

# Draft of Recommendations for Training and Use of Power Tilt systems

Chris Maurer, MS PT, ATP

Sharon Sonenblum, PhD

*Offered by*

Stephen Sprigle, PhD, PT



Rehabilitation  
Engineering &  
Applied  
Research

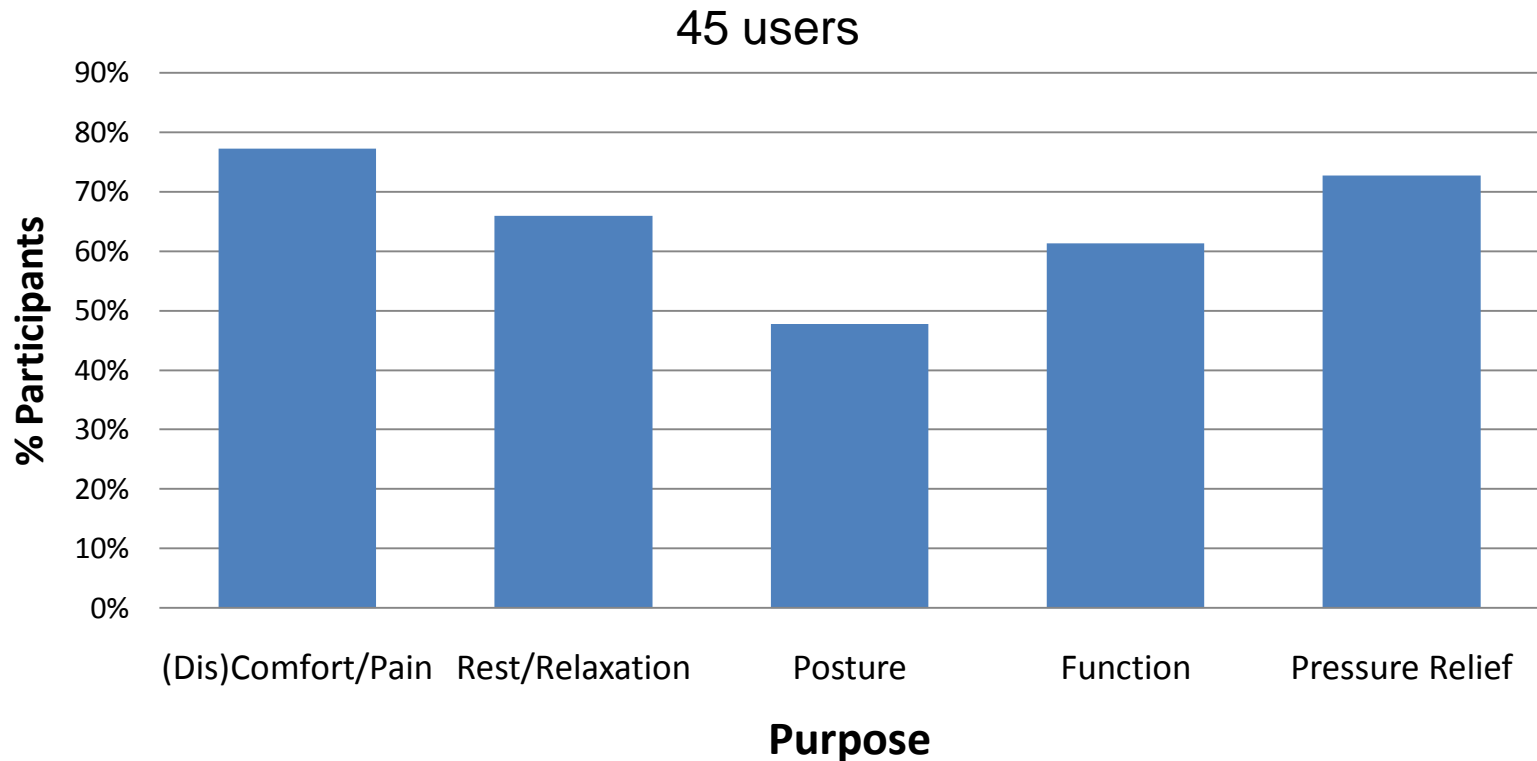
# WHY?

