

“How Injuries Happen” On the Road to Zero

MSD Prevention Strategies in the
Transportation Sector

Wednesday February 15th, 2009

Mardy Frazer, Ph.D.



On the Road to Zero

MSD Prevention Strategies in the Transportation Sector

A Conference Co-Sponsored by THSAO and CRE-MSD

Wednesday February 18, 2009

How Do Injuries Happen?



Sandalwood
Engineering & Ergonomics
Work Smarter. Work Safer.



Tissue Injury

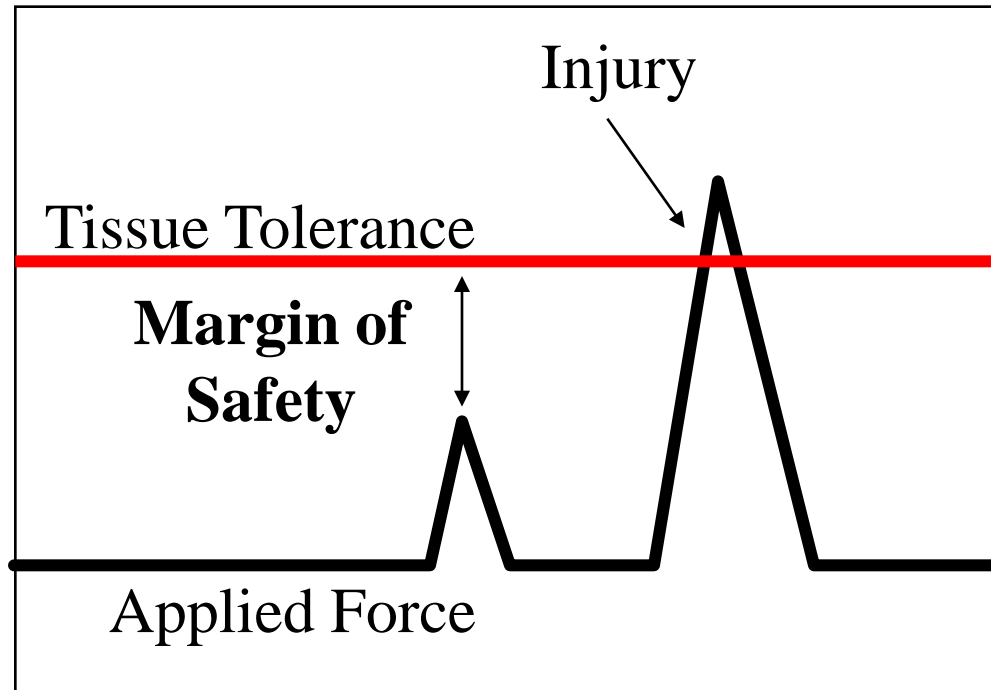
Q: How does a tissue get injured?

