The Anatomy of Sitting

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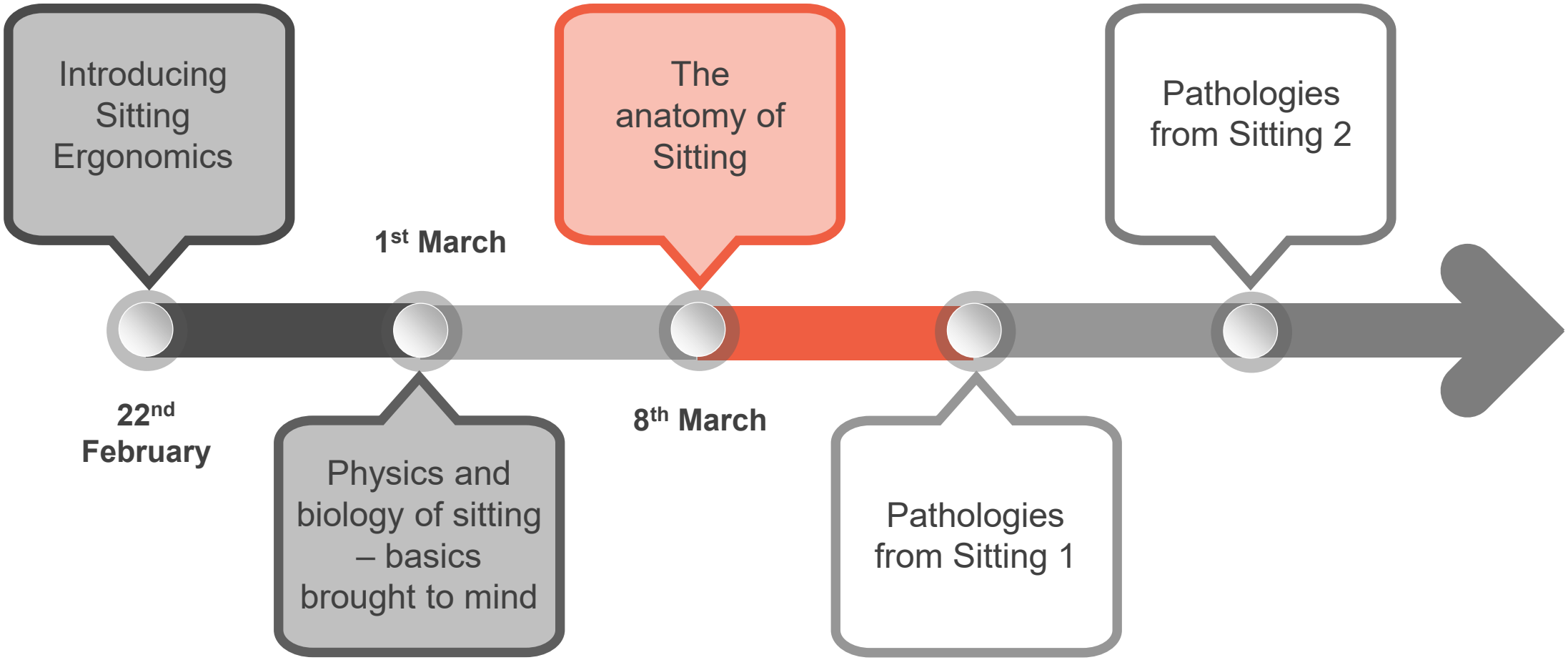
Approximate time 120 mins

Timeline


Introducing Sitting Ergonomics
22nd February
Physics and biology of sitting – basics brought to mind
1st March
The anatomy of Sitting
8th March
Pathologies from Sitting 1
Pathologies from Sitting 2

Sitting ERGONOMICS

01 Squat vs Sit
The squat vs the sit

02 Forces
Forces on the body

03 The Spine
The spine

04 Stature
Relating stature to position

Squat vs Sit

Comparing different resting positions

What happens in a resting squat?

Head position
Determines Centre of gravity

Neck muscles
Active work
Position the head

Trunk and shoulder musculature
Avtive work
Keep strong base for arms

Back Muscles
Active work
Support higher structures

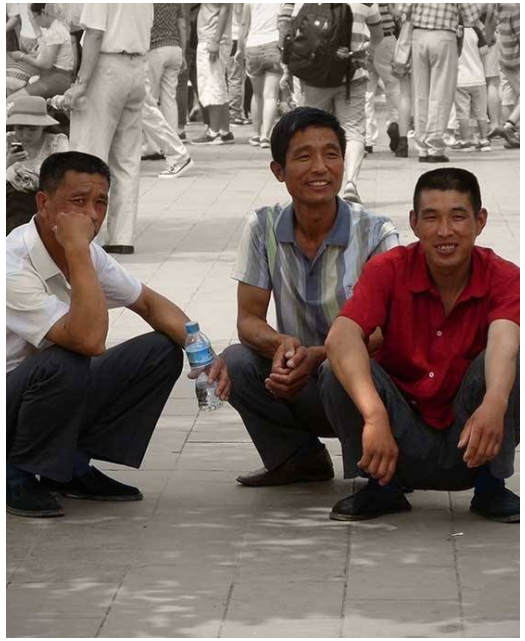
Ankle muscles
Stretching + active
Actively stretching ankle muscles

