Understanding Wheelchair Use Patterns: Tilt-in-Space

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Background

• Pressure ulcers (PUs) are a problem
• PUs are caused by loading
• Managed clinically via:
  – cushions and support surfaces (magnitude)
  – pressure reliefs (duration)
• When independent pressure reliefs are not an option, powered tilt or recline may be employed.

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How far to tilt?

- Studies say interface pressure decreases as tilt angle increases.
- Is 45° magic???
- Chris Maurer, MPT, ATP presented 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°

Purpose of the Current Study

- To explore how fulltime power wheelchair users utilized their tilt systems.
  - Did participants utilize their tilt feature?
  - Did participants perform regular weight shifts?
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
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

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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°

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Results: Use of Tilt Feature

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

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

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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?

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Pilot Study: Tilt Perception

- 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 45°, measure actual angle (x3)
- Shown 45° of tilt and asked to replicate the position, measure actual angle (x3)
- Will repeat 1 week later to see if they recall how far to tilt.

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Pilot Study: Tilt Perception

Attempts to Tilt to 45 degrees

Subject ID

Tilt Angle (degrees)

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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
Acknowledgements

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Questions?