Applied Force > Tissue Tolerance



High Force Injury

Force

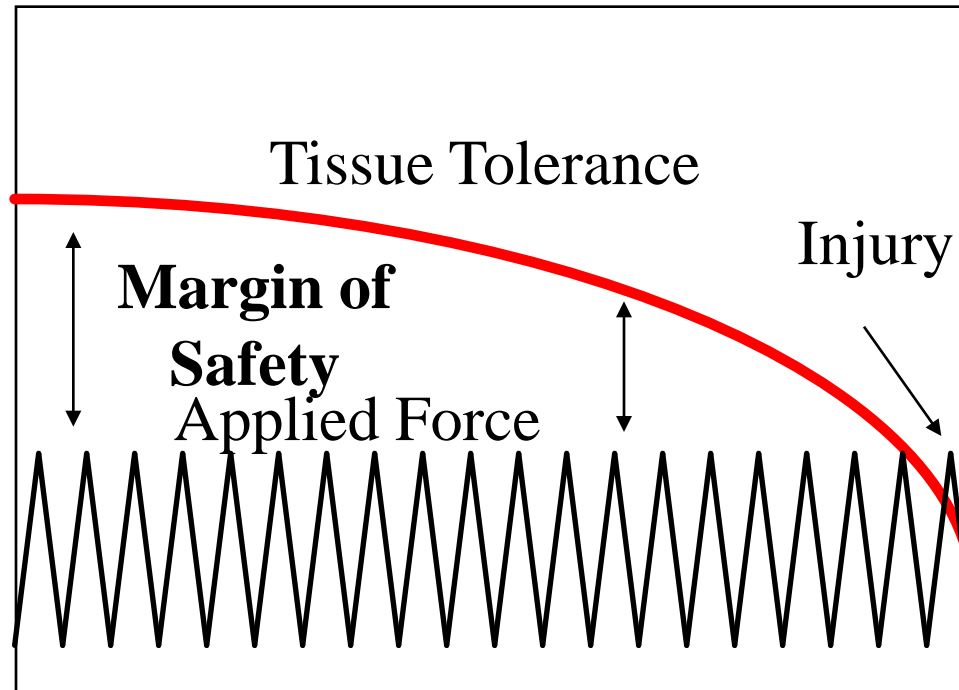


Time



Low, Repetitive Force Injury

Force

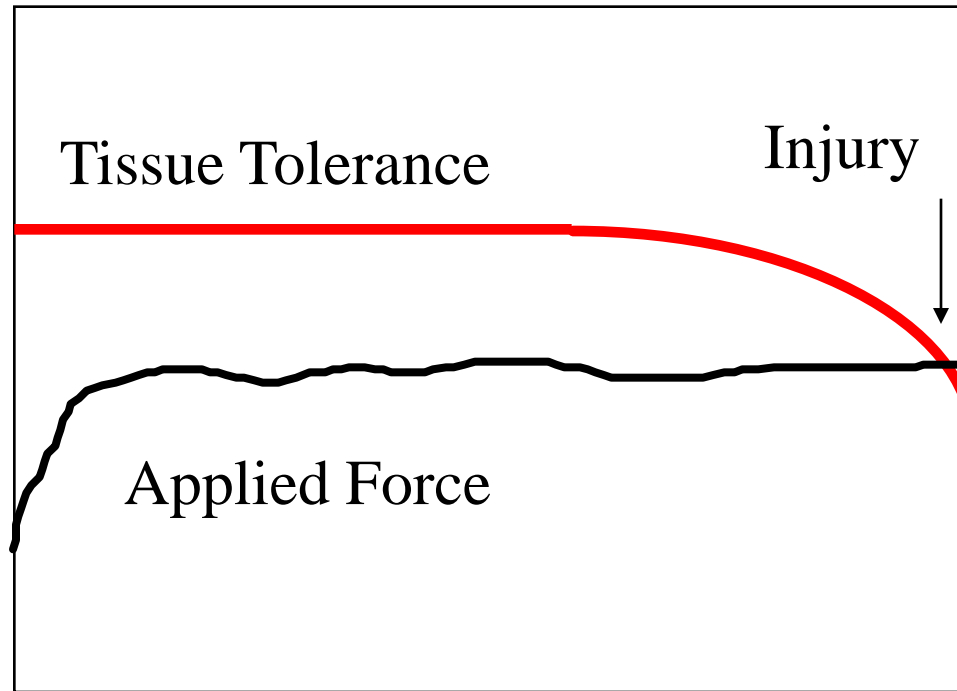


Time



Low, Constant Force Injury

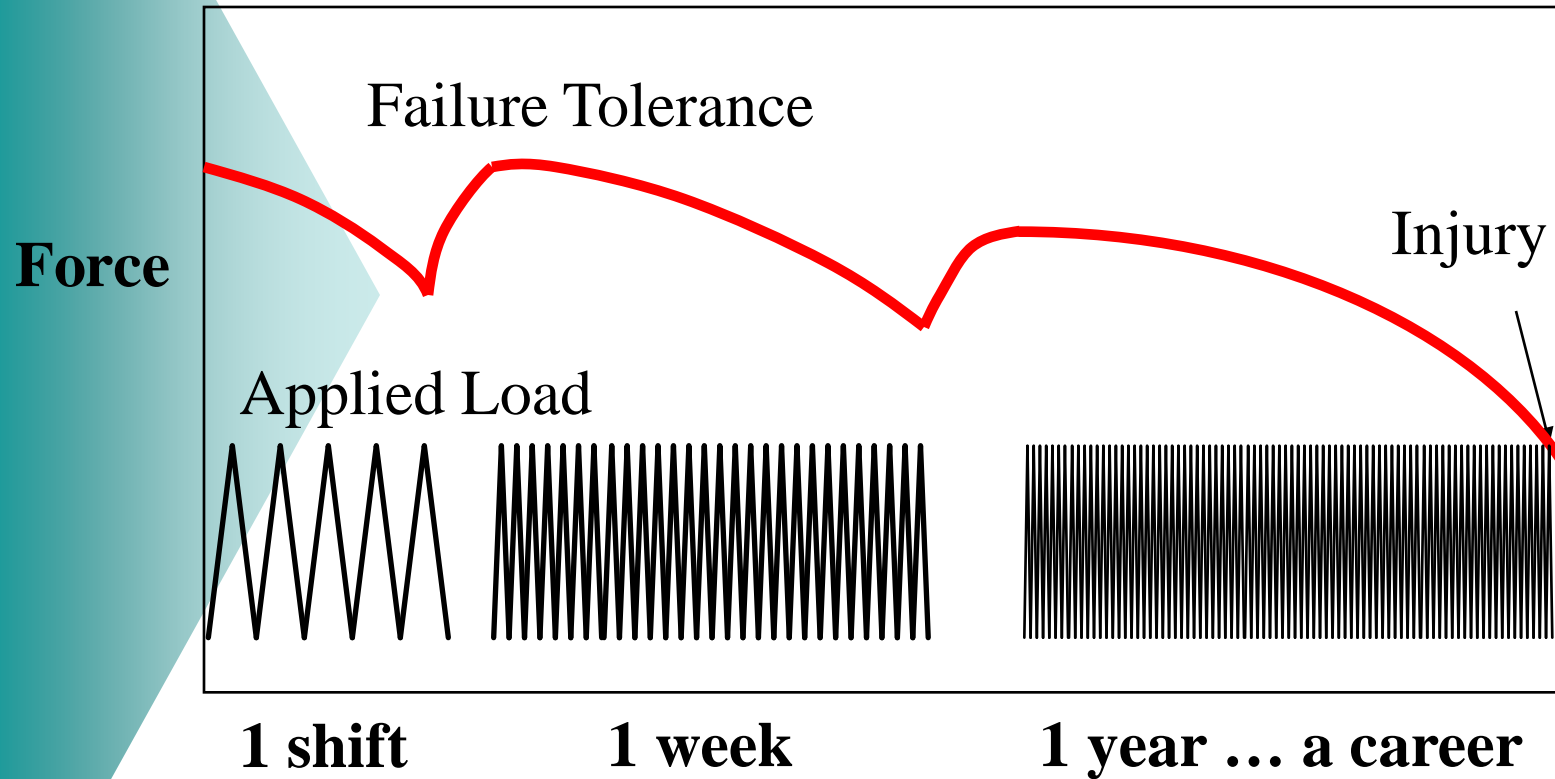
Force



Time



Failure Tolerance



Tissue Injury

1 Mechanism: Applied Force $>$ Tissue Tolerance

4 Modes of Injury:

- High Force
- Low, Repetitive Force
- Low, Constant Force
- Cumulative Loading (day, week, lifetime)



Tissue Injury

Q: How can this risk be (easily and practically) assessed?

A: Moment of Force



Moment of Force (Torque)

Moment of Force = **Load X Distance**
or

Moment of Force = **Force X Moment Arm**

This applies to ALL body joints:

- spine
- shoulders
- elbows
- knees ...



Moment of Force (Torque)

In the body, the external Moments of Force are resisted by:

- 1) muscles**
- 2) ligaments**
- 3) soft tissues**
- 4) bony stops**



Moment of Force - Cascade Effect

The $>$ the moment,

The $>$ the tissue forces,

The $<$ the safety margin!

\therefore to decrease injury risk, via decreased tissue loads, you must decrease **Moments of Force!**



Summary

- 1) Tissue Injury
- 2) Moment Force

Two very powerful concepts

Knowledge



Know How!

Sandalwood
Ergonomics
Work Smarter. Work Safer.

Thank You!