Active squat

Disuse :

Short Calves and
Achilles tendons

“ASIAN SQUAT”



“WESTERN SQUAT”

Inactivity Mismatch Hypothesis

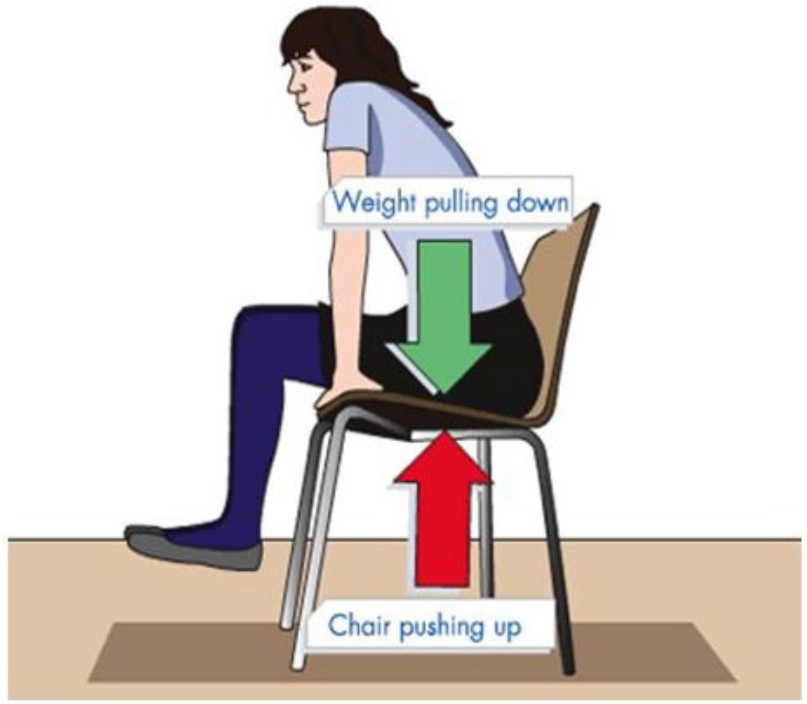
The inactivity mismatch hypothesis proposes that while sitting and resting poses may have long served humans as a sound evolutionary strategy to conserve energy, the relatively rapid environmental changes that have transformed human living spaces since the time of hunter-gatherers mean that prolonged resting is no longer as physically advantageous as it once was.

The Forces

Impact of forces on body

Forces

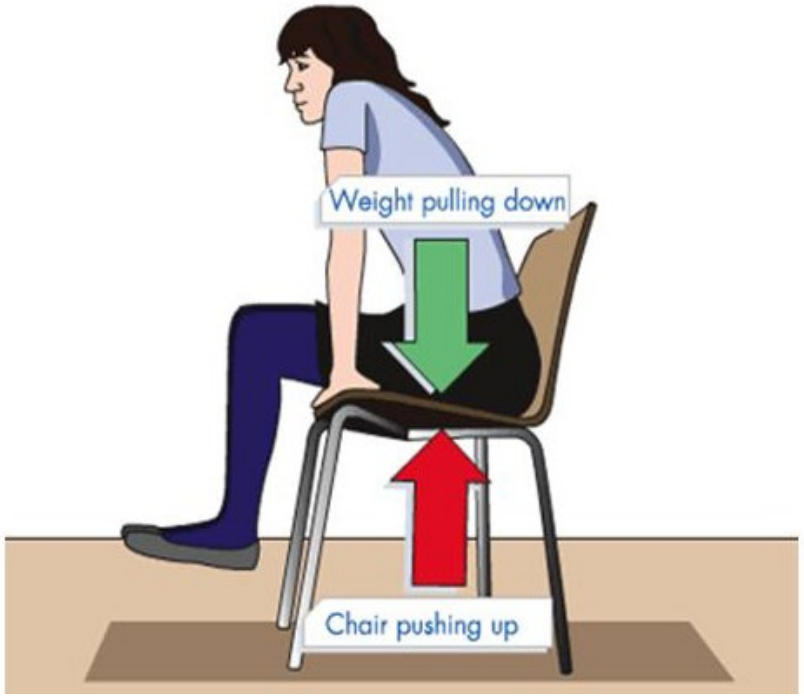
Let us recognize that every action has an equal and opposite reaction, and in the same way the force that our body exerts on the sitting surface due to gravity, which is equal to our weight, there is an equal and opposite force acting upon the body of the same magnitude as the weight of the person.



