



ارگونومی

در محیط کار

طب کار ۵

دکتر مهناز صارمی

۲۴ مرداد ۱۴۰۰



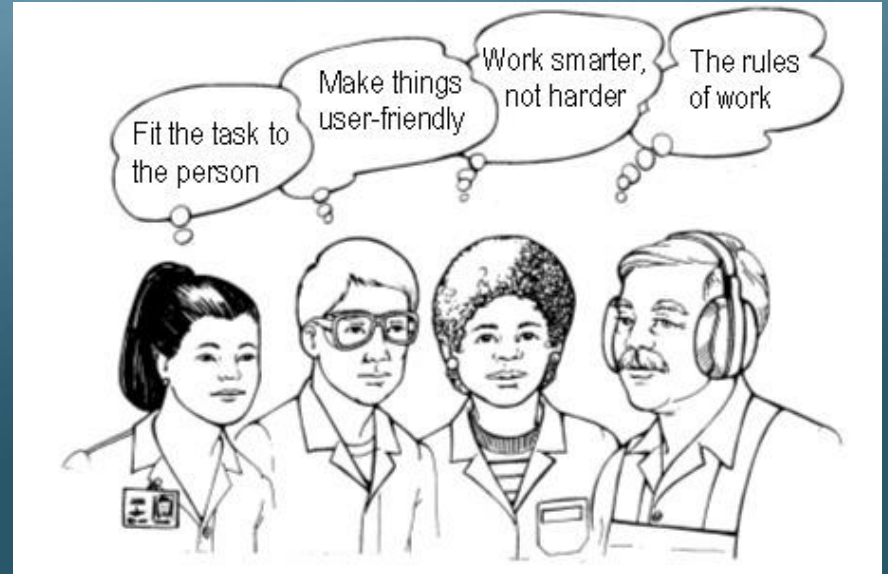
What is Ergonomics?

- ERGO = “work”
- NOMICS = “rules” or “laws”

از نظر لغوی

ارگونومی به معنی اصول و قوانین

انجام کار است



ارگونومی چیست؟

➤ طراحی کار برای تناسب کامل با کاربر

T

➤ اصلاح کاربر برای تطابق با کار

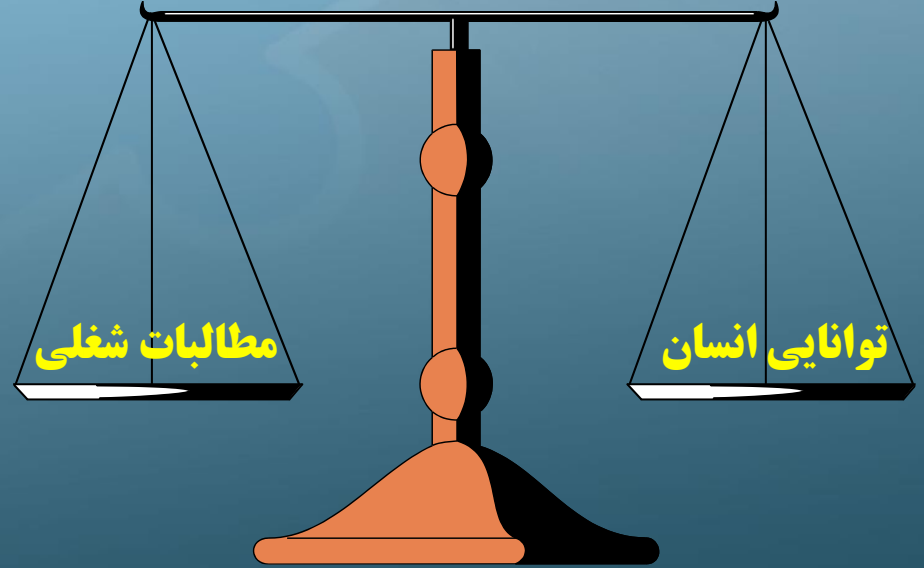
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➤ OSHA defines ergonomics as the science of

“designing the job to fit the worker, instead of forcing the worker to fit the job.”



