Mechanical and Ergonomics Hazards

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Ergonomics بيئة العمل

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human wellbeing and overall system performance.

(International Ergonomics Association)

Human factors refer to environmental, organizational and job factors, and human and individual characteristics, which influence behaviour at work in a way which can affect health and safety.

What is meant by ergonomics and how important is it to workers?

Various industries are now using ergonomics increasingly in order **to enhance human productivity, quality of working environment, and occupational safety and health**.

Studies have shown that people working at ergonomic workstations or using ergonomic equipment are less likely to experience fatigue, discomfort, or stress.

What is meant by ergonomics and how important is it to workers?

In other words, ergonomics involves ‘using a special design to make tasks more compatible with humans and not to force humans to be more compatible with tasks’.

As such, ergonomics deals with various aspects ranging from physical stress on the muscles, nerves, bones, tendons, and ligaments to environmental factors which affect hearing, vision, comfort and health.

Legal Requirements And Ergonomics Application

The Occupational Safety and Health Act, 1994 ‘the employers, who create risks for their workers, must ensure the safety and health of their workers at the workplace.

One of the objectives of this act is to create working conditions that meet the physiological and psychological needs of the workers. Thus, employers are responsible of establishing a safe work system which does not pose any health risks to the workers.

Industries

Ergonomics hazards to employees are ubiquitous, واسع الانتشار affecting almost every type of work.

Ergonomics issues can also affect service users, the general public, and the environment.

They are most important in safety-critical industries, e.g. transport and nuclear industries, and in the health services.

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Ergonomics Factors

1 Task-related (physical or cognitive)

- Loading (lifting and handling)
- Poor posture
- Repetition, particularly at high speed
- Poor equipment and workplace design
- Task overload/under load
- Mental workload
- Poor system reliability
- Poor design of information, displays, controls.

2 Individual factors

- Anthropometry
- Social support
- Personality
- Attitude and behaviour
- Risk perception
- Human error

3 Organizational factors

- Long working hours
- Shift work
- Short deadlines
- Poor staffing levels
- Lack of worker involvement in system design
- Control over work.

Adverse effects of poor ergonomics design (including health effects)

- Accidents
  - Injuries
  - Musculoskeletal disease (**back, neck, and upper limb pain**)
  - Psychological morbidity (including **stress**)
  - Critical incidents (including **environmental disasters**)
  - Decreased efficiency, poor productivity
  - Failure of complex systems
  - Job dissatisfaction
  - Low staff morale
  - High job turnover.

Lifting and handling

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Lifting and handling

Manual lifting or handling of loads constitutes one of the most common

and important ergonomics hazards.

Definition

The term **manual handling** comprises any non-mechanized (or incompletely mechanized) **manipulation of a load**, including lifting, pushing, pulling, sliding, or carrying. Loads may be inanimate or living (people and animals).

Specific industries

Manual handling is a ubiquitous exposure, which is common in a wide range of industries.

- Construction
- Warehousing and logistics
- Heavy engineering
- Airport baggage handling
- Agriculture
- Health care (patient-handling).

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Health effects

- Low back pain
- Neck/shoulder pain
- Osteoarthritis of the hip.

Risk controls

The following list is not exhaustive, but includes the most common examples of risk controls.

- **Divide load into smaller units**, or scale loads up, and switch to bulk handling systems
- Ensure load is easy to grip and stable
- Arrange lifting environment free from obstacles and on level surface
- Address extremes of height, e.g. restrict transfers to levels below elbow and above knee height. Avoid lifting from the floor

Mechanical lifting aids appropriate to the task. There are many examples for different purposes. More common examples include:

- hoists, cranes, and vehicles
- powered and non-powered trucks and trolleys
- scissor lifts or other height-adjustable surfaces
- tracks, conveyors, and rollers
- specialized equipment for ‘live’ loads (patients), e.g. slide sheets.

Posture

Repetitive work

Posture

Non-neutral means that the head, trunk, or limbs deviate from the normal anatomical (neutral) position.

Repetitive work

Repetitive work includes activities that are physically repetitive, or cognitively repetitive or monotonous. Physical and cognitive aspects of repetitiveness in work tasks often interact

Health effects

Musculoskeletal disorders

- Neck–shoulder pain
- Elbow, wrist pain
- Low back pain.