Forces

It therefore follows that the effect of the forces is dependent on :

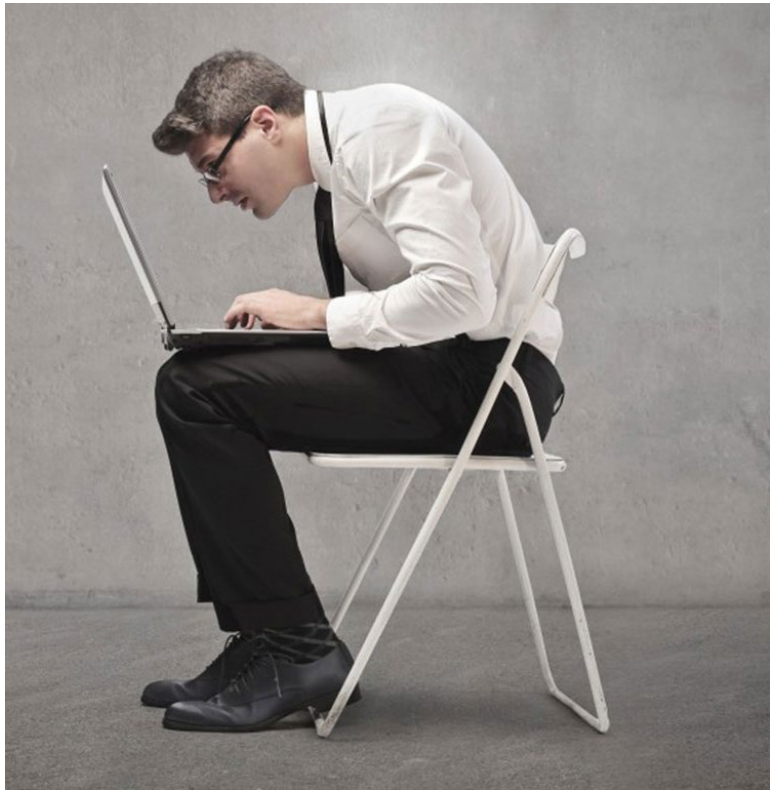
- The weight of the person
- The shape of the “chair”
- The material of the “chair”
- Presence of Armrests
- Presence of Foot rests
- The position of the head /thorax
- The tilt of the chair



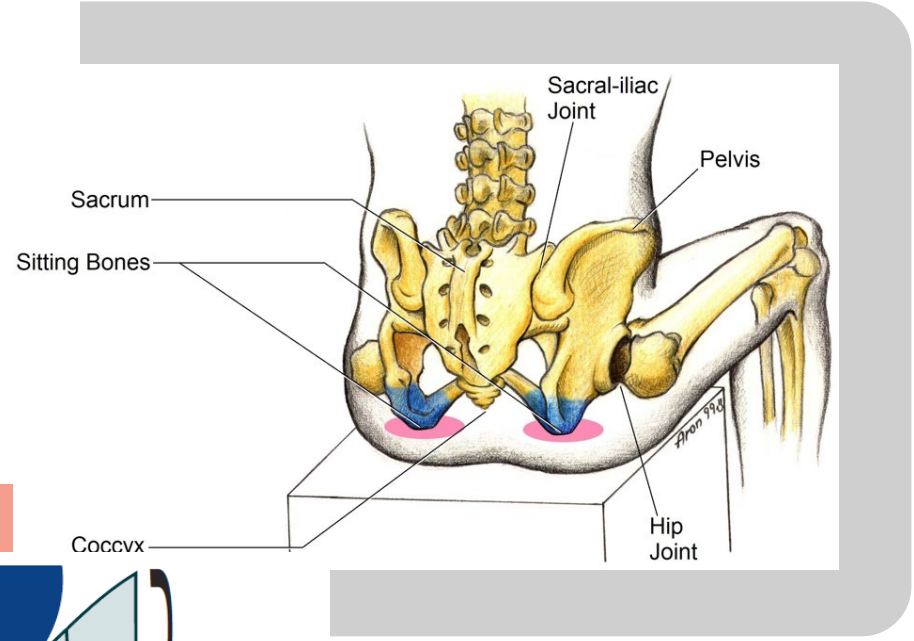
Forces

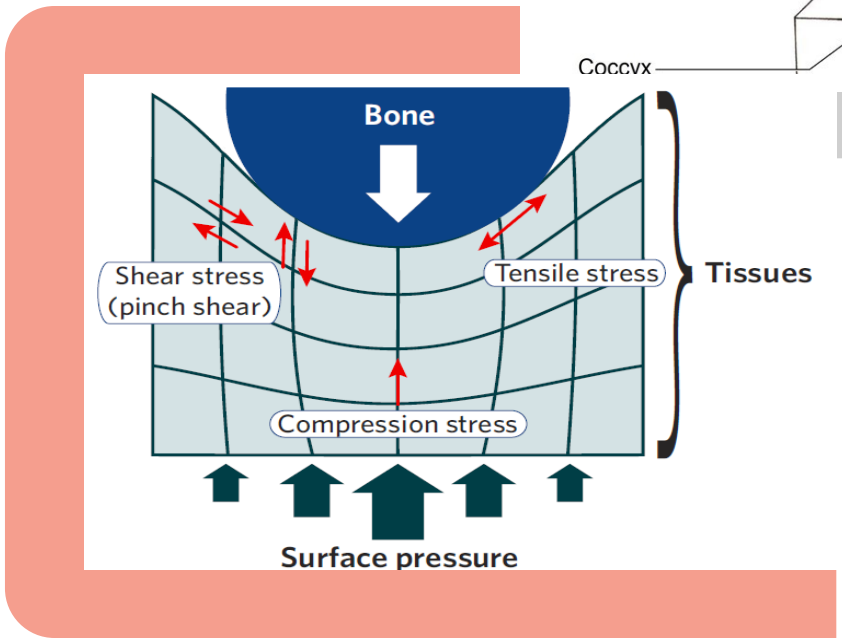
Without entering into the complexities of physics, if your feet are resting on the ground, some of your weight is being taken off, because the effective weight of the limbs is not directly on the chair.