## NO ONE TILTS (for pressure reliefs) !

# “Medically necessary” reasons for tilt:

- User’s inability to perform independent weight shifts to decrease potential for skin breakdown
- Utilize gravity assisted positioning to increase stability of users with significant physical deformities who also have a need to dynamically come out of tilt for functional activities

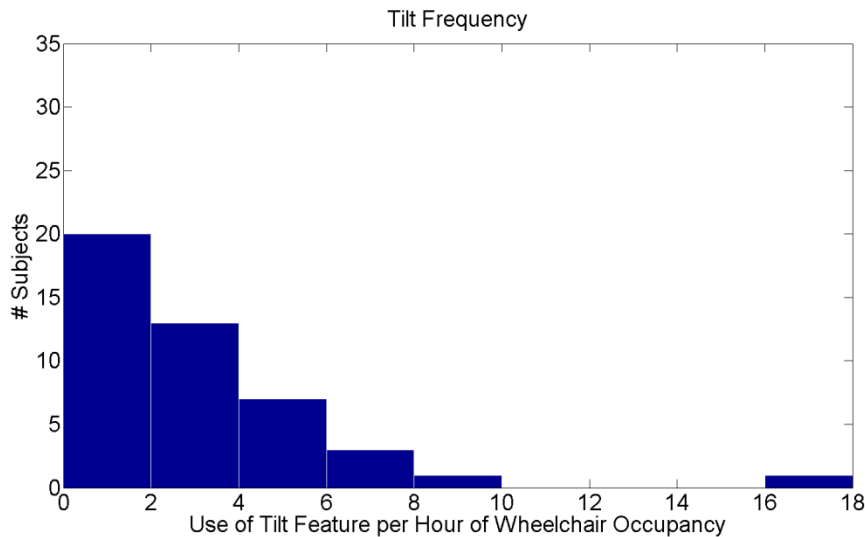
# Self Reported Purposes for Using Tilt



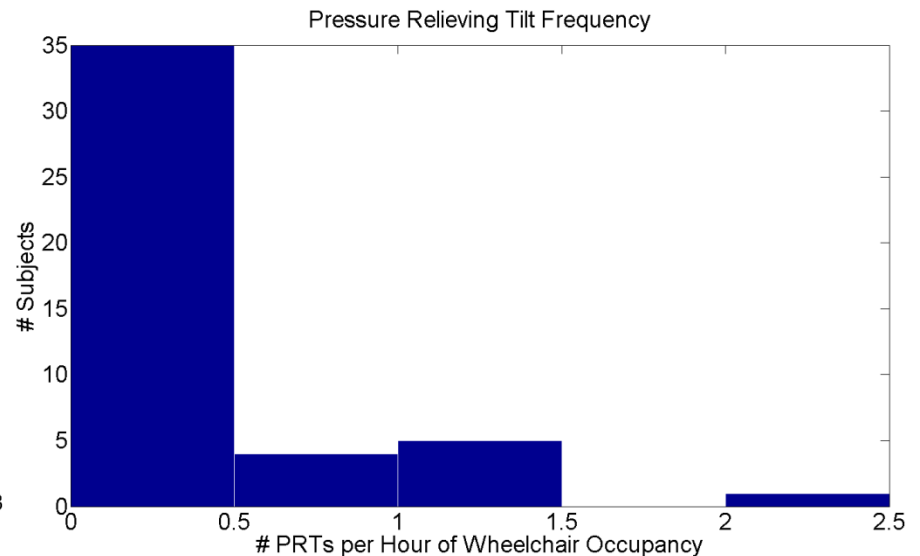
Similar results reported by Ding (2008) (n=11) and Lacoste (2003) (n=40) except  $\leq 35\%$  reported changing position for physiological reasons in Lacoste study

# Use of tilt feature per hour

**Use of tilt feature**  
**(Angle change of  $5^{\circ}$  lasting  $> 20$  sec)**



**“Pressure Relieving Tilts”**  
**(Tilts  $> 30^{\circ}$  lasting  $> 1$  minute)**



Ding (2008):subjects: accessed tilt  $19 \pm 14$  times/day,  
spent 64.1% of day in some tilt.  
 $1.6 \pm 4.1$  tilts  $> 40^{\circ}$ /day

