



POSTURE

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ANALYSIS OF SITTING POSTURES



- Sitting postures are more complex than standing postures.
- The same gravitational moments as in standing posture must be considered, but, in addition, the contact forces that are created when various portions of the body interface with various parts of chairs, such as head, back, and foot rests, and seats.
- The location and amount of support provided to various portions of the body by the chair or stool may change the position of the body parts and thus the magnitude of the stresses on body structures.

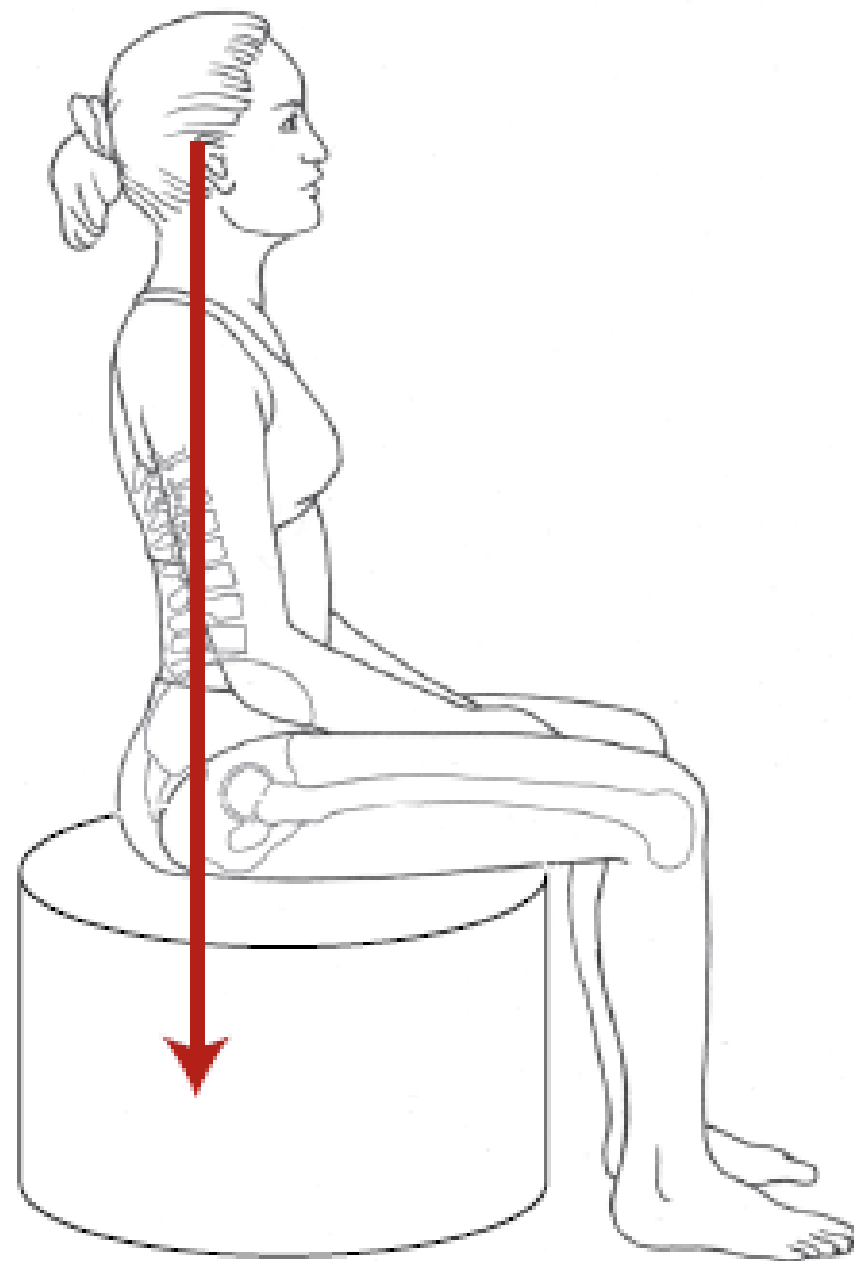


- There are many different sitting postures.
- The **active erect sitting posture**, is defined as an unsupported posture in which a person attempts to sit up as straight as possible.
- A consideration of **muscle activity, interdiscal pressures, and seat interface pressures** in the active erect sitting posture are compared to forces in **relaxed erect, slumped, and slouched** sitting and to erect standing postures.

