Understanding Tilt-in-Space Use in Shepherd Center Clients

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Shepherd Center In-service
What DO we know about Tilt-in-Space?

• Seating clinic prescribed >100 in 2007
• Expensive
• Justification – lack of ability to independently reposition or do weight shifts (pressure ulcer prevention)
• Increasing tilt angle decreases interface pressure
What DON’T we know about Tilt-in-Space

• How often it is used for pressure relief
• Whether or not people know how to use it for pressure relief
• How much physiological benefit one gets from a tilt
• What other reasons people use their tilt
How far to tilt?

• Studies say interface pressure decreases as tilt angle increases.
• Is 45° magic???
• Chris Maurer presented this graph at ISS 2007:
  • Many clinicians teach 45° or “all the way back”
    – more is better, even without magic angle
• Literature varies between > 30° and up to 45°

Purposes for Tilting

- Decreased pressure
- Increased comfort and sitting tolerance secondary to the decreased pressure
- Increased function
  - Secondary to increased sitting tolerance and more time out of bed
  - Variable positions available for access and reach in different situations
  - Improved head and neck control
  - Easier transfers
- Increased blood flow
- Easier feeding
- Improved respiratory function
- Improved sleep and rest
Lacoste et al:
A Survey about Tilt and Recline

- 40 people
- how and why they used their systems
  - comfort/discomfort/pain
  - rest/relaxation
  - posture
  - functional independence
  - physiological functions (including pressure reliefs)
- 97.5% reported using their tilt or recline system daily
- > 70% used their tilt and recline systems for comfort, rest, relaxation, and pain
- few participants reported using the chairs for prevention of pressure sores or other physiological functions.

Purpose of Tilt-in-Space Monitoring Study

- To explore how fulltime power wheelchair users utilized their tilt systems.
  - Did participants utilize their tilt feature?
  - Did participants perform regular weight shifts?
  - Why do people use their tilt?
  - Do people with different purposes for tilting use their tilt systems differently?
Methods: Subjects and Protocol

- Convenience sample: N=16 (11 men, 5 women),
- Fulltime power wheelchair users
- Varying diagnoses
- 2 weeks of monitoring
- WhAMI (Wheelchair Activity Monitoring Instrument)
  - Occupancy switches
  - Accelerometer for tilt angle
  - Record every 2 seconds
- Asked (n=15) why or when they use tilt (open ended)
Methods: Variables

- Occupancy Time
  - % Occupancy time at each position
    - Small < 15°; Medium 15-29°;
    - Large 30-44°; Extreme >45°

- Tilt
  - Reflects use of tilt feature
  - Position change of 5° in either direction lasting ≥ 20 seconds

- Pressure Relieving Tilt (PRT)
  - Backwards tilt to a position > 30° lasting ≥ 1 minute

- Tilt Frequency (either tilt or PRT)
  - # tilts on a day / occupancy time on the same day, reported in tilts per hour
Results: Occupancy Time

• Median = 11.0 hours per day
• range: 5.0-16.6 hours
• 6 subjects spent >12 hours per day in wheelchair
Results: Breakdown of Day

- 5 Subjects (yellow) spent most of their time upright.
- Only 6 subjects (blue) tilted to 45°.
- Some subjects never reached 30°.
- Some subjects spent most of their time between 15° and 30°.

<table>
<thead>
<tr>
<th>Subject</th>
<th>&lt; 15°</th>
<th>15°-29°</th>
<th>30°-44°</th>
<th>≥ 45°</th>
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<td>1</td>
<td>91%</td>
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Results: Use of Tilt Feature

- Recall:
  Tilt = a change of 5º for 20 seconds
- Nearly half of subjects tilted regularly (1 x / 15 minutes)
Results: PRT Frequency

- Recall:
  PRT = tilt > 30º for 1 minute
- Median subject = 1 pressure relieving tilt every 7 hours
- Only 3 subjects performed pressure relieving tilts at least once per hour.
Discussion

• Did participants utilize the tilt feature?
  – Most subjects (15/16) utilized their tilt feature
  – Frequent, small position changes (4/hour)
  – Most subjects sat at more than 2 different positions throughout the day
  – Diverse types or styles of use
• Did participants perform regular weight shifts?
  – No!
  – Little to no tilting to 45°
  – Infrequent tilting past 30°
Discussion: Questions Raised

• What benefits are people getting from small to medium sized tilts (<30°)?
• How can we predict who will take advantage of their tilt system?
• Why do so few people perform pressure relieving tilts with the recommended frequency?
  – What can we do to encourage people to tilt to 45° more frequently?
• Why do few subjects tilt to 45°?
  – What can we do to encourage more people to tilt as far back as 45° or greater?
• Are we training people properly to utilize tilt (frequency and magnitude) as clinicians intend?
### Purpose of Tilt Use

<table>
<thead>
<tr>
<th>Subject</th>
<th>Comfort / Discomfort / Pain</th>
<th>Rest / Relaxation</th>
<th>Posture</th>
<th>Functional Independence</th>
<th>Physiological Functions</th>
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# Median Tilt Use By Purpose

