



Project: Postural alignment and loss of independent mobility after acquired brain injury

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This research originated in observations of recovery in brain injury rehabilitation. Many people who can't stand and walk on their own after brain injury have changes in how upright they can get their posture against gravity. Improving the ability to have postural alignment more upright and even, over the base of support, has seemed to be strongly related to recovery of mobility skills. However, when we have searched the evidence, no studies have investigated this.

It is clear that many people lose independence with mobility after brain injury, and that recovering the ability to walk is often the thing they prioritise highest. However, some people are judged as too disabled and are not given access to rehabilitation. Identifying factors that are related to recovery for those with greater disability after brain injury is crucial for optimising progress.

This project aimed to:

- Measure recovery for those with severe loss of mobility after brain injury
- Evaluate whether that recovery is related to their upright postural alignment
- Explore the experience, and personal significance, of loss of independence with standing/walking, through interviews.

How we did it:

14 adults who were not walking 8 weeks after their brain injury participated in assessment of postural alignment using high-tech motion capture technology. When they were able to enter the study, the positions of head, trunk, pelvis and legs were calculated, in sitting, standing and walking while holding rails, and without rails if able. Alignment during walking was calculated at the point of midstance. Measures of mobility that are common in rehabilitation were also recorded. We developed the first measure of whole-body postural alignment, called the Postural Alignment and Dispersion (PAD) score. This score is equal to the average distance of their body segments from being directly over their base of support. All measurements were repeated after 3 months and 6 months.

Results, and statistics:

The main mobility measure (Clinical Outcome Variables Scale) improved significantly during the study ($p < 0.001$, average change 24.9 ± 15.4 , range -1 to 51). The number of people who could walk on their own increased from 2 to 10 after six months. Other mobility measures also significantly improved: sit-to-stand ($p = 0.001$), number of postural tasks participants could achieve ($p < 0.001$), and walking velocity ($p < 0.001$). Timed standing holding rails (up to 30 seconds) did not change significantly ($p = 0.258$), apparently due to timing standing to 30 seconds being too short a timeframe to demonstrate their progress.

We identified significant relationships between improving mobility scores and improving alignment scores over time: in sitting, sitting holding rails, standing, and standing holding rails (range $p = <0.001 - 0.039$).

Associations between improving mobility and postural alignment scores in walking midstance were statistically significant for only 1 of the 6 relationships (range $p = 0.012 - 0.808$). There was less data for walking as fewer participants could walk than sit or stand, but the lack of statistical significance appears to be due to the PAD score not capturing well enough how posture is best aligned during walking.

Analysing interviews:

Interviews provided valuable insights into the experience of those with severe brain injury. Most participants described devastating losses, with loss of mobility affecting many aspects of life, including control, dignity and privacy. Participants needed frequent and high levels of assistance, and judged receiving respectful assistance as crucial. Distress could last for months if they felt staff were not respectful when assisting them. Many participants felt desperate to have time away from the hospital.

Recovery of mobility was prioritised extremely highly, especially walking. All participants described progress with mobility that helped their wellbeing, including assisted mobility. Highly valued areas of assisted mobility included assisted standing, walking, car transfers, powered wheelchair mobility, and transfers without a lifter.



Conclusions

Participants with profound loss of mobility made significant, meaningful improvements over six months. This supports the importance of providing rehab to those with severe disability.

Some of the achievements that participants valued highly do not result in change in scores on commonly used measurement tools in rehabilitation, as scales tend to be designed for those with less physical disability. How to best measure progress of those with greater disability still needs to be determined for rehabilitation.

Results suggest that upright, anti-gravity postural alignment in sitting and standing has a significant relationship with progress with mobility skills. This provides scope to develop improved assessments and interventions in brain injury rehabilitation practice. Further analysis of postural alignment during walking is still needed.

Participants described frustration at waiting for opportunities like being assisted to try car transfers, to get away from the hospital. There appears to be an important need to improve how staff such as physiotherapists prioritise what to include, and when, for assessment of people with greater disability after brain injury.