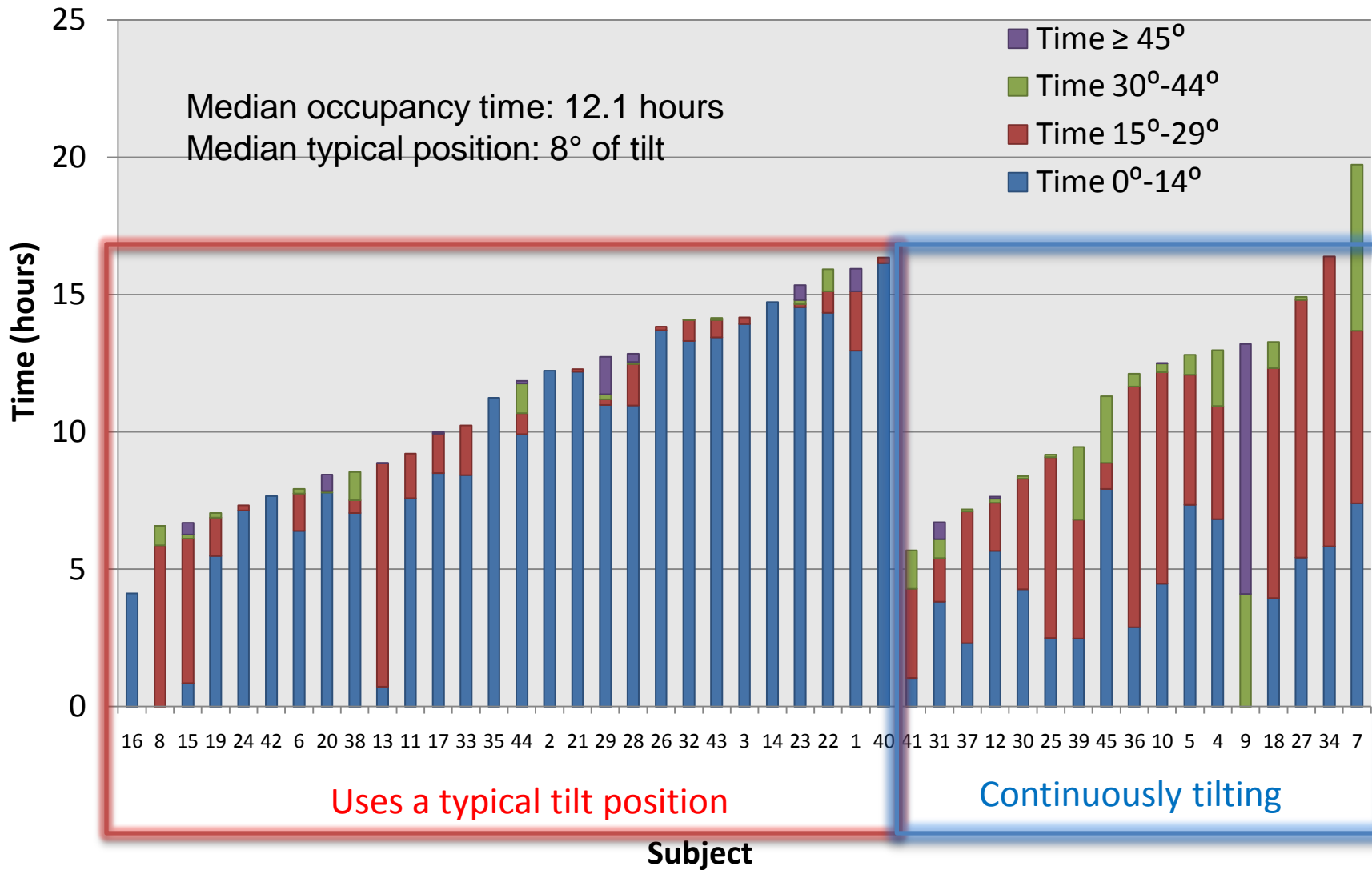
# Use of Tilt-in-Space Wheelchairs

Normalized to time in wheelchair

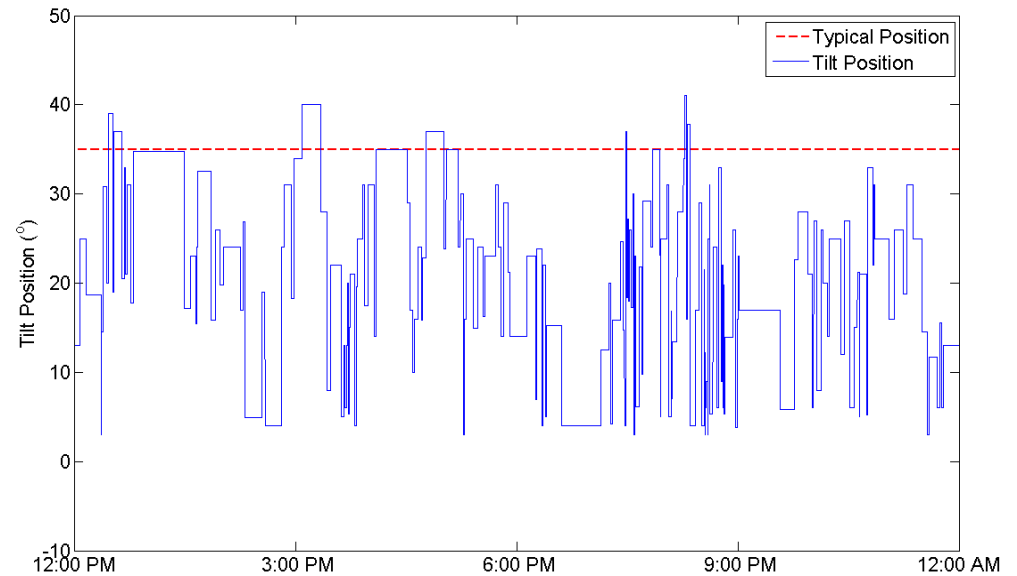
Variable	Median (Min – Max)	Mean $\pm$ SD
% Time 0° - 14°	81 (0 – 100)	65 $\pm$ 33
% Time 15° - 29°	15 (0 – 92)	26 $\pm$ 28
% Time 30° - 44°	1 (0 – 29)	5 $\pm$ 8
% Time $\geq$ 45°	0 (0 – 71)	3 $\pm$ 11