تمرکز علم ارگونومی :



بهره وری

افزایش سرعت، دقت و
انگیزه کاری

ارگونومی

کاهش حوادث و
صدمات


ایمنی

سلامتی

کاهش بیماریهای
شغلی

کاهش فشار جسمی و
روانی

رفاه و رضایت



Ergonomic problems
encountered by workers

Consequences

- ☀ Musculoskeletal disorders (MSDs)
- ☀ Stress
- ☀ fatigue

- ☀ Reduced well-being
- ☀ Increased absenteeism, employee turnover, compensation costs
- ☀ Early retirement
- ☀ errors
- ☀ Social/family conflicts

پیامدهای منفی ناشی از عدم رعایت ارگونومی:



- ناراحتی و نارضایتی
- افزایش احتمال بروز حوادث و صدمات
- افزایش خستگی
- افزایش احتمال وقوع خطا
- شیوع انواع بیماری های مرتبط با کار
- افت کیفیت (کاربرد محصولات / ارائه خدمات)
- افت کارایی و بهره وری



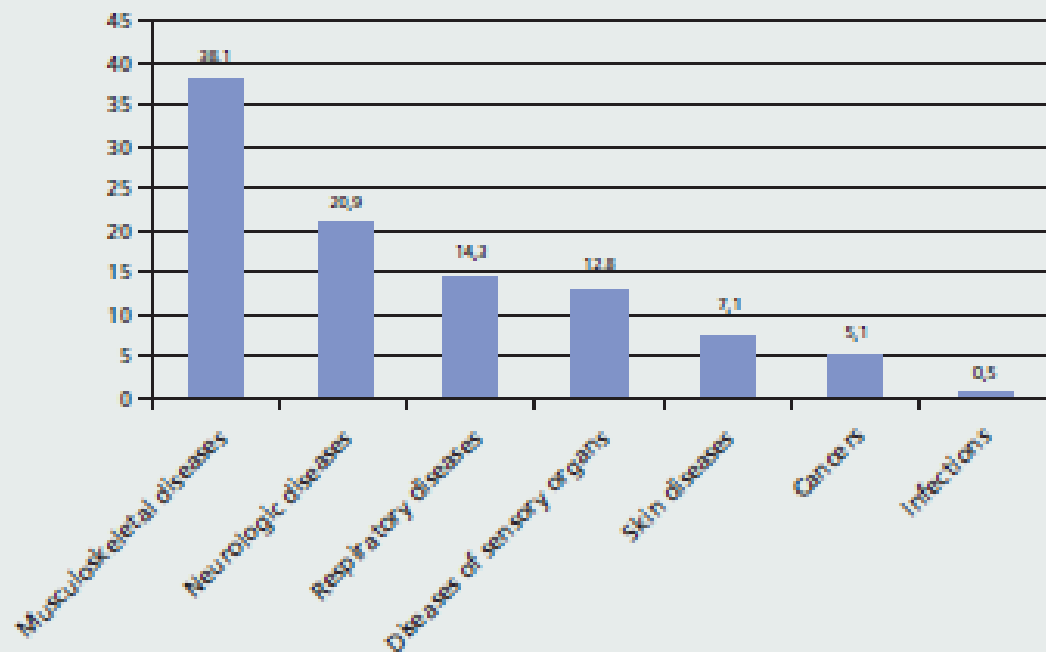
Q.

Why is ergonomics so important ?

R.

High Incidence of MSDs in workers

Figure 1: Proportion of occupational diseases in 12 EU member states according to the European Occupational Diseases Statistics obligatory list 2005



Source: OSH In figures: Work-related musculoskeletal disorders in the EU – Facts and figures, European Agency for Safety and Health at Work, 2010



Percentage of workers reporting MSDs in the past 12 months, by sector, EU-28, 2015

| | Backache | Upper limb disorders | Lower limb disorders |
|---|----------|----------------------|----------------------|
| Agriculture, forestry, fishing | 60% | 56% | 46% |
| Water supply | 53% | 49% | 40% |
| Construction | 52% | 54% | 41% |
| Human health and social work activities | 47% | 46% | 31% |
| All | 46% | 43% | 30% |

Source: Panteia based on the European Working Conditions Survey (EWCS) 2015



What are Musculoskeletal Disorders (MSDs)?

MSDs affect ligaments, muscles, tendons, cartilage, blood vessels & nerves & spinal discs

Acute:

A sudden or one-time traumatic event or incident, e.g., slip, trip, fall or car wreck

Chronic or Cumulative:

Injuries that occur over a period of time (months/years) & are caused by a combination of risk factors



Some Common MSDs

- ☀ **Strains and Sprains (neck, back, shoulder)**
- ☀ **Low Back Pain & Sciatica**
- ☀ **Bulging or Herniated Spinal Discs**
- ☀ **Carpal Tunnel Syndrome**
- ☀ **Tendinitis & Tenosynovitis (upper extremities)**
- ☀ **Epicondylitis (Tennis Elbow/Golfer's elbow)**
- ☀ **Rotator Cuff Tear (shoulder)**
- ☀ **Bursitis (shoulder or knees)**

