

CHAPTER 4

4.1 Ergonomics

Ergonomics is a relatively new branch of science which celebrated its 50th anniversary in 1999 but relies on research carried out in many other older, established scientific areas, such as engineering, physiology and psychology. Ergonomics is a branch of science that aims to learn about human abilities and limitations, and then apply this learning to improve people's interaction with products, systems and environments.

To achieve best practice design, Ergonomists use the data and techniques of several disciplines:

- anthropometry: body sizes, shapes; populations and variations
- biomechanics: muscles, levers, forces, strength
- environmental physics: noise, light, heat, cold, radiation, vibration
body systems: hearing, vision, sensations
- Applied psychology: skill, learning, errors, differences
- Social psychology: groups, communication, learning, behaviours.

Ergonomics aims to create safe, comfortable and productive workspaces by bringing human abilities and limitations into the design of a workspace, including the individual's body size, strength, skill, speed, sensory abilities (vision, hearing), and even attitudes.

4.2 Posture

Posture is a term used to describe a position of the body or the arrangements of body parts relative to one another. Ideal postures are those assumed to perform an activity in the most efficient manner utilizing the least amount of energy. All activity begins with a posture and ends with a posture. The relationships between body parts can be controlled voluntarily but to do this would require too much concentration. During normal functioning one's postures and adjustments to postures are automatic and occur quickly.

- Posture is Dynamic - it is usually during these transitions from one posture to another that injury occurs.
- Posture requires Coordination - The movement between one static posture and another requires the coordinated timing and recruitment of muscles specific to the task at hand. It is a programmed pattern of muscle activity that the body counts on to maintain stability.
- Poor movement patterns can result from any of the following: Joint dysfunction, Pain, Stress, Central nervous system disorder/injury, Overwork or overtraining and prolonged postures or repetition of the same activity.

A. Postural Mechanism

Sitting Posture

- When sitting on an office chair at a desk, arms should be flexed at a 75 to 90-degree angle at the elbows. If this is not the case, the office chair should be adjusted accordingly.

- Be sure the back is aligned against the back of the office chair. Avoid slouching or leaning forward, especially when tired from sitting in the office chair for long periods
- For long term sitting, such as in an office chair, be sure the chair is ergonomically designed to properly support the back and that it is a custom fit
- Knees should be even with the hips, or slightly higher when sitting in the office chair
- Keep both feet flat on the floor. If there's a problem with feet reaching the floor comfortably, a footrest can be used along with the office chair
- Sit in the office chair with shoulders straight
- Don't sit in one place for too long, even in ergonomic office chairs that have good back support. Get up and walk around and stretch as needed

Standing Posture

- Stand with weight mostly on the balls of the feet, not with weight on the heels
- Keep feet slightly apart, about shoulder-width
- Let arms hang naturally down the sides of the body
- Avoid locking the knees
- Tuck the chin in a little to keep the head level
- Be sure the head is square on top of the spine, not pushed out forward
- Stand straight and tall, with shoulders upright

- If standing for a long period of time, shift weight from one foot to the other, or rock from heels to toes.
- Stand against a wall with shoulders and bottom touching wall. In this position, the back of the head should also touch the wall - if it does not, the head is carried too far forward (anterior head carriage).

Walking Posture

- Keep the head up and eyes looking straight ahead
- Avoid pushing the head forward
- Keep shoulders properly aligned with the rest of the body

Driving Posture

- Sit with the back firmly against the seat for proper back support
- The seat should be a proper distance from the pedals and steering wheel to avoid leaning forward or reaching
- The headrest should support the middle of the head to keep it upright. Tilt the headrest forward if possible, to make sure that the head-to-headrest distance is not more than four inches.

Posture and Ergonomics While Lifting and Carrying

- Always bend at the knees, not the waist
- Use the large leg and stomach muscles for lifting, not the lower back
- If necessary, get a supportive belt to help maintain good posture while lifting

- When carrying what a heavy or large object, keep it close to the chest
- If carrying something with one arm, switch arms frequently
- When carrying a backpack or purse, keep it as light as possible, and balance the weight on both sides as much as possible, or alternate from side to side
- When carrying a backpack, avoid leaning forward or rounding the shoulders. If the weight feels like too much, consider using a rolling backpack with wheels.

