Rethinking Sitting and Seating

Beyond Ergonomics (???)
National Ergonomics Conference and Exposition 2013

“The elephant in the room

“Toto, I have a feeling we’re not in Kansas anymore”

Dorothy, Wizard of Oz

The elephant in the room

“Active sitting” (late 1990’s or early 2000’s)
“Intelligent seating” (on its way?)
Recent progression of seating

Increasingly adjustable seating (mid-1970’s on?)
“Passive ergonomics” (early 1980’s - ?)
“Dynamic seating” (early 1980’s - ?)
“Active sitting” (late 1990’s or early 2000’s)
“Intelligent seating” (on its way?)

“Dynamic seating”
• Seat intermittently continually moves → redistributes forces acting on users.
• As users change position → chairs re-align their postures.
• Seat demonstrates a shifting center of gravity in synchrony with the user.
• “Rotatory” seat movements.

“Rotatory” seating

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**Active sitting**


**Prolonged sitting**

Prolonged sitting is a serious metabolic health problem caused by pathogenic mechanisms:

- low energy expenditure → accumulation of visceral fat and low-grade system inflammation;
- impaired endocrine function of skeletal muscles → malfunction of organs and tissues.


- Sitting time not associated with obesity.
- Prior obesity was prospectively associated with time spent watching TV per week but not other types of sitting.


- Prolonged sitting is a risk factor for all-cause mortality, independent of physical activity.
- Prolonged sitting explained 6.9% of the mortality risk.

Questionnaire data from 222,497 individuals 45 years+ from parts Australia.

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**Active sitting**

“Less postural sway and less muscle activity were observed during... active sitting, compared with sitting on a conventional office chair.”


**Anterior postures and intradiscal loads**

Intradiscal loads on the spine are almost twice as high when flexing forward unsupported – and almost three times higher than relaxed sitting.


**Anterior postures & loads on spine**

- Static forward leaning (anterior) postures led to dramatic increases in upper and lower back loads.


**Ligaments and anterior postures...**

“Prolonged exposure to repetitive lumbar flexion-extension is triggered by an acute inflammation in the viscoelastic tissues”... that is “characterized by lingering residual creep, pronounced changes in neuromuscular control and transient changes in lumbar stability.”


**Anterior postures and viscoelastic creep**

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**Static postures and ligament damage**

- During exposure to flexed postures for prolonged periods, as in sitting, the posterior passive elements of the spine can experience viscoelastic creep.
  

**Prolonged sitting and ligaments**

- Prolonged loading increases injury risk...
  - destabilizes the spine
  - laxity viscoelastic tissues
  
  (Dolan, Green, 2006; Le et al, 2009)

- Only 10 minutes of static postures with lumbar flexion → muscle spasms and → creep in the lumbar viscoelastic tissues.

**Ligaments and proprioception**

- Ligaments stabilize joints, but are also important sensory organs that provide proprioceptive input to the CNS / Central Nervous System.


**Ligaments and anterior postures**

- Only 10 minutes of static postures with lumbar flexion → muscle spasms and → creep in the lumbar viscoelastic tissues.

  - microdamage to collagen structures and inflammation


**Lumbar support**

- A significantly reduced lumbar spine reposition sense after ‘slouching’ for 300 seconds.
  - ‘Slouched’ 5 min posture → increased reposition error.

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Trapezius loads and near vision

Near vision places demands on the trapezius


Thank you!

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