علل اختلالات اسکلتی – عضلانی

عوامل فیزیکی و
بیومکانیکی

عوامل روانی
اجتماعی



سبک زندگی

عوامل فردی

حرکات تکراری

اعمال نیرو

وضعیت نامطلوب بدن

زمان طولانی

ارتعاش

عوامل فیزیکی و
بیومکانیکی

عوامل روانی اجتماعی

سبک زندگی

عوامل فردی



سرعت بالای کار
عدم رضایت شغلی
عدم حمایت اجتماعی در محیط کار
نیاز شغلی بالا
عدم کنترل بر روی شغل
استرس شغلی و غیر شغلی
کمبود اختیار

**عوامل فیزیکی و
بیومکانیکی**

عوامل روانی اجتماعی

سبک زندگی

عوامل فردی



چاقی
اضافه وزن
سیگار
کلسترول بالا
ورزش

عوامل فیزیکی و
بیومکانیکی

عوامل روانی اجتماعی

سبک زندگی

عوامل فردی



سن
جنس
ژنتیک
سطح تحصیلات

عوامل فیزیکی و
بیومکانیکی

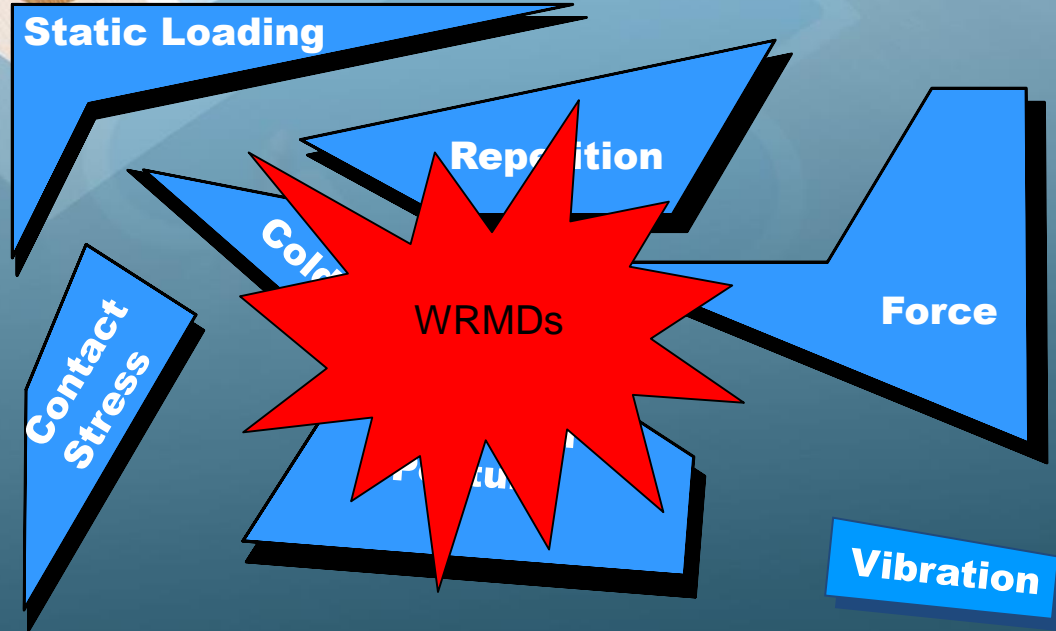
عوامل روانی اجتماعی

سبک زندگی

عوامل فردی



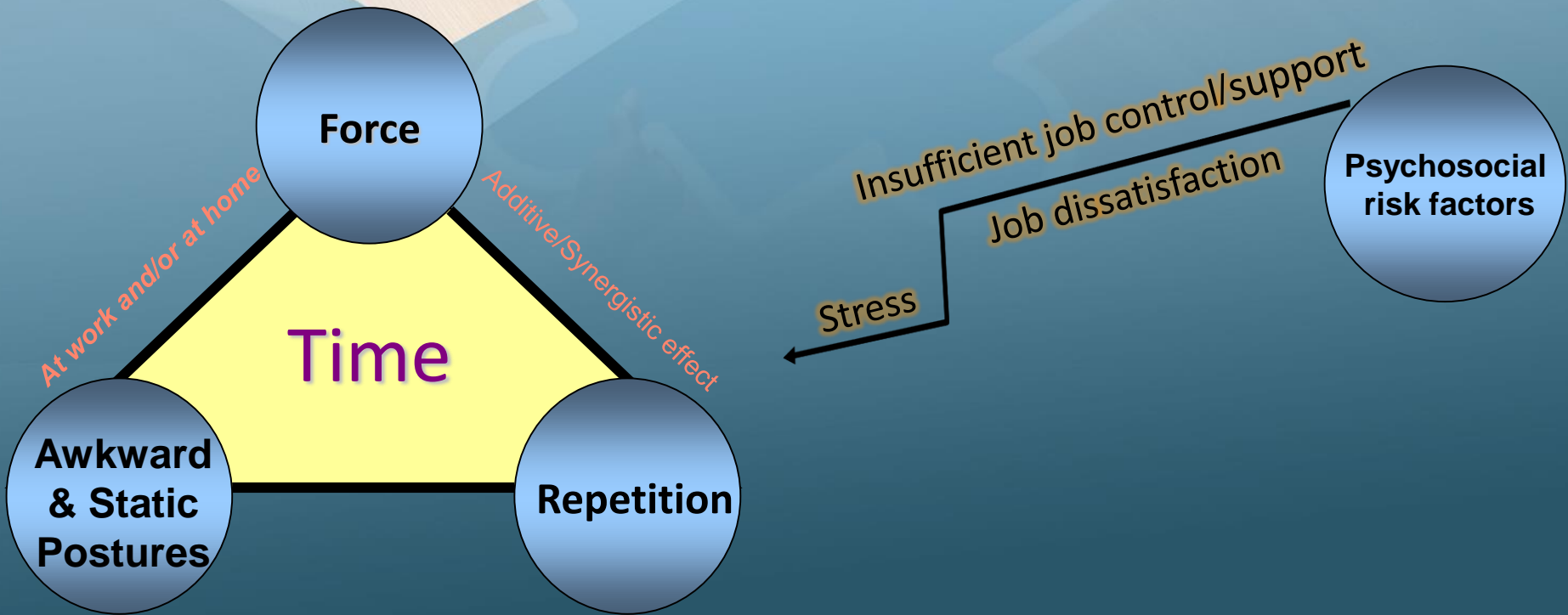
Physical task demands & risk factors cont.



Risk of injury increases with:

- Prolonged exposure to any of these ergonomic risk factors
- Presence of multiple risk factors within a single job task

Essential Risk Factors For MSDs





Awkward Posture & MSDs

Definition:

Position of the body when performing physical tasks. Assuming positions that place strain on the body (leaning over a bed, kneeling or twisting the trunk while lifting) is the frequency of the same (series of) movements.

Awkward postures cause biomechanical stress to joints and surrounding soft tissues. Strength to the body part is decreased accelerating muscle fatigue and increasing risk of injury.

Awkward Posture & MSDs

Awkward Postures include:

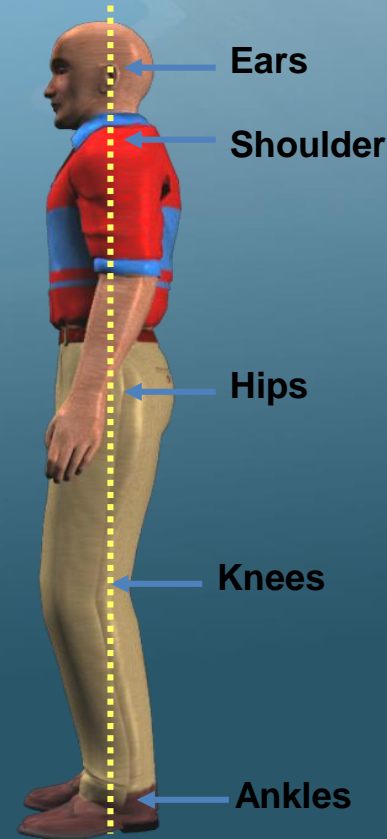
- Bending
- Twisting
- Reaching overhead
- Kneeling
- Squatting
- Pinch grips



Neutral Standing Posture

Neutral Posture for Work Performed in Standing Position

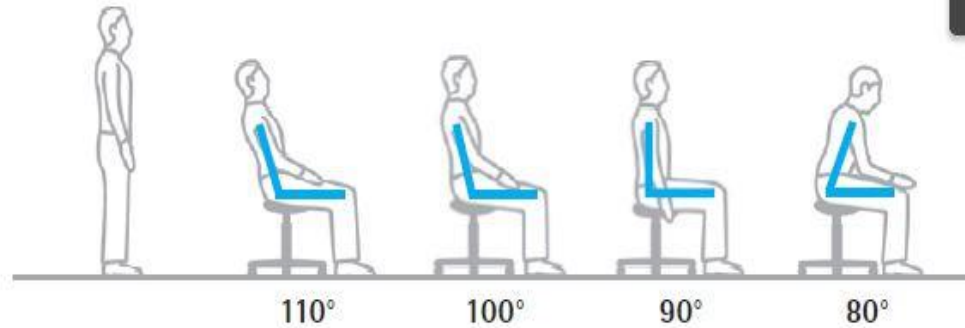
- Stand with feet shoulder width apart
- Knees are flexed/unlocked
- Head upright
- Shoulders relaxed (not rolled forward)
- Chest up
- Back straight
- Elbows not locked or flexed more than 110 degrees
- Wrists straight
- Ears, shoulders, hips, knees and ankles should be in straight alignment to maintain natural “S” curve of the spine (neutral position)