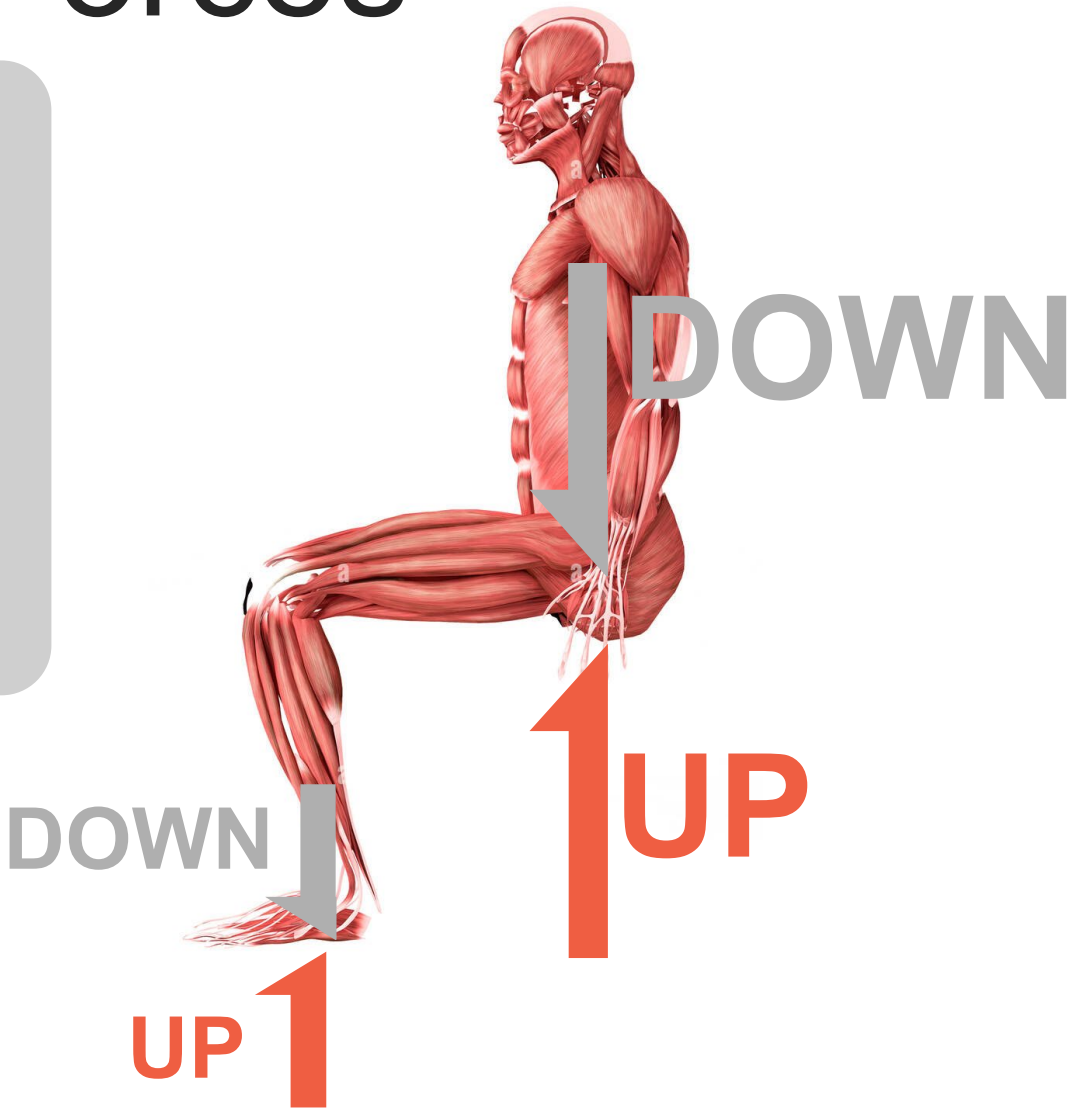
Add to these the effect of the arm rests, seating thickness and position of the head/trunk in relation to the seat, to start appreciating how these can help or hinder.



Transfer of Forces







Negative aspects of sitting :

- Passive
- Weakens muscles
- Does not promote range of movement in limb joints
- Prone to forces that may cause harm
- Skin and circulatory issues
- Creep sets in affecting back ligaments, neck and intervertebral discs
- Still puts strain on the back
- Is unsustainable for long periods of time

Introducing positive aspects :

- Intersperse with standing/ walking/moving breaks
- Micro changes in posture are welcomed by the body
- Reduce the forces on body structures
- Introducing unstable surfaces or activity
- Adequate cushioning, materials and textiles
- Training posture
- Proper working environment is set up
- Countered by high levels of activity.
- Allow different changes in posture.