Ding (2008) (n=11) ; users spent

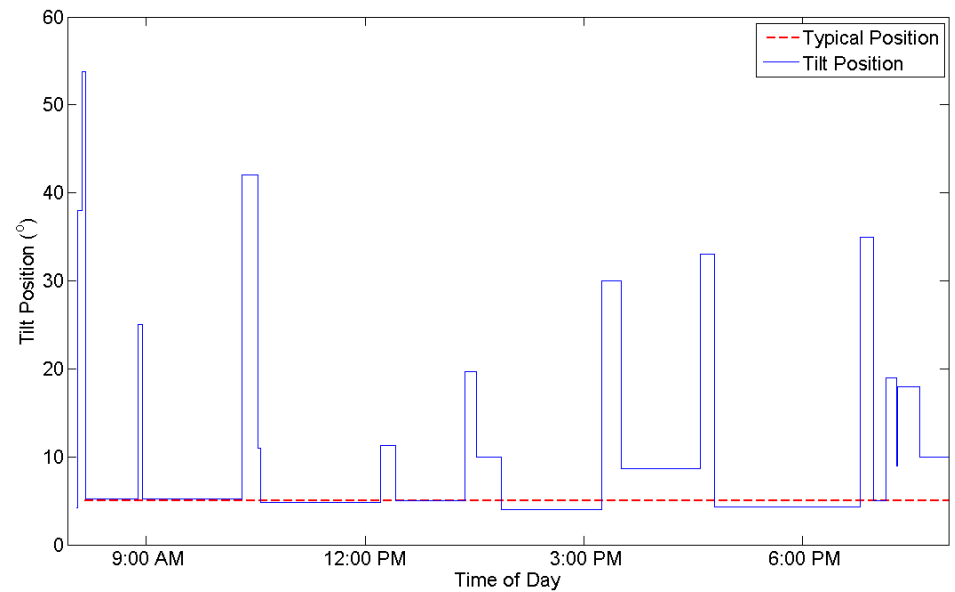
272.7 $\pm$ 228.7 minutes /day in 2.5-10° tilt & 14.8 $\pm$ 28.6 in >40°



Example Participant who tilts continuously  
(No regular or typical position)



Example Participant who sits in a typical tilt position



# Why should we care?

- People use their TIS feature more in small ranges than large ranges
  - May indicate that small changes in position increase comfort , stability and/or function
  - Regardless of the reason, **use of feature should be encouraged during set-up and training**
- Many people sit in some tilt for extended periods
  - May indicate gravity-assisted positioning is sought
  - Perhaps we can investigate this during evaluation for and training of TIS systems