How posture affects disc pressure

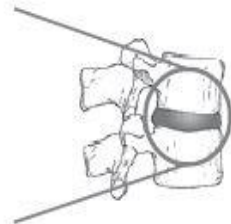
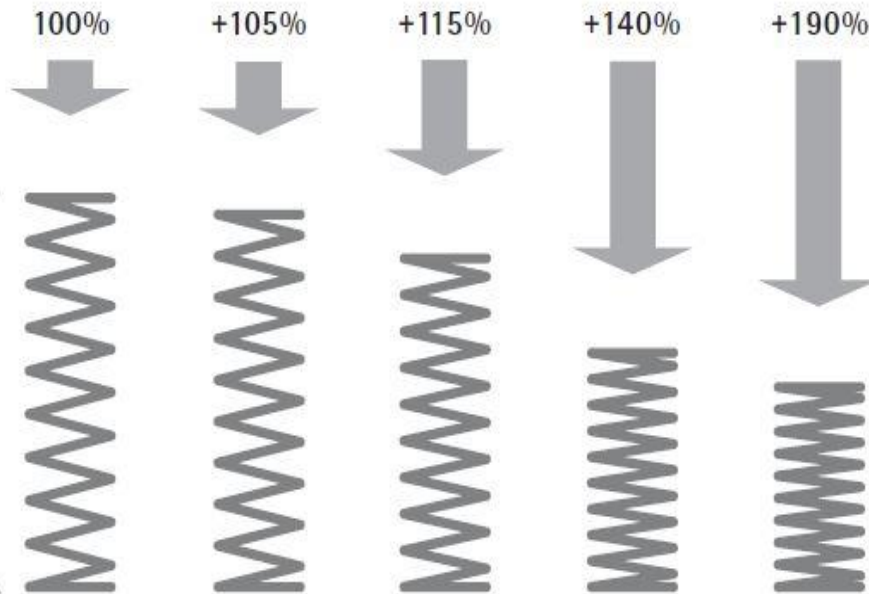
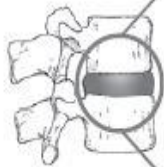
Click on Sign to activate and place signature PDF File.

Back angle



Disc pressure

The effect of four postures on the intervertebral disc pressure as measured between the 3rd & 4th lumbar vertebrae. The pressure when standing is taken as 100%.
According to Nachemson and Elfstrom.



Awkward postures



Neutral

Extension

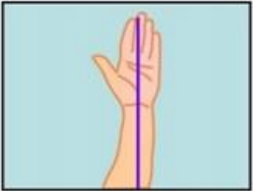
Flexion

Side Bending

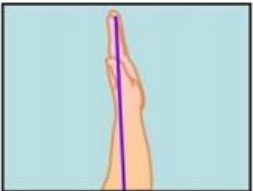
Twisting

Neutral Posture

View #1
(minimal radial/ulnar deviation)

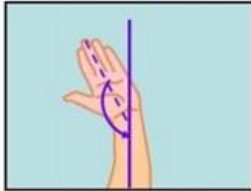


View #2
(minimal flexion/extension)