The Spine

Effect of posture on the spine

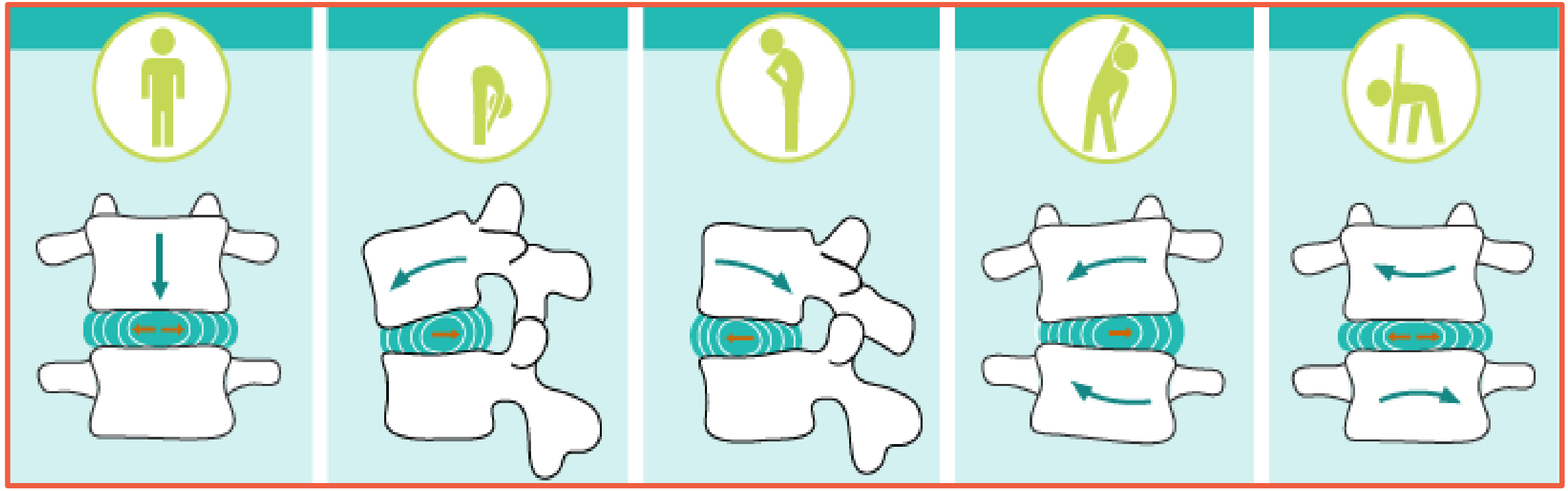
Canadian Centre of Occupational health and safety 2018

The CSA Standard Z412-17 Office ergonomics
– An application standard for workplace ergonomics recommends that alternating between sitting and standing, or variations on sitting and standing postures (e.g., reclining, forward tilting, and semi-standing) are encouraged in order to avoid the negative effects of prolonged sitting or standing in one posture.

”The basic requirements are to have a workstation and job tasks designed to allow a person to remain in a balanced position or neutral posture, regardless of the work being done. “

CSA also states that

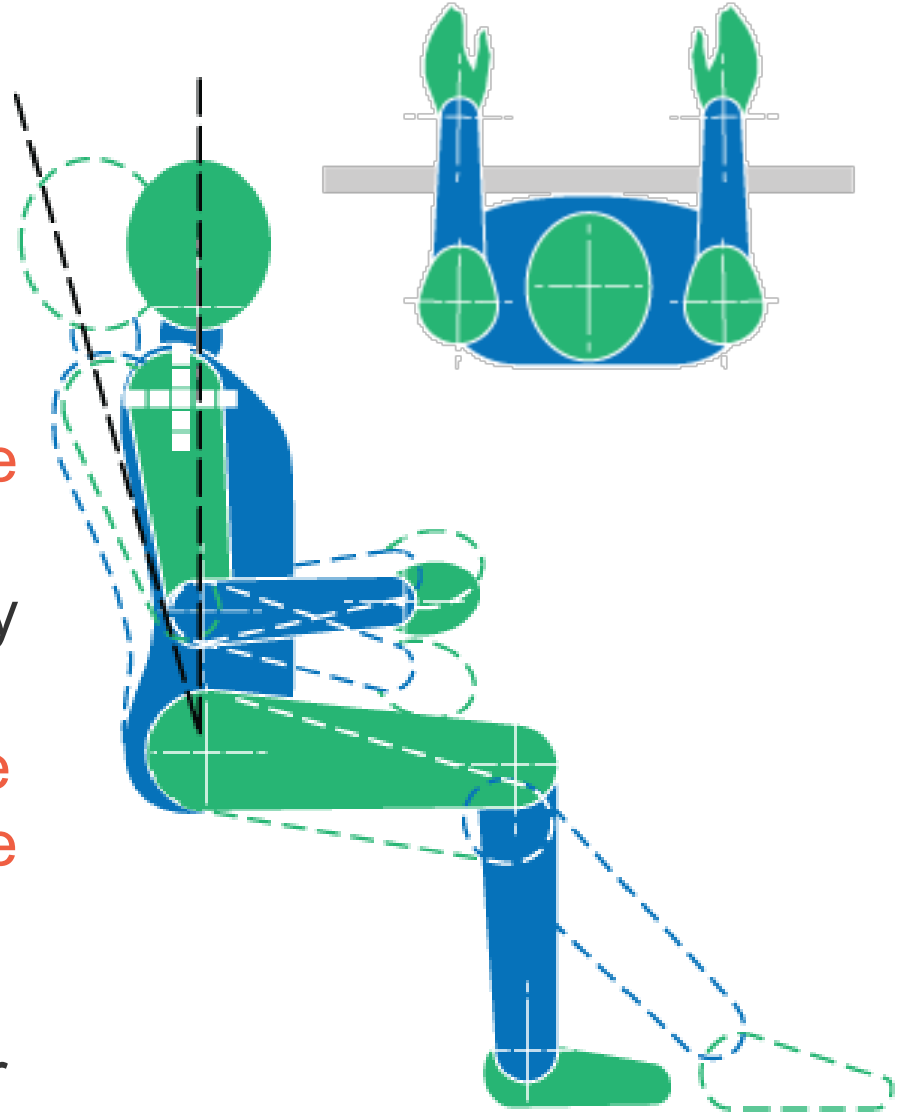
“there is no uniquely correct working posture that fits a user for an extended period of time.”