# Tilt Angle Awareness Study

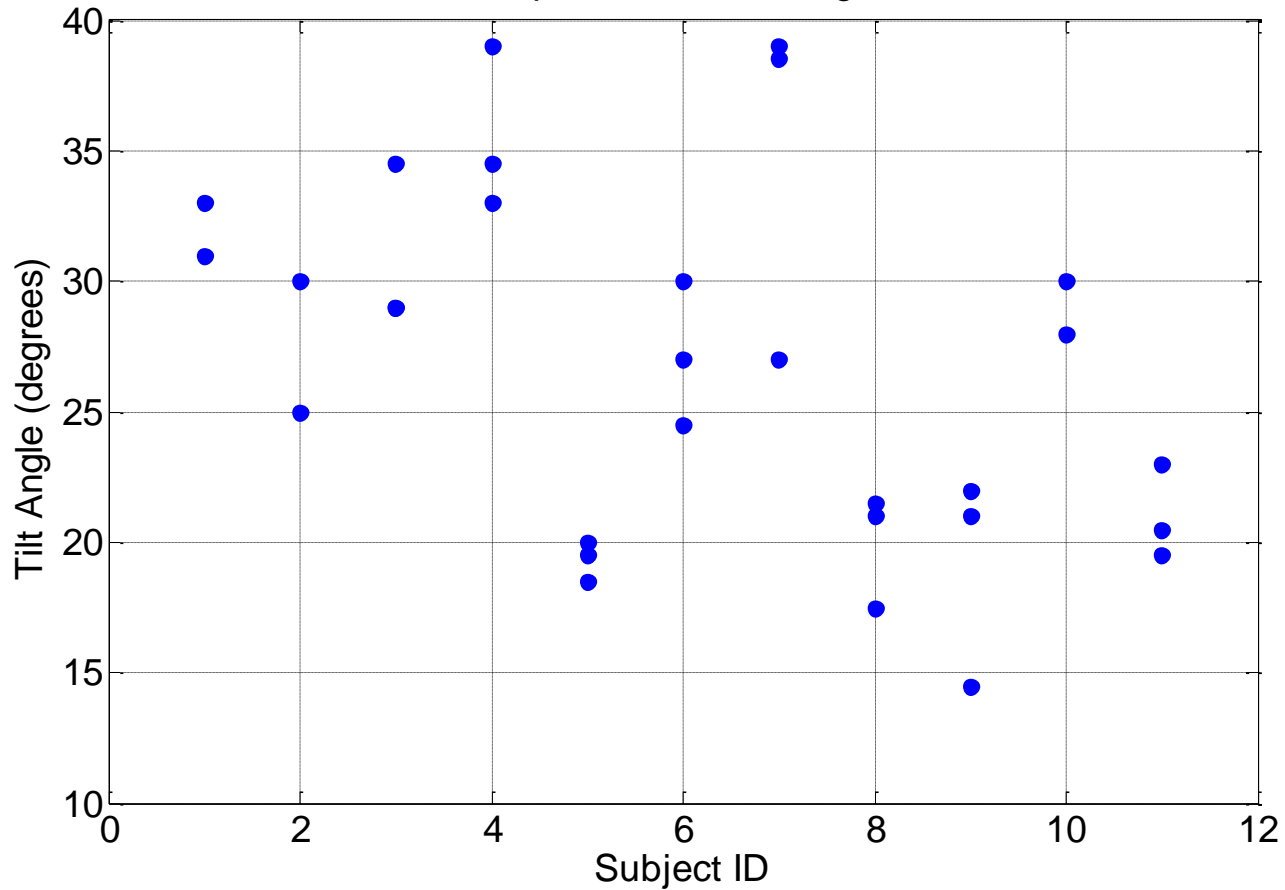
- Tilt Angle Awareness Study: To determine if people know how far to tilt for pressure reliefs
  - Do people know how far to tilt for pressure relief?
  - Are people aware of how far they are tilted?
  - Does training help?

# Tilt perception: able-bodied students “Novice Users”

- N = 11 able bodied students
- Asked to tilt to 45°, measure actual angle (x3)
- Shown 45° of tilt and asked to replicate the position, measure actual angle
- 1 week later – ask subjects to tilt to 45°