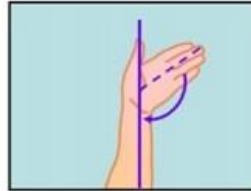


Awkward Postures

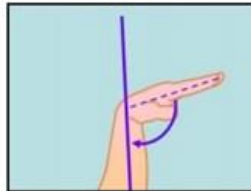
Radial Deviation



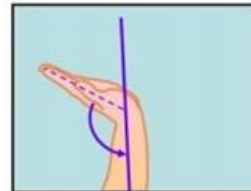
Ulnar Deviation



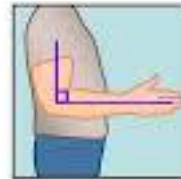
Flexion



Extension

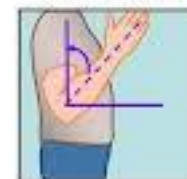


Neutral Posture

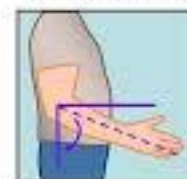


Awkward Postures

Elbow Flexion

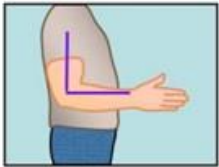


Elbow Extension



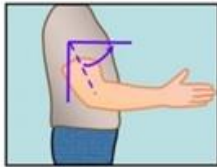
Awkward postures

Neutral Posture

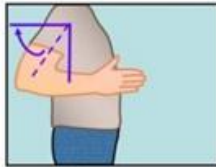


Awkward Postures

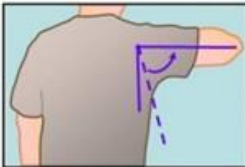
Shoulder Flexion



Shoulder Extension



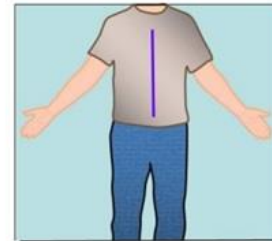
Shoulder Abduction



Shoulder Abduction & Extension

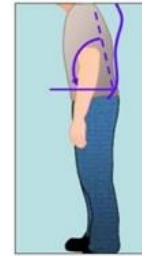


Neutral Posture

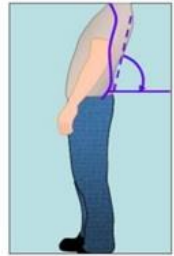


Awkward Postures

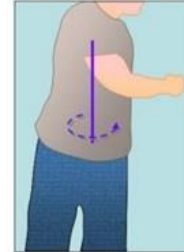
Back Flexion



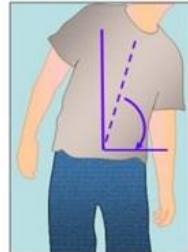
Back Extension



Twisting about Waist



Lateral Bending



Awkward postures happen when the work is:



Too low

Too high



Too far away

Awkward Posture & MSDs: Examples



(a)



(b)



(c)



Awkward Posture & MSDs: Examples





Static or Fixed Postures & MSDs

Definition:

Postures or work positions that are held for a period of time

Blood supply reduced to muscles → muscle fatigue

Static or Fixed Postures & MSDs : Examples

- Prolonged standing or sitting
- Performing tasks with static awkward posture for a few minutes or longer





Force and MSDs

Definition:

Amount of physical exertion or muscular effort expended when performing a task or activity such as lifting, pushing, pulling, carrying or gripping tools or equipment

The greater the force exerted and/or sustained over time accelerates muscle fatigue and increases risk of injury



Force and MSDs: examples



Repetitions and MSDs

Definition:

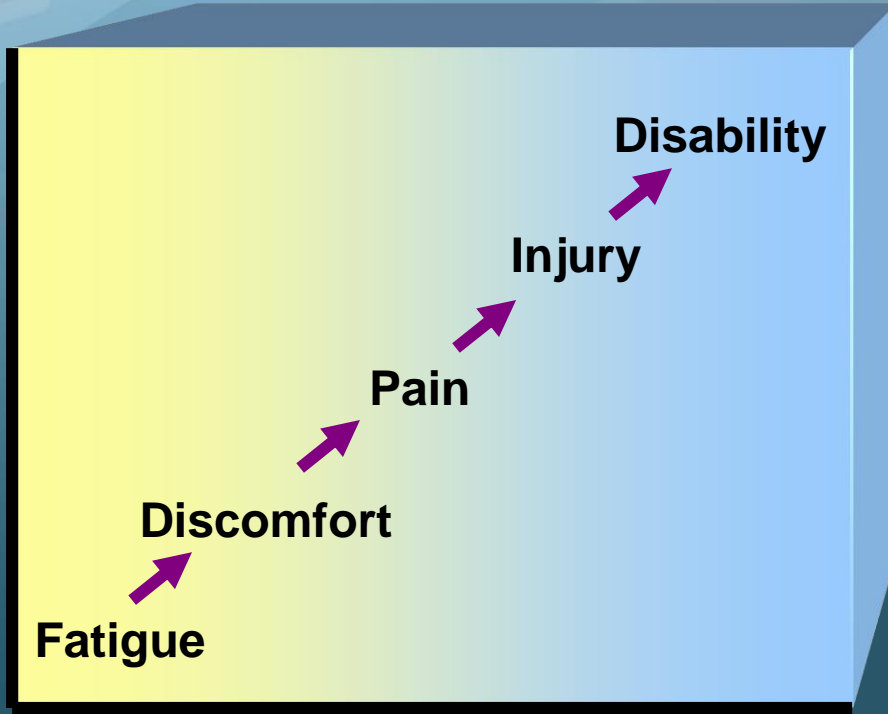
Performing the same motion over and over again or the frequency of the same (series of) movements

Example:



The Cumulative Effect

Continued
Exposure
to
Risk
Factors



Time



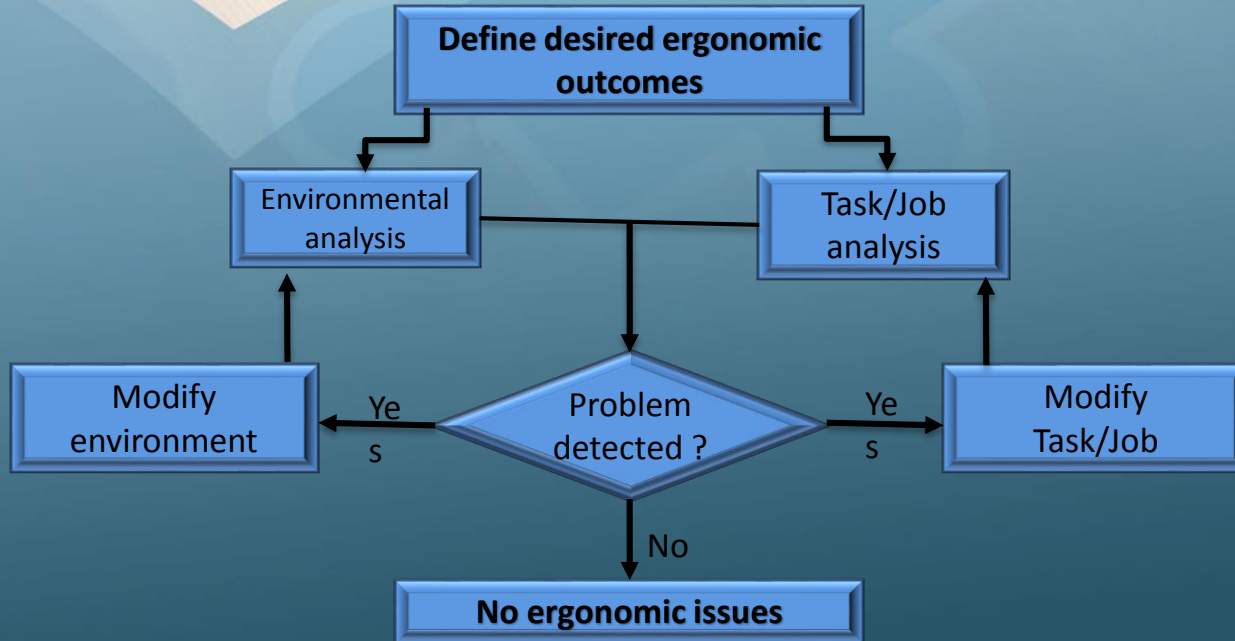


ergonomics

prevents

Prevention

Ergonomics as a Process





Ergonomics program

Engineering
controls

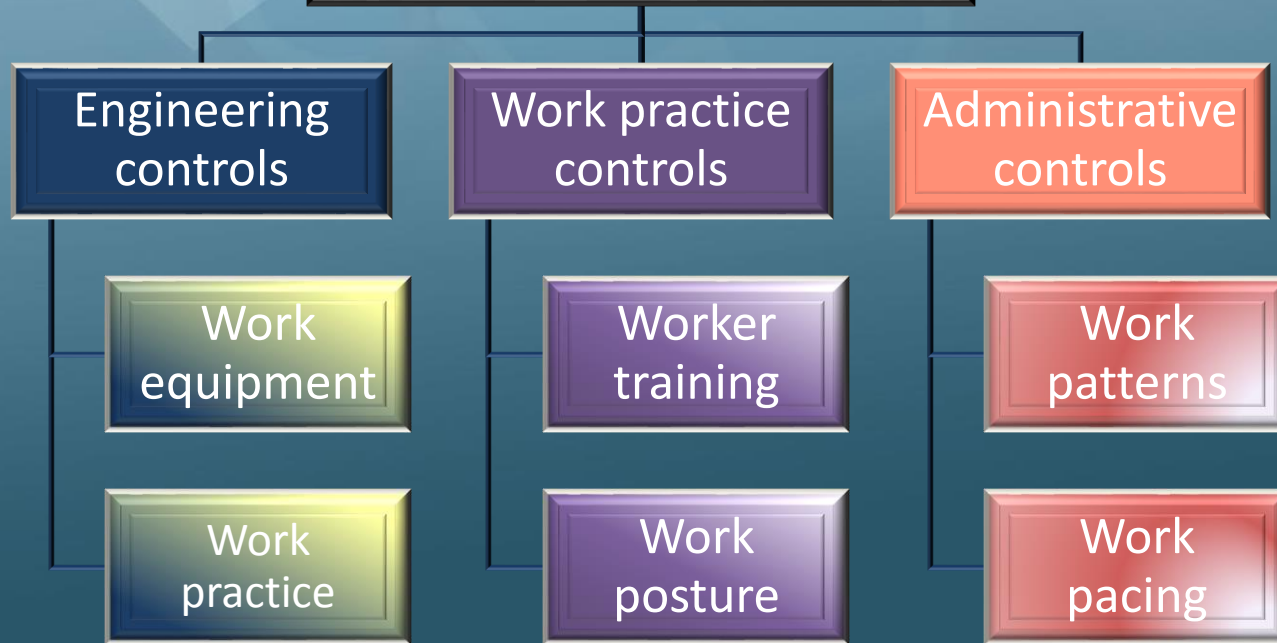
Work practice
controls

Administrative
controls





Ergonomics program



Preventing MSDs



Engineering Controls

Eliminate or reduce **primary risk factors**

e.g., Use robots and/or cobots for reducing repetition,
force exertion or awkward postures



Preventing MSDs



Work Practice Controls

Reduce employee exposure to primary risk factors by using best work methods, e.g.,

- **Plan work organization**
- **Use good housekeeping practices**
- **Use adjustments on equipment**
- **Get help**
- **Eliminate unnecessary movements**
- **Don't use broken equipment**

Preventing MSDs



Work Practice Controls

- Use neutral or good body postures
 - Neutral postures reduce physical stress on musculoskeletal structures and enable optimum blood flow to the musculoskeletal system.
 - Your body is in the strongest and most balanced position.