Standing	Forward Flexion	Extension	Side flexion	Rotation
Equal pressure	Pushes backwards	Pushes forwards	Pushes to opposite side	Puts more compression
Standing produces equalised pressure on the disc structure as the surfaces of the vertebrae are in parallel.	As the front is pinched, the disc is pushed backwards. **Sitting in a slouched position** puts this kind of pressure.	As the back is being pinched, the disc is pushed anteriorly	As one side is pinched, the disc is pushed towards the opposite side.	Rotation causes compression apart from the normal pressure. Combined with flexion, it is the most dangerous movement.

Trunk Thigh angle ”Lumbofemoral rhythm”

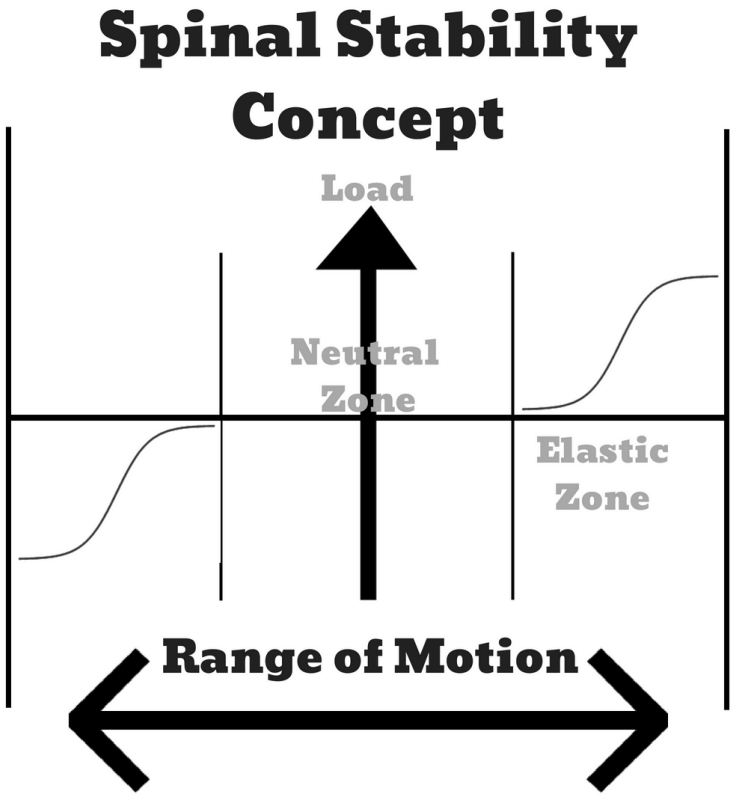
- hip flexion angle influences the lumbar spine during sitting, as the thighs and lumbar spine move concurrently,
- flexion of the hips causes flexion of the lumbar spine.
- Therefore the posture of the lumbar spine in sitting is dependent on the angle of the thighs with respect to the trunk.
- Conventional sitting at 90degrees requires more activity in the back extensors to hold the spine in neutral
- With a trunk to thigh angle of around 120 degrees there is significantly less muscle activity and the neutral spine can be sustained for longer
- subjects sitting in the 90° posture would experience more muscle fatigue, evidenced by a slump into lumbar flexion over time.



Neutral Spine

The body position that has the highest strength to handle the pressure felt by the supporting structure, while causing the least amount of strain on the muscles, tendons, and ligaments, is called the neutral or balanced body position.

Neutral Spine Concept



Neutral Spine Position

Neutral Spine Position

Disc pressure dissipated

Initial neutral position in which posture should start. Postural and core muscles are working maintaining posture, ligaments are comfortably tight

Neutral Zone

Disc pressure low

Safe wiggle zone – where it is still safe for the intervertebral discs. Within safe range for ligaments, muscles work well within this range.