Sleeping Posture with Mattresses and Pillows

- A relatively firm mattress is generally best for proper back support, although individual preference is very important
- Sleeping on the side or back is usually more comfortable for the back than sleeping on the stomach
- Use a pillow to provide proper support and alignment for the head and shoulders
- Consider putting a rolled-up towel under the neck and a pillow under the knees to better support the spine
- If sleeping on the side, a relatively flat pillow placed between the legs will help keep the spine aligned and straight.

B. Types of Postural Deformities

- ✓ *Kyphosis* (Greek -kyphos, a hump) is also called round back or Kelso's hunch back, is a condition of over-curvature of the thoracic vertebrae (upper back). It can be either the result of degenerative diseases (such as arthritis), developmental

problems, osteoporosis with compression fractures of the vertebrae, and/or trauma.

Causes

- Habitual Bad Posture
- Underdevelopment/ Weakness of Longitudinal Back Muscle
- Rickets
- Mental/Physical Fatigue
- Injury/Disease of Spine
- Arthritis

Symptoms

- Appearance of poor posture with a hump appearance of the back or "hunchback," backpain, muscle fatigue, and stiffness in the back.
- In rare cases, this can lead to compression of the spinal cord with neurologic symptoms including weakness, loss of sensation, or loss of bowel and bladder control.
- Thoracic kyphosis can also limit the amount of space in the chest and cause cardiac and pulmonary problems leading to chest pain and shortness of breath.

Remedial Exercise

- Mobilizing exercises are given for whole spine.
- Strengthening exercises are given for abdominal muscles and back extensors.
- There may be associated tightening in hamstring muscles. Hence stretching of hamstring is done.

- ✓ *Scoliosis* is an abnormal curving of the spine. The spine is backbone. It runs straight down to back. Everyone's spine naturally curves a tiny bit. But people with scoliosis have a spine that curves too much. The spine might look like the letter "C" or "S".

Causes

- In most cases (85%), the cause of scoliosis is unknown (what doctors call idiopathic). The other 15% of cases fall into two groups:
- Non-structural (functional): This type of scoliosis is a temporary condition when the spine is then normal. The curvature occurs as the result of another problem. Examples include one leg being shorter than another from muscle spasms or from appendicitis.
- Structural: In this type of scoliosis, the spine is not normal. The curvature is caused by another disease process such as a birth defect, muscular dystrophy, metabolic diseases, connective tissue disorders, or Marfan's syndrome.

Symptoms

- One shoulder is higher than the other
- One shoulder blade sticks out
- One side of the rib cage appears higher
- One hip appears higher or more prominent
- The waist appears uneven
- The body tilts to one side
- One leg may appear shorter than the other one

Remedial Exercise

Bracing - Braces will help control any worsening of a spine curvature but do little to correct an existing deformity. Bracing is most effective for scoliosis treatment when used in children that are rapidly growing and have worsening scoliosis curves.

Surgery- Surgery is often the best options for more severe curves. Depending on the site of the curve and the degree of curvature, the surgeon will fuse vertebrae in a more normal anatomic position.

- ✓ *Lordosis* is a medical term used to describe an inward curvature of apportion of the lumbar and cervical vertebral column. Excessive or hyper lordosis is commonly referred to as swayback or saddle back.

Causes

- Imbalances in muscle strength and length are also a cause, such as weak hamstrings, or tight hip flexors(psoas).
- Tight low back muscles.
- Excessive visceral fat.

Symptoms

- The major clinical feature of lordosis is a prominence of the buttocks.
- Symptoms will vary depending if lordosis occurs with other defects, such as muscular dystrophy, developmental dysplasia of the hip, or neuro muscular disorders.