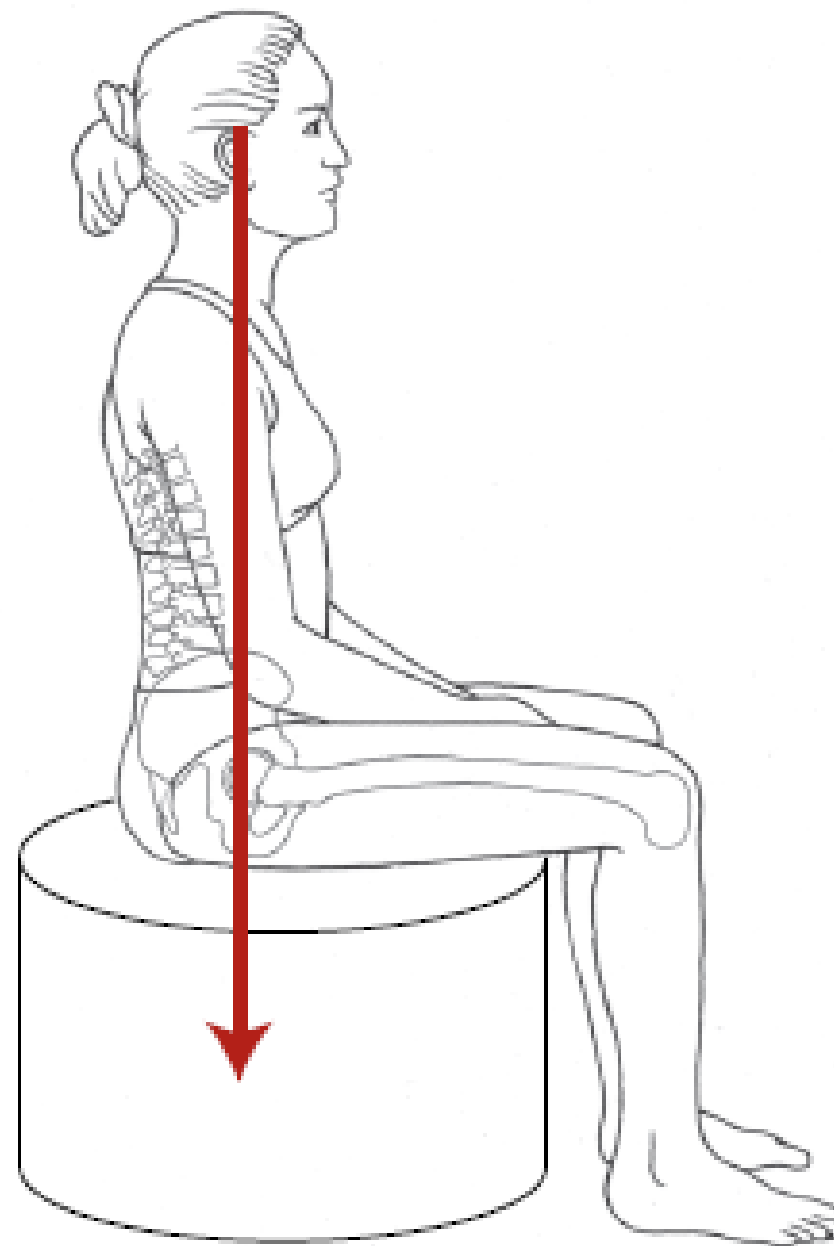


MUSCLE ACTIVITY:

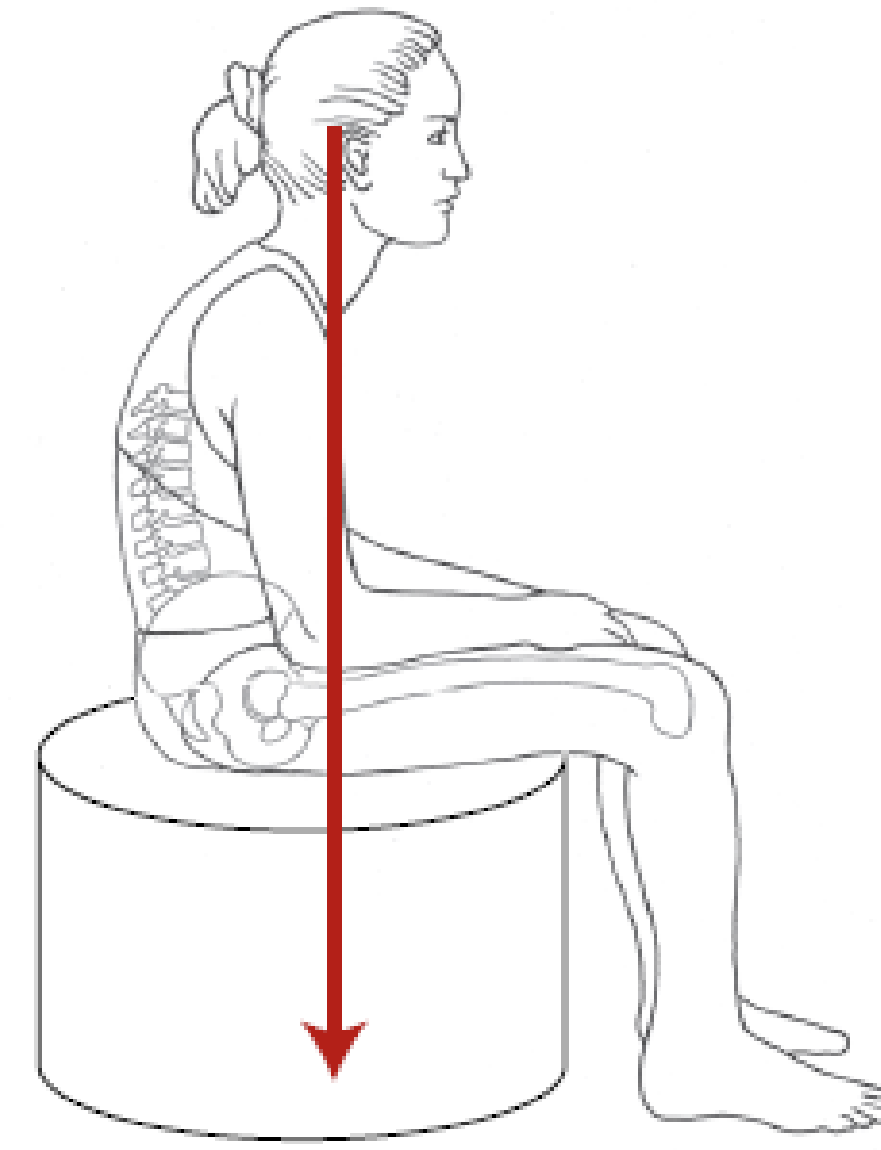
- The LoG passes close to the joint axes of the head and spine in active erect sitting posture.
- In the slumped posture, the LoG is more anterior to the joint axes of the cervical, thoracic, and lumbar spines than it is in either active or relaxed erect sitting.
- Therefore more muscle activity would be required in the slumped posture than in the other sitting postures.