Danger Zone

High disc pressure

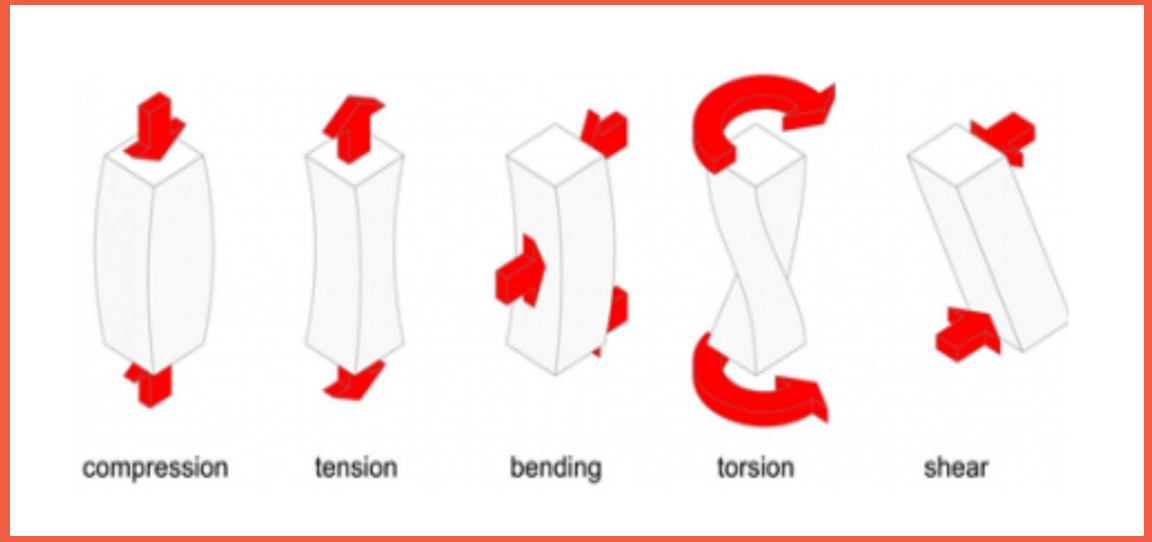
Damaging the disc over time as pinching, creep and shear forces start causing irreparable damage over time to collagen fibers around the disc. Ligaments are overstretched, muscles are at a disadvantage

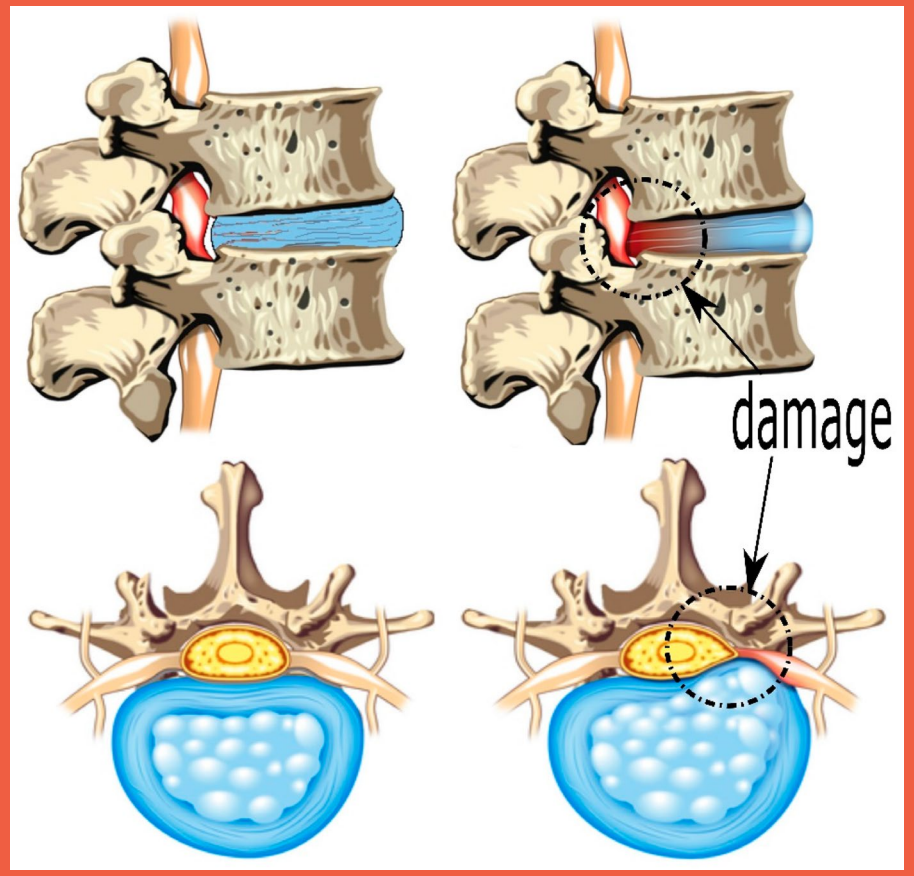
PAIN!

Disc extrudes

High risk of disc damage, ligaments overstretched, muscles at a great mechanical disadvantage, no protection from active or passive structures. Core musculature unable to protect.