<table>
<thead>
<tr>
<th></th>
<th>Comfort/Discomfort/Pain</th>
<th>Rest/Relaxation</th>
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<tbody>
<tr>
<td></td>
<td>No (6)</td>
<td>Yes (9)</td>
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<tr>
<td>Typical Position ( )</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Tilt Frequency / hour of wheelchair occupancy</td>
<td>4.9</td>
<td>2.8</td>
</tr>
<tr>
<td>PRT Frequency / hour of wheelchair occupancy</td>
<td>0.6</td>
<td>0.1</td>
</tr>
<tr>
<td>% Time &gt; 30</td>
<td>12%</td>
<td>3%</td>
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Tilt use when used for physiological purposes including pressure reliefs

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<tr>
<th></th>
<th>Physiological</th>
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<tbody>
<tr>
<td></td>
<td>No (4)</td>
<td>Yes (11)</td>
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<tr>
<td>Typical Position (°)</td>
<td>15</td>
<td>8</td>
<td>0.461</td>
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<tr>
<td>Tilt Frequency / hour of wheelchair occupancy</td>
<td>2.8</td>
<td>3.2</td>
<td>0.292</td>
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<td>Pressure Relieving Tilt Frequency / hour of wheelchair occupancy</td>
<td>0.1</td>
<td>0.3</td>
<td>0.598</td>
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<tr>
<td>% Time &gt; 30</td>
<td>3%</td>
<td>4%</td>
<td>0.673</td>
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Comparison with Lacoste et al.’s Survey Results

SIMILARITIES
• 14/15 subjects reported comfort, pain, or rest as a purpose of use

DIFFERENCES
• Many participants reported physiological purposes
• Many participants had at least one day in which they did not use their tilt feature to change position more than 5°.
Purpose of the Tilt Angle Pilot Study

• **Tilt Angle Pilot 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?
Able-bodied Students “Novice Users”

- N = 11 able bodied students
- Adjusted footrests on a tilt-in-space power wheelchair for optimal fit
- Asked to tilt “as far as needed for pressure relief”, measure actual angle (x3)
- Asked to tilt to 45º, measure actual angle (x3)
- Shown 45º of tilt and asked to replicate the position, measure actual angle
- 1 week later – ask subjects to tilt to 45º
Tilt Angle Pilot Study

wheeled mobility in everyday life
Tilt Angle Pilot Study

Able-bodied Students: Before Training

![Box plot showing Tilt Angle Pilot Study](image)
Able-bodied Students: Training Effects

Tilt Angle Pilot Study

wheeled mobility in everyday life
Current Tilt Users

- Randomly selected people who use powered tilt wheelchairs were asked to “demonstrate a pressure relief” 3 times
- Angle with horizon was measured
Current Tilt Users

Tilt Angle Pilot Study

wheeled mobility in everyday life
Discussion

Monitoring Study
• Do frequent, small position changes offer restorative benefits to wheelchair users?
• How can we predict who will take advantage of their tilt system?

Tilt Angle Study
• How can we improve training to make sure everyone knows how far to tilt?
• What sort of follow-up can we provide to improve retention of knowledge about tilts and pressure reliefs?
• If training successfully teaches people how far to tilt, why are some people still not tilting?
What now?

- **Monitor more people**
  - Is pressure relieving tilt frequency low across more people?
  - Does a person’s knowledge of how far to tilt relate to whether or not they tilt?
  - Does more frequent tilting relate to improved health?

- **Study blood flow**
  - Do small tilts increase blood flow at all?
  - What is the smallest tilt needed to produce a hyperaemic response?

- **Graduate**
How will I do all of this and be able to graduate next year?

Monitoring more people and studying blood flow might take up to 50 participants... I need your help!

• Tell your patients about ongoing research.
• Encourage them to learn about the studies and consider participating.
• Give out my email address (sharon.sonenblum@coa.gatech.edu)
• Encourage people to join the CCN (www.catea.org >> click on “Join the CCN”)

wheeled mobility in everyday life
Other Applied Clinical Research at Shepherd Center: Ongoing

- Manual Wheelchair Monitoring
- Cushion Degradation Study determine the functional lifespan of wheelchair cushions used in typical daily fashion
  1. verify or negate the 5 year expected lifespan for durable medical equipment (DME)
  2. identify critical factors contributing to or accelerating degradation
  3. develop a simple and comprehensive test to assist clinicians and users with the decision of replacement

wheeled mobility in everyday life
Other Applied Clinical Research at Shepherd Center: Ongoing

- Dartfish - Real-time video feedback
  - investigate the use of real-time video feedback to improve training on mobility and activity of daily living (ADL) related skills that are commonly taught during therapeutic rehabilitation.
Wheeled mobility in everyday life
Other Applied Clinical Research at Shepherd Center: Upcoming

- Pressure ulcer risk analysis
  - Do clinical risk factors change blood flow occlusion or tissue stiffness at the IT?
- Pressure relief monitoring in manual wheelchair users
  - Do people with a history of recurrent pressure ulcers have different pressure relief behaviors than people without a history?
Acknowledgements

- Research Team and Co-Authors
  - Stephen Sprigle, Ph.D., PT
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- Tilt Angle Pilot Study:
  - Weerawat Limroongreungrat & Allen Chang
- Participants
- Funding Sources
  - NIDRR – RERC on Wheeled Mobility
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Acknowledgements

- Collaborative Research Team – people you might run into at Shepherd Center
  - Stephen Sprigle
  - Chris Maurer
  - Kim Davis
  - Christy Acker
  - Weerawat Limroongreungrat
  - Sharon Sonenblum
  - Brian Dunlap
Questions?
Ideas for research projects?
Ways to improve tilt use?

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