A Active erect sitting



B Relaxed erect sitting

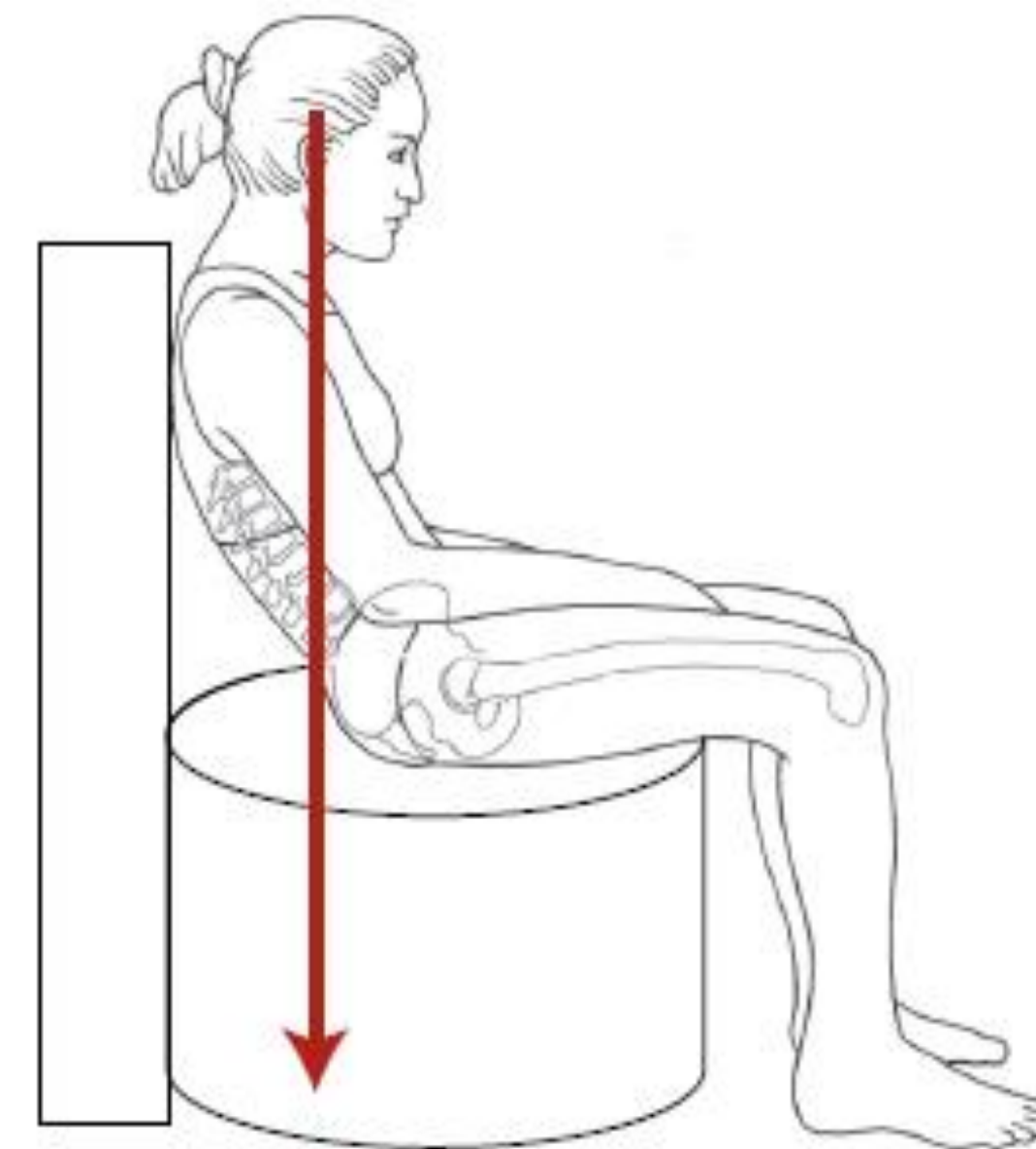


C Slumped sitting



- Activity in the superficial lumbar multifidus, thoracic erector spinae, and internal oblique abdominal muscles in erect and slumped sitting postures.
- Muscle activity in the active erect sitting posture is greater than in both relaxed erect and slouched sitting.
- In relaxed erect sitting, the LoG is only slightly anterior to its position in active erect sitting.

- In the slouched posture, the LoG is posterior to the spine and hips, but body weight is being supported by the back of the chair, and so less muscle activity is required than in active erect posture



Slouched sitting



- Conversely, sustained slumped postures in which the lumbar spine is flattened or flexed leads to an increase in interdiscal pressure due to an increase in compressive stress and load on the anterior annulus and an increase in the tensile forces on the posterior annulus.



MUSCLE ACTIVITY IN SITTING VERSUS STANDING POSTURES:

- The amount of muscle activity employed to maintain a particular posture affects the amount of interdiscal pressure and energy expenditure.
- In general increases in muscle activity cause increases in interdiscal pressures and decreases in muscle activity are accompanied by decreases in interdiscal pressures.



- The upper and lower erector spinae muscles shifted to higher levels of activity during active erect sitting than during standing.



INTERDISCAL PRESSURES AND COMPRESSIVE LOADS ON THE SPINE:

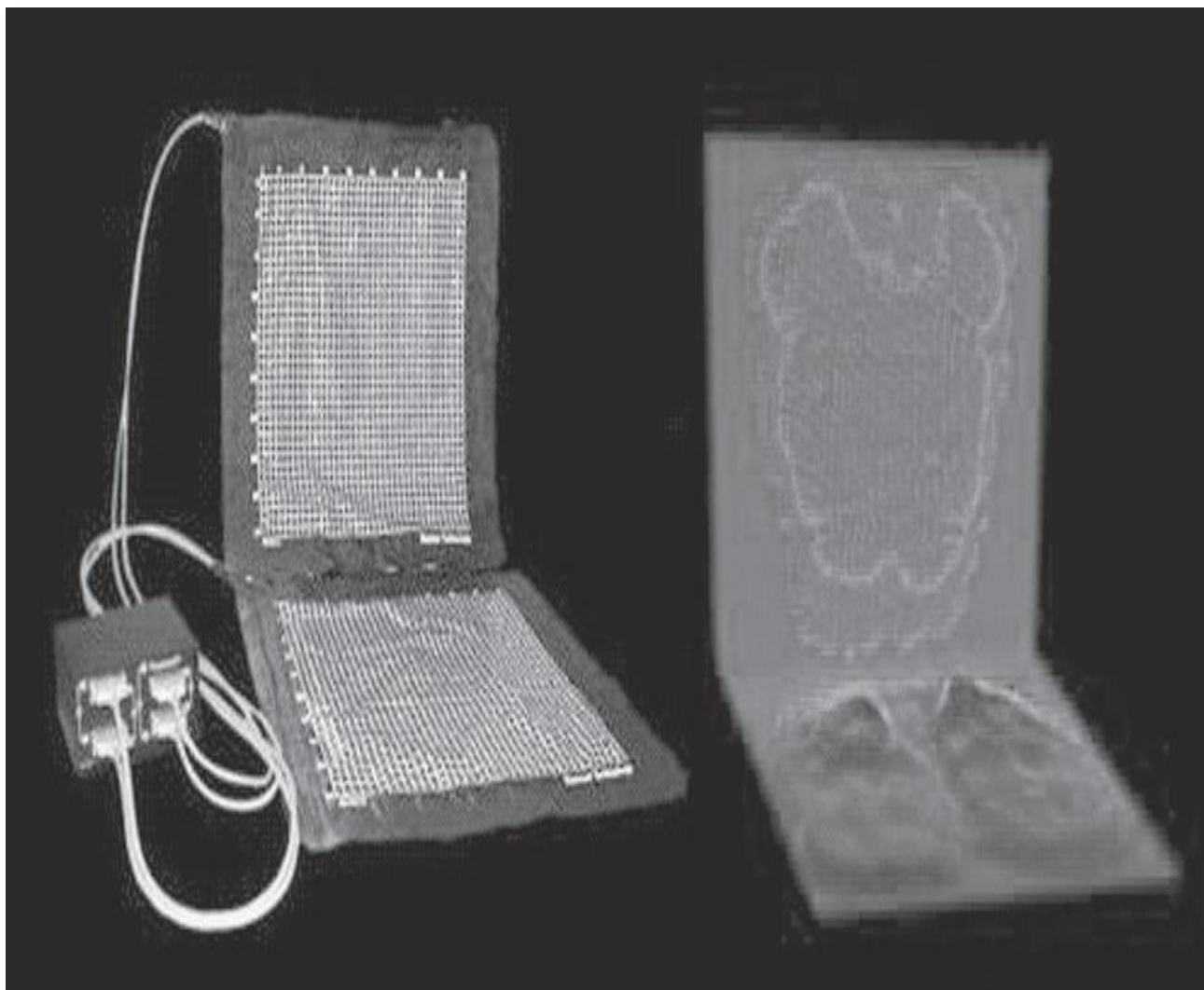
- Direct determinations of interdiscal pressures have been made through the insertion of pressure-sensitive sensors or transducers into one or more intervertebral discs.
- Indirect determinations of interdiscal pressures have used measurements of spinal shrinkage (creep) and calculation of compressive forces based on information obtained from electromyography about muscle activity.



- Active erect sitting requires co-contractions of trunk extensors (erector spinae muscles) and flexors (abdominal muscles), which cause higher pressures in the disc between L4 and L5 than does slumped sitting.
- Shrinkage of the lumbar spine in sitting (1.73 mm) was much less than the shrinkage in standing (4.16 mm).

SEAT INTERFACE PRESSURES:

- The pressure caused by contact forces between the person's body and the seat is referred to as the **seat interface pressure**.
- Pressure mapping techniques using sensor-containing mats that can be placed on the seat of a chair are used to measure average and maximum seat interface pressures





- Individuals with physical disabilities such as myelomeningocele and paraplegia have significantly higher seat interface pressures than do people without such disabilities.
- The wheelchair users also had higher tension, compression, and shear strains in the gluteus muscles compared to the healthy subjects.



ANALYSIS OF LYING POSTURES



INTERDISCAL PRESSURES:

- In general, interdiscal pressures are less in lying postures than in standing and sitting postures.
- Interdiscal pressures in supine lying (0.10 MPa) were less than in either lying prone (0.11 MPa) or lying on the side (0.12 MPa), and in all of these postures the interdiscal pressure was less than in sitting and standing postures.



- Lying prone with the back extended and supported on one's elbows had the largest interdiscal pressure (0.25 MPa) among the lying postures tested and was only slightly less than in slouched sitting (0.27 MPa).