Treatment

- Physical Therapy- Exercises may be used to strengthen muscles and increase range of motion. It may also be taught how to maintain a correct posture.
- Medications- Non-steroidal anti-inflammatory drugs (NSAIDs) may be given for discomfort or to decrease swelling.
- Back Brace- Braces are sometimes used with children. The brace can make sure the curve doesn't worsen as they grow.
- Surgery- Surgery is reserved for severe cases. In this case the spine is straightened by using a metal rod, hooks, or screws in the back bones. Surgeons also use a bone graft to promote new growth and stability.

✓ **Bowlegs** is a condition in which the knees stay wide apart when a person stands with the feet and ankles together.

Causes

Bowlegs may be caused by illnesses such as:

- Bone disease
- Bone dysplasia (abnormal development)
- Fractures that do not heal correctly Lead or fluoride poisoning
- Rickets, which is caused by a vitamin D deficiency.

Symptoms

- Knees do not touch when standing with feet together (ankles touching)

- Bowing of legs is same on both side of the body (symmetrical)
- Bowed legs continue beyond age 3

Treatment

- If the condition is severe or the child also has another disease, special shoes, braces, or casts can be tried. It is unclear how well these works.
- At times, surgery is performed to correct the deformity in an adolescent with severe bowlegs.

- ✓ **Knock Knee** is a deformity of the legs in which the knees are abnormally close together and the ankles are spread widely apart.

Causes

- Rickets- Rickets are the result of a vitamin D deficiency. Vitamin D helps regulate the calcium and phosphate in the blood.
- Injury- An injury to the knee affecting the anterior cruciate ligament or ACL causes instability to the knee in children or young adults.

Symptoms

- A large difference between the angle of one leg and the other when standing straight,
- An excessive inward or outward knee angle, pain linked to the angle of their knee, and
- Difficulty walking or an awkward way of walking.

Treatment

- A change of diet, if knock knee is caused by a condition such as rickets or scurvy,
- Wearing special heel supports inside shoes to correct the line of the legs,
- Wearing braces or splints to correct the line of the legs, and surgery, although this is only considered in severe cases.
- ✓ **Flat Foot** is a medical condition in which the arch of the foot collapses, with the entire sole of the foot coming into complete or near-complete contact with the ground.

Causes

- Family history - experts say fallen arches can run in families.
- Weak arch - the arch of the foot may be there when no weight is placed on it, for example, when the person is sitting. But as soon as they stand up the foot flattens (falls) onto the ground.
- Injury
- Arthritis
- Nervous system or muscle diseases

Symptoms

- Foot pain, particularly in the heel or arch area
- Difficulty standing on tip toe
- Swelling along the inside of the ankle

Treatment

- Pain in the foot that is caused by flat feet may be alleviated if the patient wears supportive well-fitted shoes.
- Fitted insoles or orthotics (custom-designed arch supports)

may relieve pressure from the arch and reduce pain if the patient's feet roll or over-pronate.

- Wearing an ankle brace may help patients with posterior tibial tendinitis, until the inflammation comes down.
- Bodyweight management - if the patients obese the doctor may advise him/her to lose weight. A significant number of obese patients with flat feet who successfully lose weight experience considerable improvement of symptoms.

4.3 Exercise and Postural Mechanism

Proper posture and breathing may sound like simple things to remember during exercise but all too often injuries like muscle strains and even falling can occur when we fail to maintain good posture and inadvertently holding breath during exertion. Good posture helps the body to function effectively and will minimize muscle strain and injury. During exercise, whether sitting or standing, the body will potentially be in several different positions. If weights added, such as dumbbells used for strength training, or increasing exercise intensity to a vigorous level remember to maintain proper form and posture. If there are lax on posture or physic can easily sustain an injury and be side lined. Take the time to learn proper body alignment and be mindful about how the body is feeling is better. Pain could be an indicator of incorrect form or posture.

Some of

- Keep neck in line with spine
- Chin aligned with neck, ears over shoulders

- Back straight
- Shoulders back, relaxed and down
- Keep knees relaxed do not lock them
- Pelvis slightly tucked under; belly button pulled back towards spine