# Tilt Perception: Attempting 45 degrees

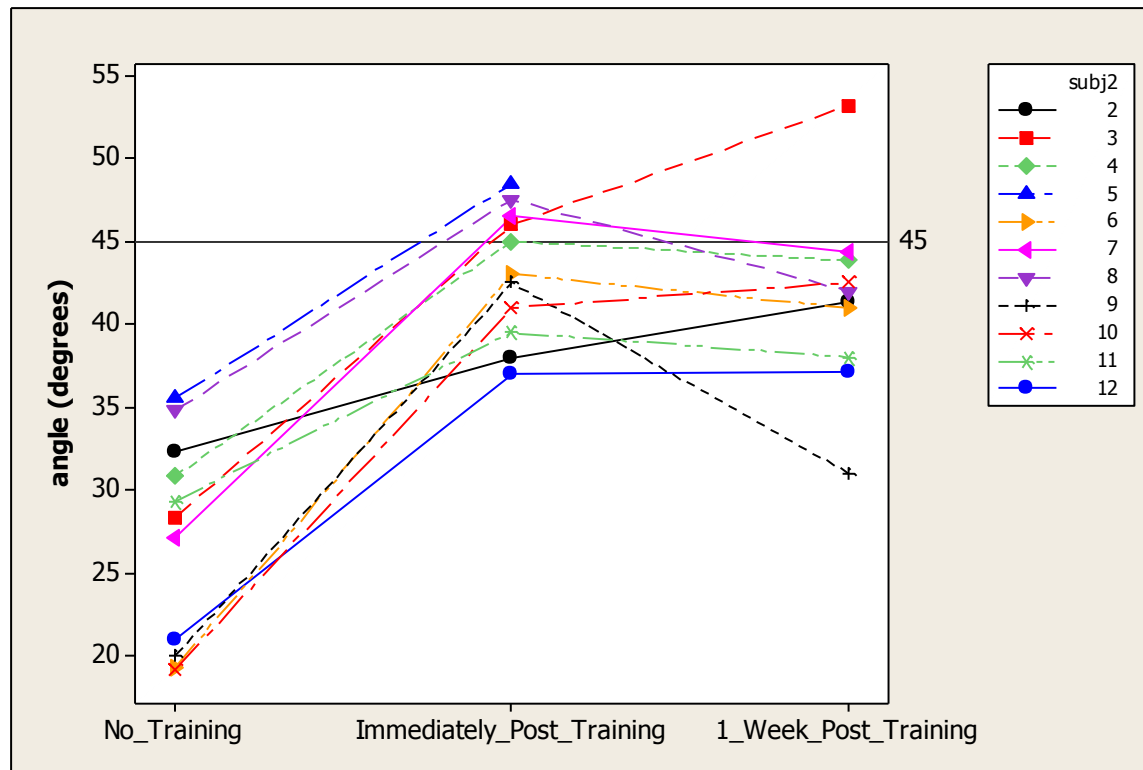
Attempts to Tilt to 45 degrees



# Pilot Study: Tilt Perception

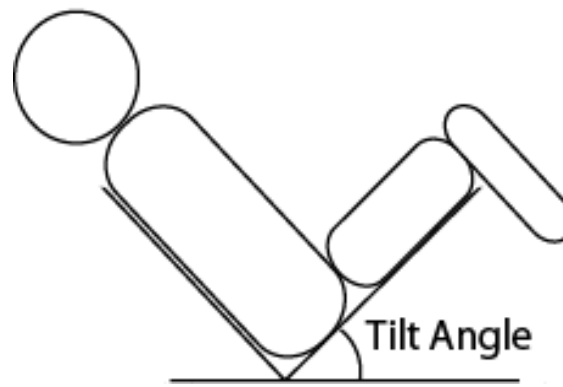
- Overall: Mean  $27^\circ \pm 6^\circ$  (off by 40%!)
- With no training,  $45^\circ$  is much farther back than people expect
- Consistent with subjects in study

# Able-bodied Students: Training Effects



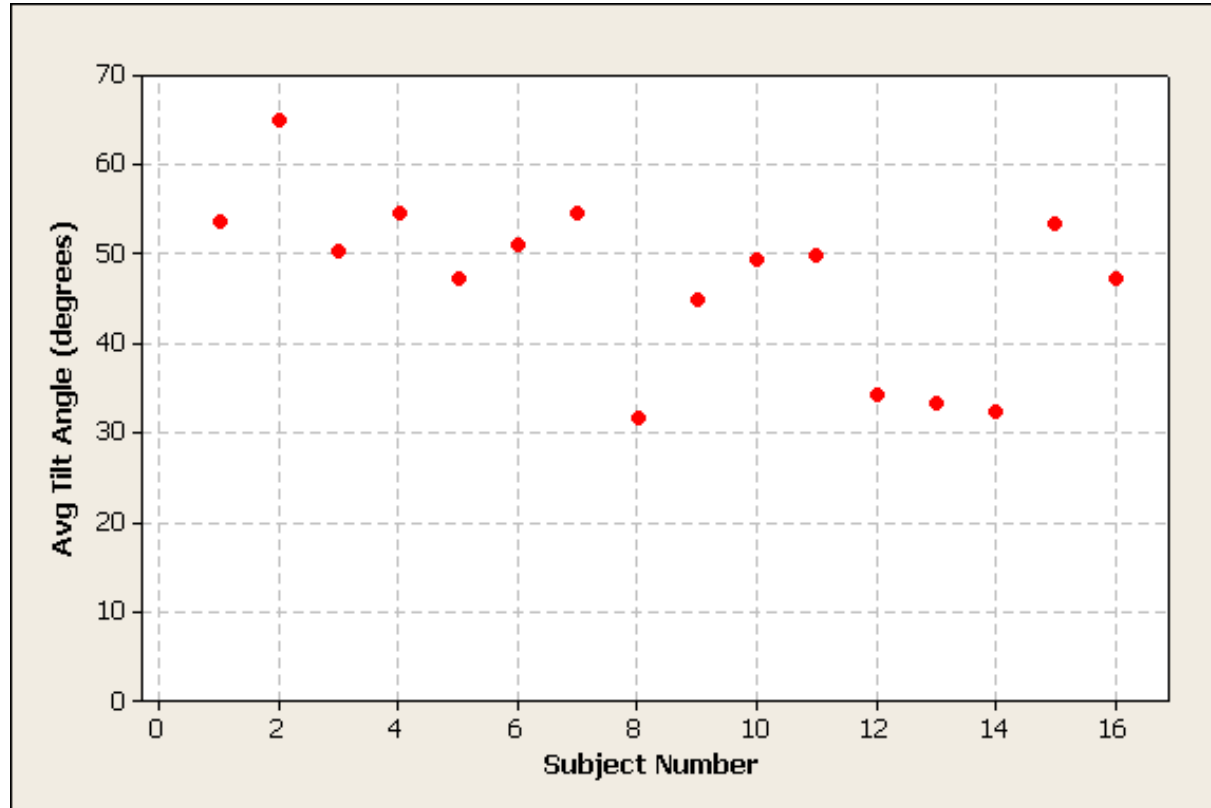
# Current Tilt Users

- Randomly selected people who use powered tilt wheelchairs
- Asked to “demonstrate a pressure relief” 3 times
- Angle was measured