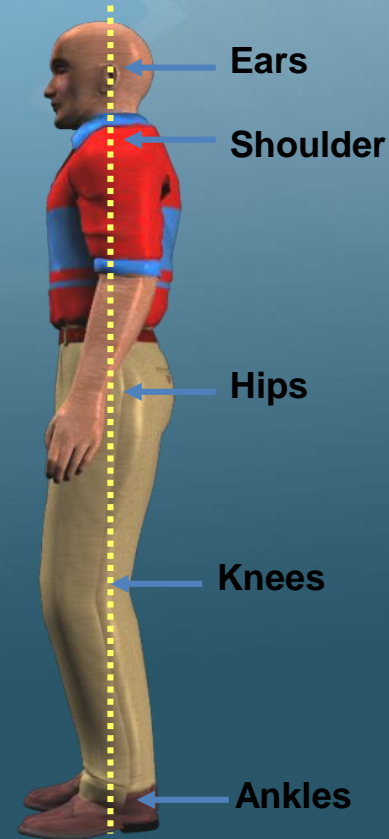
Example:

Work at proper heights & keep everything in easy reach

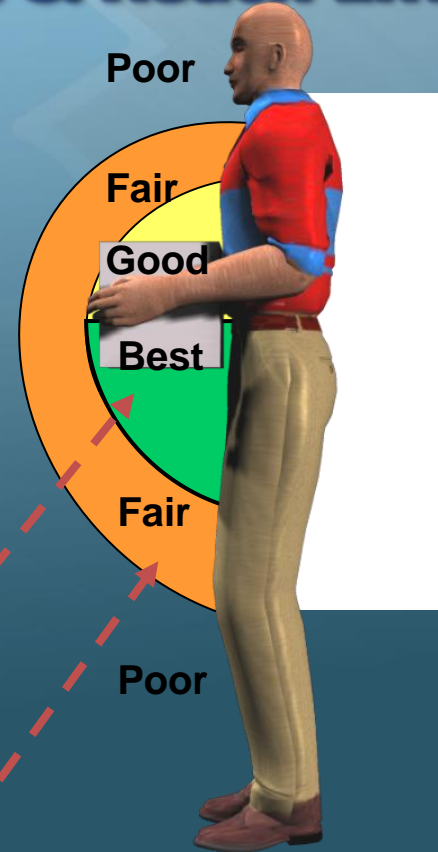
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- Chest up
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- Wrists straight
- Ears, shoulders, hips, knees and ankles should be in straight alignment to maintain natural “S” curve of the spine (neutral position)



Optimal Work Height & Reach Envelopes



Primary
Secondary

Preventing MSDS



Administrative Controls

Reduce employee exposure to primary risk factors, e.g.,

- Ergonomics training
- Policy & procedures that define good work practices
- Job rotation
- Staffing and overtime practices

A group of business professionals in a meeting room are gathered around a wooden table, holding large, interlocking puzzle pieces. The puzzle pieces are in shades of blue and green. One piece prominently displays the text "Any Question?". The scene is set against a dark background, and the overall atmosphere is professional and collaborative.

Any Question?

Thank you !