Mechanical hazards

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In the operation of machines a person may be injured as a result of:

- Machine movement
- Being trapped between the machinery and materials
- Being struck by materials ejected from the machinery.

Risk controls

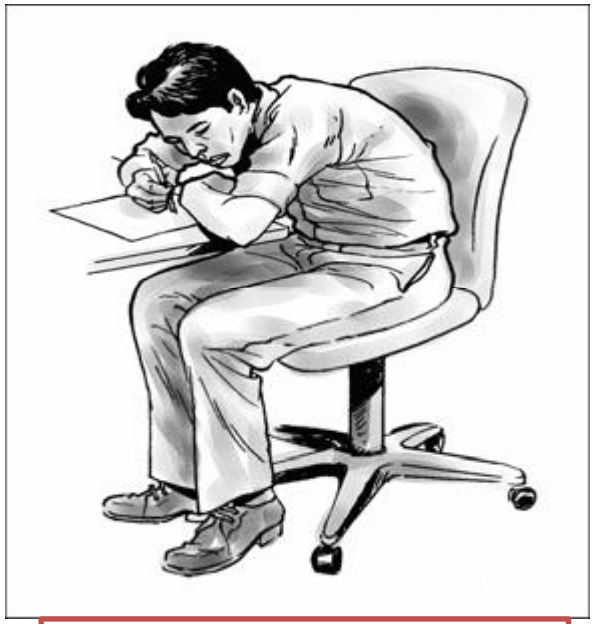
- Mechanical hazards should be considered when purchasing equipment
- Machinery should be fitted with suitable safety devices, e.g.
- machine guards
- emergency stop buttons
- interlocks to prevent operation if guards are removed
- Machinery should have appropriate warning signs
- Worker information, instruction, and training
- Safe systems of work including machine isolation before maintenance
- Personal protective equipment, e.g. safety goggles.

a stationary job: a production operator

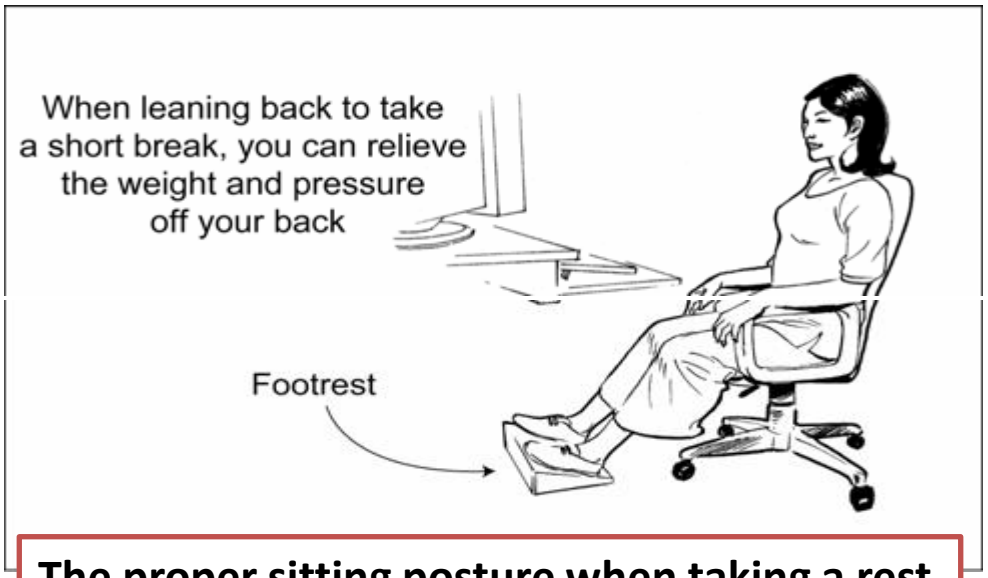
The potential for physical stress increases with stationary jobs when workers fail to take such precautions as periodically standing/ stretching/ moving.

A construction worker requires more strength/ power on the job

jobs that demand larger amounts of strength/power are generally more stressful than those requiring less.