Remember?

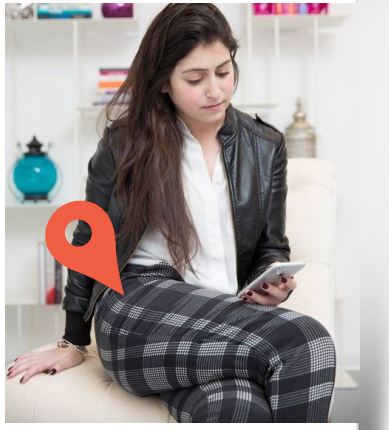




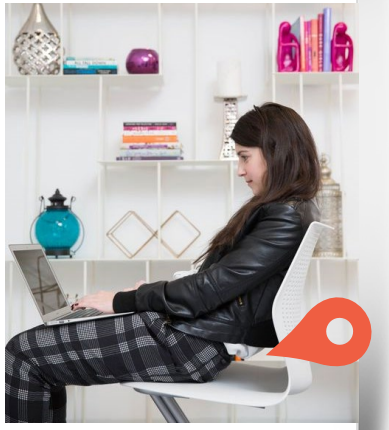
Wrong sitting postures

Arched back

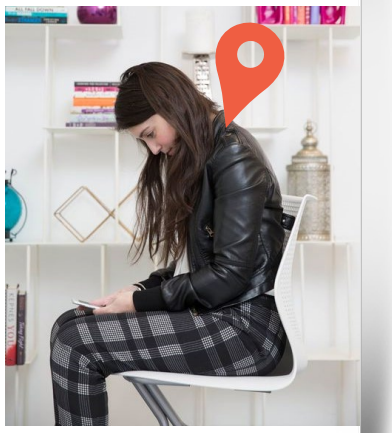
Shift



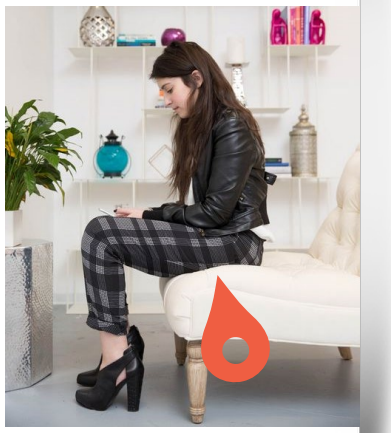
Slouched



Neck strain



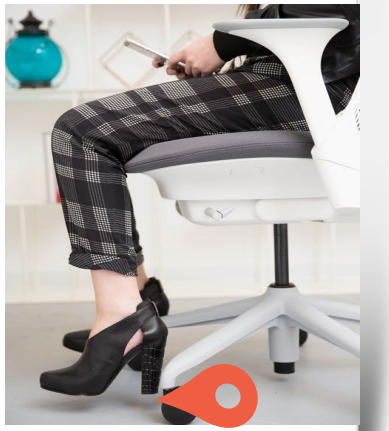
Perched



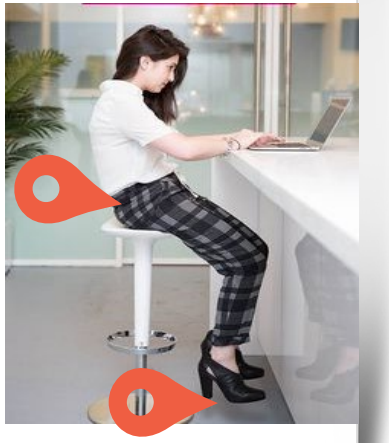
More wrong postures

Sliding

Feet dangling

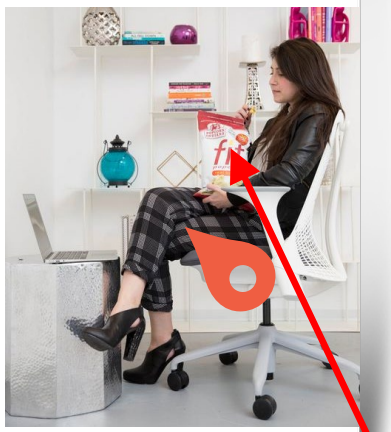


Multiple issues



Arm rests too high

Low screen + side shift



..Crisps are OK

Closed Kinetic vs Open Kinetic Chain

Gravity constantly exerts a downward force on our bodies. Parts of our body in contact with a supporting structure (the seat of chairs, armrests, floors, etc.) will feel pressure from the structure to balance this force.

Parts of our bodies that are not in contact with a supporting structure will use muscles, tendons, and ligaments to balance the force of gravity with an upward force of their own

Dynamic sitting

Dynamic or Active sitting means **changing your sitting position and posture as often as possible**

every new sitting position means movement and is good for the body, however hunching over or straining structures is obviously not well tolerated

No **one** seating position can remain comfortable over a long period of time.

For this reason, multiple positions in which the body can be in the neutral position are recommended.

A good workstation should allow the worker to adjust and move between these positions frequently.

Stature

Effect of stature on the sitting position

STATURE - AGE - ACTIVITY

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STATURE - AGE - ACTIVITY


THANK YOU