# Current Tilt Users

(all recently completed rehab training)





Typical tilt position



**First time ever going back to full tilt!**

# Why not full tilt?

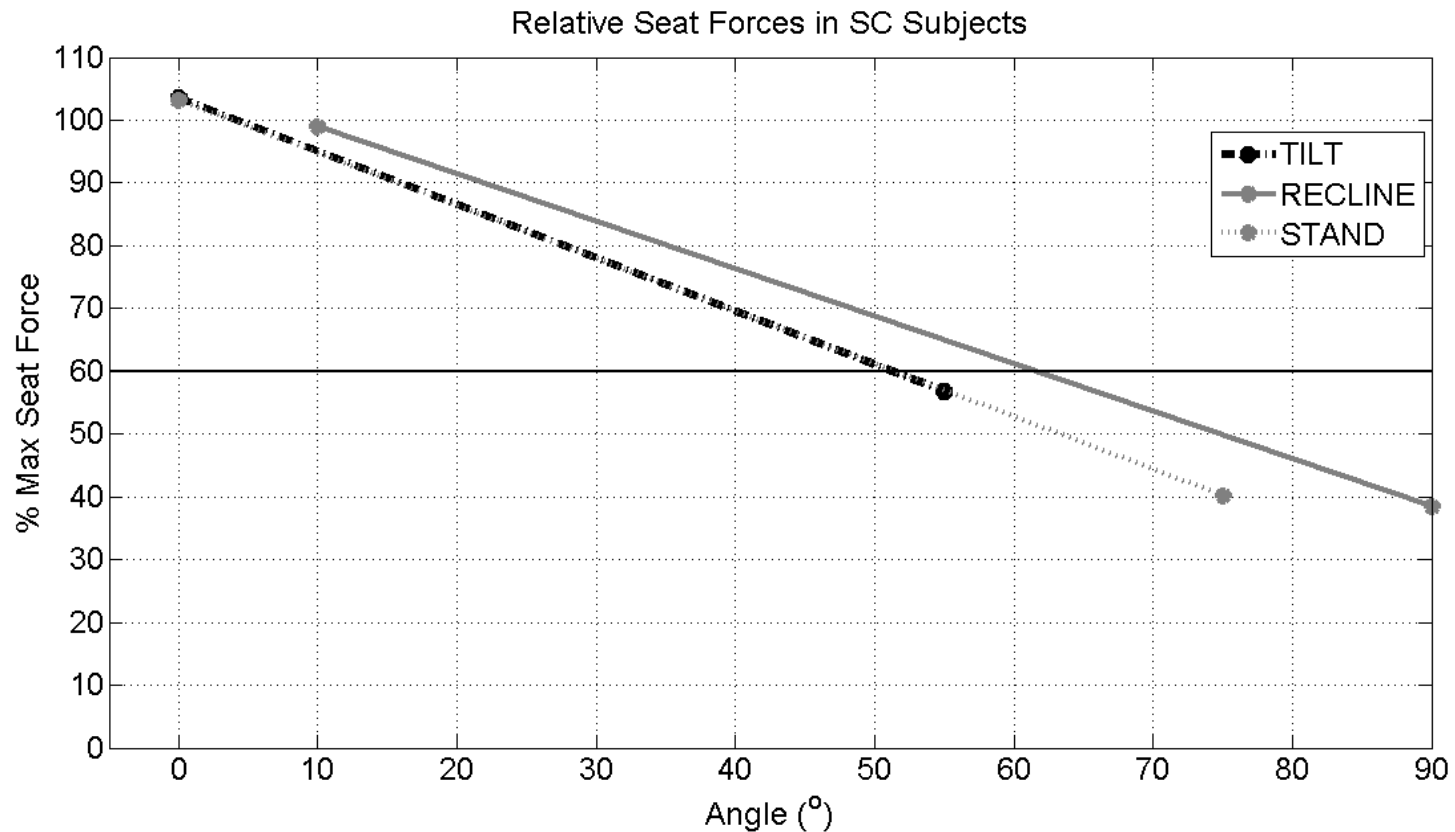
Survey says!