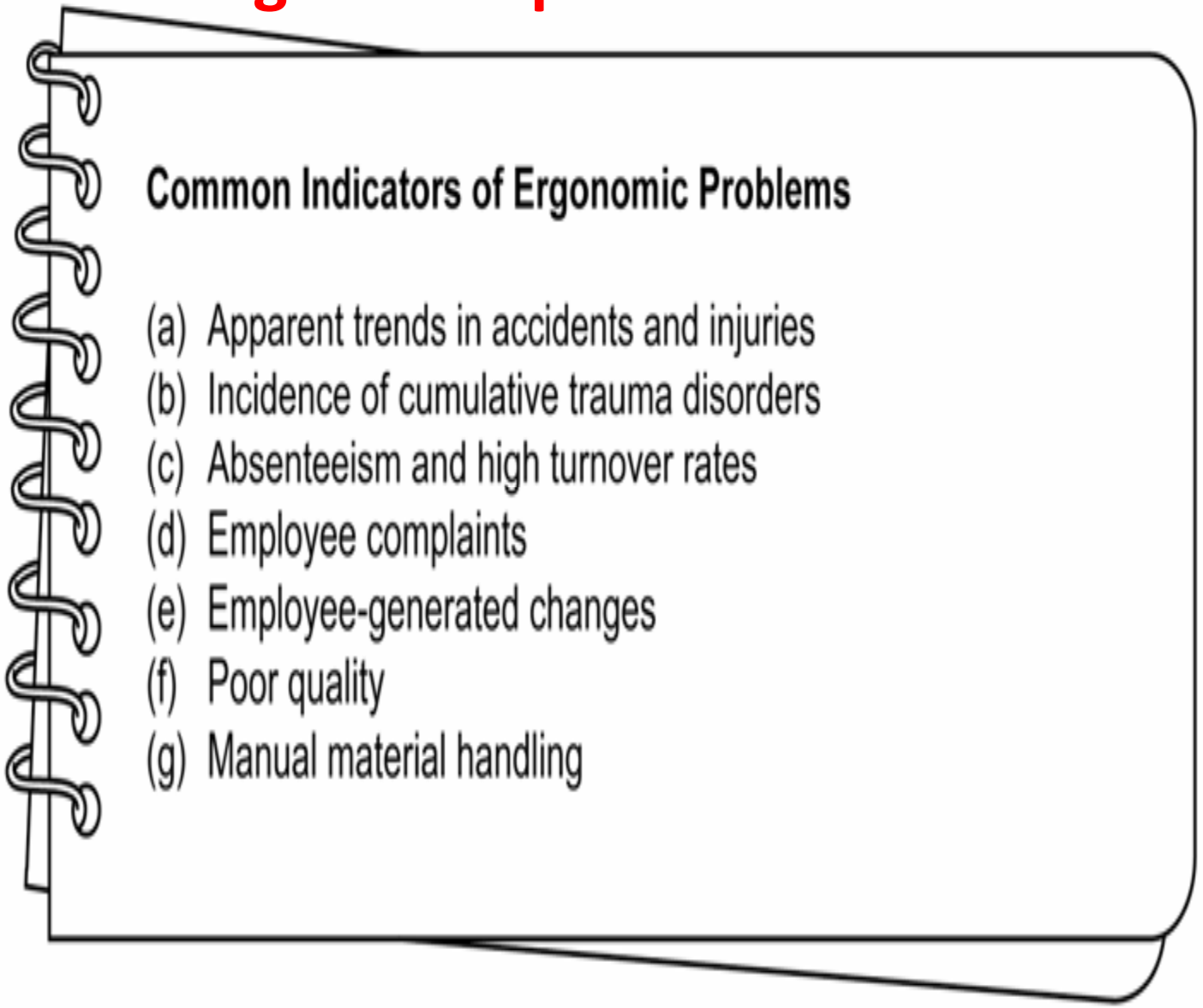
Improper sitting posture



The proper sitting posture when taking a rest

Proper sitting posture

7 Ergonomic problems indicators



Ergonomic problems indicators

(a) Apparent Trends in Accidents and Injuries

By examining **accident reports**, **record-keeping documents**, **first-aid logs**, **insurance forms**.

A high incidence rate of a specific type of injury typically indicates that an ergonomic problem exists.

Ergonomic problems indicators

(b) Incidence of Cumulative Trauma Disorders (CTDs)

Factors associated with CTDs include a high level of repetitive work, greater than normal levels of hand force, awkward posture, high levels of vibration, high levels of mechanical stress, extreme temperatures, and repeated hand-grasping.

For example, a worker who uses a concrete/asphalt breaker frequently is exposed to **White Finger Syndrome** due to high vibration.

