Real-life Movement Analysis: Circumstances of falls involving walkers in frail older persons living in long term care

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Introduction

Falls are the leading cause of injuries in older adults, with over half of those over 80 years falling once a year [1,2]. Paradoxically, walkers have been found a risk factor for falls, while often prescribed to support stability [3]. Evaluations of walkers mostly focus on spatiotemporal changes during steady gait [4], as the lack of insight into real-world falls with walkers limit representative biomechanical analysis.

Research Question

How does holding a walker affect the circumstances of falls (activity, cause, direction and head injury risk) by older adults living in long-term care?

Methods

We analyzed videos of 3046 falls by 784 long-term care residents ($\geq$65 years) using a validated questionnaire [5, 6]. We used t-tests and chi-square analyses to test for differences in demographics, cause, activity, fall direction and risk for head injury, between falls with a walker (rollator, 2-wheeled walker or walking frame), versus without holding objects (significance: $p<0.05$).

Results

Of all falls, 16% involved a walker (Fig 1a&b). Residents who fell while holding walkers (85.9±7.4 years) were older than unassisted fallers (82.5±7.9 years; $p<0.001$). Females (n=436) were 1.46-fold more likely to fall with a walker (odds ratio=1.46; 95% confidence interval = 1.14-1.87).

Most of these falls with walkers occurred during walking (49%), standing (30%) and sitting down (13%; Fig 1c). The most likely activities at the time of falling differed with walker use ($p<0.0001$), particularly for falls while standing and sitting down (which were 23% and 6% of falls without walkers respectively). The most common causes of walker falls were incorrect weight shift (48%), trips (17%), and loss of support with an external object (15%; Fig 1d). Residents were 1.7-fold (1.7; 1.18-2.43) more likely to experience a loss-of-support fall when using a walker compared to the other causes.

Walker-supported residents mostly fell backward (34%) and sideways (35%), over forward (17%) and straight down (13%). With walker use, residents were 2.5-fold more likely to fall backward (2.51; 1.78-3.54), and 1.9-fold more likely to fall sideways (1.94; 1.39-2.72), relative to falling forward. Residents were less likely to experience a head injury from falls when holding a walker (0.65; 0.48-0.90).

Discussion

Residents with walkers fell mostly during walking and standing, and due to an incorrect weight shift or trip. With walker support, falls were more likely while standing or sitting down, and due to loss of support. The decreased likelihood of forward walker falls may reflect the device's ability to resist downward hand-contact forces when people fall, but not backward or sideways forces. Further analysis will give the biomechanics community the types of falls to study to understand unsafe rollator use and develop training to prevent falls.

References

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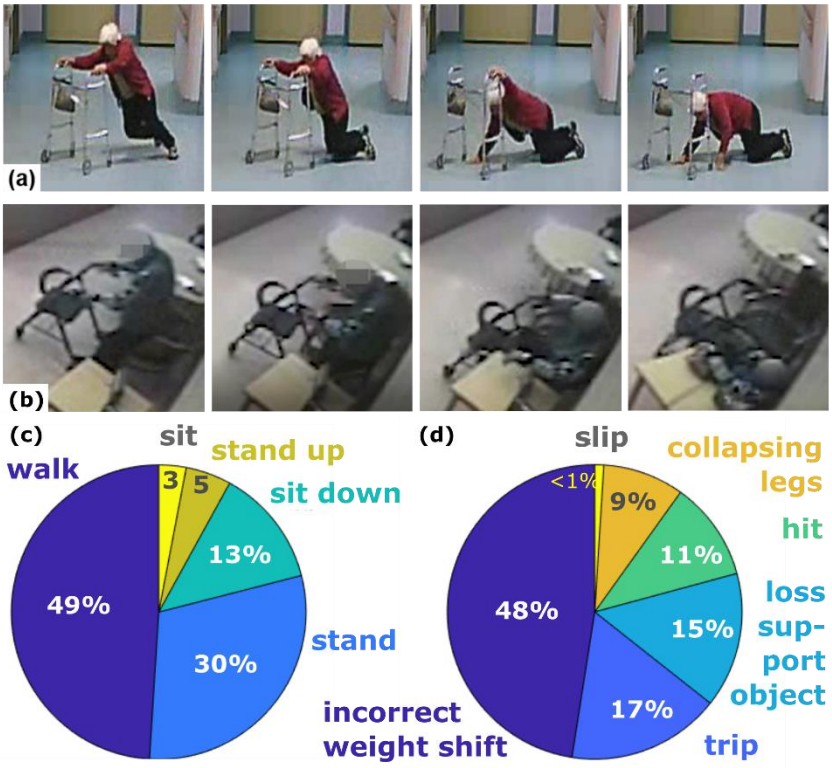

Fig 1: example fall while walking (a) and sitting down (b). Overview of movements (c) and causes of falls (d).