- Users feel unstable, even though they knew they weren't going to tip over
- Users feel they will tip over
- It is disruptive to tilt during daily activities/work/school
- Users are embarrassed to tilt in front of other people

# What we know about tilt systems:

- People sit in their chairs for a LONG time/day (12 hours)
- The farther back you tilt, the more load is redistributed off of the buttocks
- Tilting to 20° and beyond offers significant shear reduction compared to upright and recline.
- Slight improvement in LE blood flow with 30° and 50 ° tilt
- Even small tilts- as small as 15 ° from upright - increases superficial blood flow at IT's

# Load redistribution in variable position wheelchairs



Rate of loading change per angle of seat forces for SC subjects

Sprigle S, Maurer C, Sonenblum S, Load redistribution in variable position wheelchairs, in press. (JSCIM)

# The impact of tilting on blood flow

Tilt Position	Mean Blood Flow	<i>P</i> -value
15°	1.08 (0.19)	<i>0.016</i>
30°	1.24 (0.48)	<i>0.003</i>
45°	1.84 (1.84)	<i>0.007</i>
Max Tilt	3.34 (5.09)	<i>0.034</i>

**Normalized pressure and blood flow values (normalized by preceding upright values).  
Statistics were computed for normalized blood flow compared with a ratio of 1.**

Sonenblum SE. Biomechanical Responses to Seated Full Body Tilt and their Relationship to Clinical Application. Atlanta: Georgia Institute of Technology; 2009.

# What we know about tilt systems:

- People with MS breathe better at 25° and 45° of tilt
- Improved voice volume with tilt for people with MS may allow them to be heard in times of stress/danger
- Improved sitting balance and posture in tilt has been shown in different user groups
- Power tilt allows users to alternate from upright for functional activities to tilting back for postural support and physiological reasons throughout the day
- Via usage patterns & self report: users who tilt often for increased comfort & decreased pain
  - We wish we could determine whether this leads to more activity



# Gravity assisted positioning

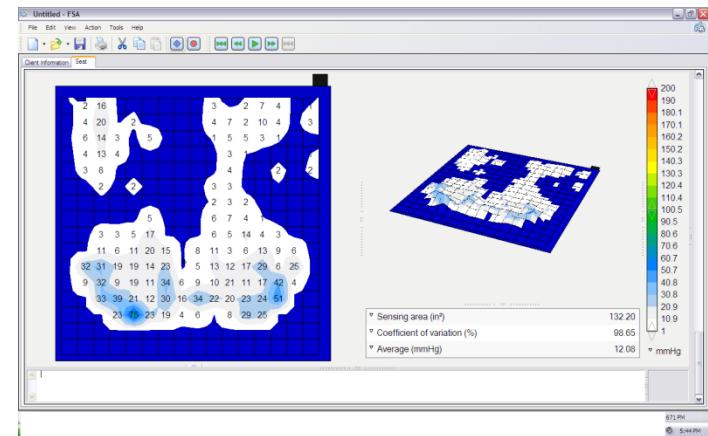
# Summary of what we know:

- Tilt helps in more ways than redistributing pressure
- But if you want to best redistribute pressure, tilt back as much as one can
- Many people are not utilizing the tilt feature.
  - Assume most learn by trial and error to impact pain/comfort/relaxation

How do we best educate users on use of tilt?

# Training tips for use of tilt

- Dedicate time to fully review system and use upon delivery.
- Educate regarding necessity of full tilt for pressure redistribution. Use pressure mapping as educational tool.



- Pressure ulcer prevention and treatment following SCI practice guidelines report weight shifting every 30-60 minutes for 30 seconds to a full minute.

# Training tips for use of tilt

- Educate user on benefits of small tilt ranges to ↑ blood flow, ↑ posture/balance, ↑ comfort, ↓ pain, rest/relaxation
- Take user through full range of tilt to decrease fear. Reinforce returning to complete upright may not be goal
- Ensure user can access tilt switch throughout full range and can perform tilt independently
- Provide written instructions reviewing why, how, frequency, duration of tilt. Pictures can help!

# Training tips for use of tilt

- Encourage users to use the tilt feature as often as possible
- Consider memory seating to pre-program positions (make sure there is enough room!)
- Use of timer for reminder OR discuss other means (b/f meal or meeting, during commercials etc)
- Educate regarding use of tilt for postural stability when negotiating over uneven terrain/ramps/obstacles

# Discuss

- Working assumptions given data:
  - Tilt feature is useful
  - People are underutilizing tilt feature
- What training is being offered?
  - What other training suggestions should be added?
  - Who does the training/delivery?
    - Therapist, supplier, delivery tech?
  - Is there a benefit to a written document outlining clinical tilt training practice?
- What barriers exist to implement this training in the field?
  - Perceived importance of tilt use?
  - Disparate personnel involved?

# Thank you

Full paper at <http://www.mobilityrerc.gatech.edu/>.

Click on “Project Documents”. (different site than what is in proceedings)

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