equipment must be adjusted so that workers can perform their tasks with the forearms close to the body and with the wrists straight.

Note to the facilitator: As you describe each of the previous examples, you can show the movements to give participants a visual.

Activity 5: Let's practice some basic ergonomics principles that can be applied to work

Notes for the facilitator: This section will be done using cardboard blocks. Participants will simulate movements that are often done at work to identify the difference between performing tasks in a safe manner versus being unsafe, using basic ergonomic principles. The facilitator will place the cardboard blocks in a

wrong position and ask participants to move the cardboards to a safe position as described in each of the following examples:

Head height

There must be enough headroom for the tallest worker to fit comfortably. Any objects that the workers have to observe while working must be at the height of their eyes or a little lower since people tend to look down a little.

Shoulder height

Any control panel must be placed at a height between the shoulders and the waist. Placing any objects or control panels above shoulder height must be avoided, especially if they are used frequently.

Reach of the arms

Objects must be located as close as possible to the arm's reach to avoid having to extend the arms too much to reach for them or take them out. The objects necessary to work must be placed in a manner that the tallest worker does not have to stoop to reach them. All materials and tools often used should be kept near the worker and in front of him/her.

Elbow height

The work surface must be adjusted to the height of the elbow or slightly lower for the majority of the general tasks.

Hands height

We must ensure that any objects that must be lifted or carried are at a height between the hands and the shoulders.

Length of the legs

The height of the seat must be adjusted to the length of the legs and to the height of the work surface. There must be room to be able to stretch the legs, with enough space for someone that has long legs. There must be an adjustable footrest, so that the legs do not hang and the worker can switch positions

Activity 6: How do we make things easier at work?

Using different scenarios, workers will have to come up with a response plan to activities at work that could potentially put them at risk of developing a musculoskeletal disorder. Review each scenario and ask participants to name work tasks that require them to adapt that particular position. For example, a gardener may have to bend forward to cut weed. After you have reviewed all the positions listed below, divide the workers in three teams. Each team will have to come up with alternatives to doing those positions at work based on the principles of ergonomics. Each group will present their alternatives. Here are the scenarios:

- Bending forward

- Reaching above shoulder level
- Reaching behind the body
- Rotating the arms
- Bending the wrist
- Manipulating heavy objects
- Using vibrating tools

Activity 7: Exercises to Relax the Muscles (Post-test)

The facilitator will guide participants in muscle relaxing exercises. Once they finish the exercises, participants will be asked post-test questions. Participants will be provided with three different cards (one red to respond no, one yellow to respond unsure and one green to respond yes) to respond.

Pre/Post Test: Human Body Mechanics, Ergonomics and the Workplace

Questions:

1. What are musculoskeletal disorders?
2. True/False: Some of the factors that can lead to MSDs are stress, muscle inactivity and weather.
3. What is ergonomics?
4. Please demonstrate on a safe manner, the best way to lift a heavy object at work.
5. Please demonstrate on a safe manner, what is the best way to position objects around you so you don't hurt your arms when reaching for them.

Answers:

1. When our musculoskeletal system is damaged, these injuries are called musculoskeletal disorders (MSDs). They are basically a variety of conditions that affect the muscles, bones, and joints.
2. True
3. Ergonomics at work consists of designing the products and the tasks so that these adapt to the workers and not the other way around.
4. Open answer
5. Open answer

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Human Body Mechanics, ergonomics and the Workplace
Evaluation Form

Please let us know how we did:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The training met my expectations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I will be able to apply the knowledge learned.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. The training objectives for each topic were identified and followed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. The content was organized and easy to follow.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. The trainer was knowledgeable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Class participation and interaction were encouraged.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. How do you rate the training overall?					
Excellent	<input type="radio"/>				
Good		<input type="radio"/>			
Average			<input type="radio"/>		
Poor				<input type="radio"/>	
Very poor					<input type="radio"/>

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