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Why Full-time Power Wheelchair Users Tilt

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ABSTRACT

Tilt-in-space features are often prescribed for persons unable to independently perform pressure reliefs, but who are at risk for pressure ulcers. Yet, little research has been conducted on how tilt systems are utilized. This paper describes the self-reported reasons why 16 power wheelchair users utilized their tilt systems, and the relationship between the purposes and tilt utilization. Seat tilt angle was recorded every 2 seconds on a data logger. Most subjects reported using their tilt for pressure reliefs, comfort/discomfort/pain, and rest/relaxation. No statistical differences were found in tilt use based on purposes of use. However, some trends were evident between subjects using their chairs for comfort versus those using it for rest. This analysis supports the need for a larger study exploring how and why people utilize their tilt features, the benefits of small tilts, and the need for interventions to increase the use of tilt for pressure reliefs.

KEYWORDS

Power wheelchair, tilt-in-space, data logger

BACKGROUND

Pressure ulcers remain a leading secondary complication of spinal cord injury (SCI), affecting more than 50% of people with SCI during their lifetimes (1). Two factors, the magnitude of pressure and duration of loading, are the defining causes of pressure ulcers (2,3). Clinically, these causative factors are addressed by the selection of appropriate wheelchair cushions and by the establishment of pressure relief schedules. Power weight-shift systems (e.g., tilt, recline) are frequently prescribed for persons who are unable to perform manual weight shifts. This study focused exclusively on tilt systems because they are frequently prescribed in the local seating clinic for pressure relief and are believed to have many additional benefits.

Previously, Lacoste et al. asked 40 people who used tilt or recline wheelchairs about how and why they used their systems (4). The purposes of use considered in their study were garnered from a literature review and focus group, and separated into five categories: 1) comfort/discomfort/pain, 2) rest/relaxation, 3) posture, 4) functional independence, and 5) physiological functions (including pressure reliefs). In response to the survey, 97.5% of respondents reported using their tilt or recline system daily. More than 70% of the respondents said they used their tilt and recline systems for comfort, rest, relaxation, and pain; yet few participants reported using the chairs for prevention of pressure sores or other physiological functions.

This paper examines the self-reported reasons why fulltime power wheelchair users utilized their tilt systems and compares subject responses to objective data captured using seat tilt angle sensors. This allows researchers and clinicians to better understand how and for what purposes tilt systems are used.

METHODS

A convenience sample of 16 adults (11 men, 5 women) who used power tilt-in-space wheelchairs as their primary mobility device were recruited with IRB approval. Subject's tilt use was monitored for one to two weeks using the WhAMI (Wheelchair Activity Monitoring Instrument) (5,6). Seat tilt angle

was measured every two seconds with a uni-axial accelerometer fixed to the seat pan. Wheelchair occupancy was monitored every two seconds using Ribbon Switches placed beneath the cushion.

For this analysis, we measured the tilt frequency, or the frequency with which subjects changed their position (Figure 1). A tilt was defined as a position change of 5° in either direction (i.e., more tilted or towards upright) lasting 20 seconds or more. A specific type of tilt, called a pressure relieving tilt (PRT), was defined as a backwards tilt to a position > 30°. The tilt frequency was calculated by dividing the total number of tilts per day by the number of hours spent in the wheelchair on that day. We also considered the typical position at which a person sat and the percent of the time they were seated spent tilted more than 30°.

During wheelchair instrumentation, subjects were asked to describe the purposes for which they used their tilt features. Responses were categorized into Lacoste's five categories described above. Kruskal-Wallis tests were performed to compare the tilt usage of people who reported a particular purpose and those who didn't. This statistic was chosen because of the small n and non-normality of the data. P values will be reported and differences with $p < 0.2$ will be fully discussed.

RESULTS

Most subjects reported at least two purposes for using their tilt feature. The most common purposes were physiological (69%); comfort, discomfort or pain management (56%); and rest and relaxation (50%) (Table 1). Although none of the categories were mutually exclusive, most participants reporting using the feature for comfort/discomfort/pain did not also report using it for rest/relaxation.