Ergonomic problems indicators

(c) Absenteeism and High Turnover Rates

High absentee rates and high turnover rates can be indicators of ergonomic problems. People who are uncomfortable on the job to the point of physical stress are more likely to miss work or leave for less stressful conditions.

Ergonomic problems indicators

(d) Employee Complaints

A high incidence of employee complaints about physical stress or poor workplace design can indicate the presence of ergonomic problems. For example, a typist might complain that her chair is too high causing physical stress to legs and back.

Ergonomic problems indicators

(e) Employee-Generated Changes

Employees tend to adapt the workplace to their needs.

For example, workers may place additional padding on their chairs, modify protective equipment, install additional lights.

Ergonomic problems indicators

(f) Poor Quality

Poor quality, although not necessarily caused by ergonomic problems, may be the result of ergonomics.

Ergonomic problems indicators

(g) Manual Material Handling

The incidence of musculoskeletal injuries is typically higher in situations that involve a lot of manual material handling. Musculoskeletal injuries increase significantly when the job involves one or more of the following:

Lifting large and bulky objects

Lifting objects from the floor

Lifting frequently

Lifting heavy objects inappropriately and not receiving proper training can lead to musculoskeletal injuries. When such conditions exist, the company has ergonomic problems.

The following rules must be taken into consideration when adapting the job to the worker:

- Nerve conduction velocity, hand-grip strength, muscle mass, range of motion, and flexibility all begin to diminish upon reaching the age of 45.

- Weight and mass tend to increase throughout the age of the early fifties (50)

- Height begins to slowly diminish from the age of 30

- Lower back pain is more common in people 45 years of age and older

- Visual acuity at close range diminishes with age.

HAZARD PREVENTION AND CONTROL

In dealing with ergonomic problems, it is more cost-effective for employers to take proactive actions to prevent ergonomic stress.

1 **Engineering solutions**, where feasible, are the preferred method for ergonomic hazard prevention and control

HAZARD PREVENTION AND CONTROL

2 The focus of an ergonomics programme is to **make the job fit the person** not to make the person fit the job.

3 This is accomplished by **redesigning** the workstation, work methods, or tools to reduce the demands of the job, including high force, repetitive motion, and awkward postures.

HAZARD PREVENTION AND CONTROL

3 examples of engineering controls that have proven to be effective and achievable.

No.	Example	Explanation
1.	**Workstation Design**	Workstations should be designed to accommodate the persons who actually use them; it is not sufficient to design for the average or typical worker. Workstations should be easily adjustable and should be either designed or selected to fit a specific task, so that they are comfortable for the workers who use them. The work space should be large enough to allow for the full range of required movements, especially where knives, saws, hooks, and similar tools are used.
2.	**Design of Work Methods**	Traditional work method analysis considers static postures and repetition rates. This should be supplemented by addressing the force levels and the hand, arm and leg postures involved. The tasks should be altered to reduce these and the other stresses associated with cumulative trauma disorders (CTDs).

3.	**Tool Design and Handles**	Tools should be selected and designed to minimise the risks of upper extremity CTDs and back injuries. Examples of criteria for selecting tools include the following: (a) Designing tools to be used by either hand, or providing tools for both left- and right-handed workers. (b) Selecting pneumatic and power tools that exhibit minimal vibration and maintaining them in accordance with manufacturer's specifications. (c) Using handles and grips that distribute the pressure over the fleshy part of the palm, so that the tool does not dig into the palm.

Apart from engineering controls, the following steps can be used to prevent and control ergonomic problems

(a) Periodic Health Surveillance

Periodic health checks (every two to three years) should be conducted on all workers who are assigned to positions involving exposure of a particular body part to ergonomic stress.

(b) Ergonomic Programme

An effective ergonomics programme must include continuous training and education.

The purpose of training and education is to ensure that employees are sufficiently informed about the ergonomic hazards to which they may be exposed and thus able to participate actively in their own protection.

The educational programme must expose workers to:

Types of CTDs and preventive measures;

Causes of CTDs;

Early signs and symptoms of CTDs; and

Treatments for CTDs.

Through such education and training programmes, CTDs can be detected at an early stage, hence reducing their effects.

c) Early Report of CTD Symptoms

Employees should be encouraged to report early signs and symptoms of CTDs to the in-plant health facility. This allows for timely and appropriate evaluation and treatment by employers.