Table 1 Goes Here

No statistical differences in tilt feature use were found based on self-reported purposes. However the low statistical power may explain this lack of significance, since a number of interesting differences are evident. Subjects using the feature for comfort/discomfort/pain typically sat at a greater angle than those who did not (15º v. 7º), whereas subjects who reporting tilting for rest/relaxation purposes typically sat at smaller angles (6º v 15º). All subjects who used their tilt feature for physiological purposes indicated their intent to perform weight shifts or pressure relief. However, they did not perform more pressure relieving tilts nor did they spend more time in a tilted position >30º than their counterparts.

DISCUSSION

The most common self-reported purposes of tilt use in this study differed from those reported by Lacoste et al (4). The majority of subjects in the current study reported using tilt for pressure reliefs and other physiological purposes, whereas few subjects in Lacoste's study reported using tilt/recline for pressure reliefs. Despite the difference in pressure relief as a purpose, comfort and/or rest were reported as purposes by most subjects in both studies.

Lacoste et al. found that large amplitude tilts were used for rest and to decrease pain while small amplitude tilts were used to increase comfort (4). This is different than the trends found in our results, in which subjects using their tilt for comfort sat at larger tilt angles while subjects using the chair for rest sat at smaller angles. It is possible, however, that common tilt amplitudes differ from the typical position, although the two may be related.

Another difference between our studies was the daily use of tilt. In Lacoste et al.'s study, most subjects reported using their tilt and recline systems daily. During interviews with our subjects, they all

said they used their tilt systems and that they found them very comfortable. However, unlike Lacoste et al.'s results, many of our subjects had at least one day in which they did not use their tilt feature to change position more than 5º.

The finding that subjects who reported using tilt for pressure reliefs did not perform more frequent pressure relieving tilts, or spend more time tilted past 30°, may indicate the need for additional study. If the participant's intent was to use the tilt feature for pressure reliefs, different methods of training might be needed to insure that clinical objectives are met.

This small sample size is insufficient to draw generalizable conclusions regarding the use of power tilt. However, it suggests a few possibilities regarding how and why people use their tilt feature, which may be important for prescription and design. Because use of tilt was measured objectively, it adds additional information to the self-reported results of Lacoste et al. Our interesting findings regarding purpose, in addition to the frequent use of tilt for small positions indicate the need for further study. Future work should identify the benefits of small position changes in terms of comfort, pain reduction, and pressure ulcer prevention. Additionally, it should aim to demonstrate for which subjects the tilt feature will be most beneficial.

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Table 1

	Comfort/Discomfort/Pain (N=9 YES)			Functional Independence (N=6 YES)			Posture (N=4 YES)		
	No	Yes	p-val	No	Yes	p-val	No	Yes	p-val
Typical Position (°)	7	15	0.290	9	11	0.688	7	12	0.308
Tilt Frequency / hour of wheelchair occupancy	4.9	2.8	0.178	3.3	3.0	0.615	3.2	3.1	0.734
PRT Frequency / hour of wheelchair occupancy	0.6	0.1	0.194	0.4	0.1	0.482	0.2	0.0	0.193
% Time > 30°	12%	3%	0.194	11%	3%	0.315	5%	3%	0.193
	Rest/Relaxation (N=8 YES)			Physiological (N=11 YES)					
	No	Yes	p-val	No	Yes	p-val			
Typical Position (°)	15	6	0.102	15	8	0.461			
Tilt Frequency / hour of wheelchair occupancy	4.2	1.6	0.248	2.8	3.2	0.292			
PRT Frequency / hour of wheelchair occupancy	0.2	0.1	0.211	0.1	0.3	0.598			
% Time > 30°	5%	3%	0.441	3%	4%	0.673			

Median values and p-value of Kruskal-Wallis test.

This table describes the median tilt use (i.e., typical position, tilt frequency, pressure relieving tilt frequency, and percent of time spent at a tilt angle greater than 30 degrees) based on self-reported purpose of tilting.