

# A Non-Exercise Intervention to Improve Balance in the Elderly

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## Background & Purpose

Falls are the leading cause of accidental deaths in adults over age 60.<sup>1</sup>

└ Fear of falling leads to a restriction of activity, social isolation, and poor health.

• Fall risks in older adults may be exacerbated by stooped posture.

• Exercise is helpful, but may not be suitable for everybody.<sup>2</sup>

• A mindful approach could be complementary to exercise.<sup>3</sup>

The purpose of this research is to determine how different ways of attending to posture can influence laboratory measures associated with fall risk in older adults.



## Methods

### Three Postural Sets

**A. Relaxed:** "Stand as if you are feeling tired and lazy and nobody is watching."

**B. Effortful:** "Pull yourself up to your greatest height, using muscular effort."

**C. Light:** "Allow your head to float at the top of your spine. Let your bones send you up."

### Subjects

• We tested 20 healthy adults aged 60-80.

### Discrete Task

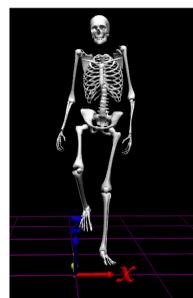
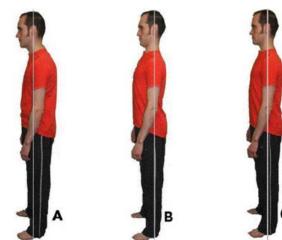
• Rapid raising of one foot

### Rhythmic Tasks

• Rhythmic lateral weight shifts and arm raises (for 30 seconds at 72 beats per minute)

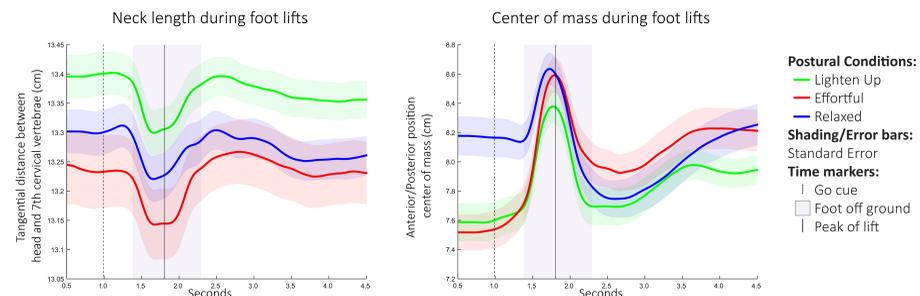
### Measures

- Distance between the first and 7th vertebrae (neck length)
- Forward and lateral displacement of center of mass
- Amplitude and rhythmicity of movement



## Results

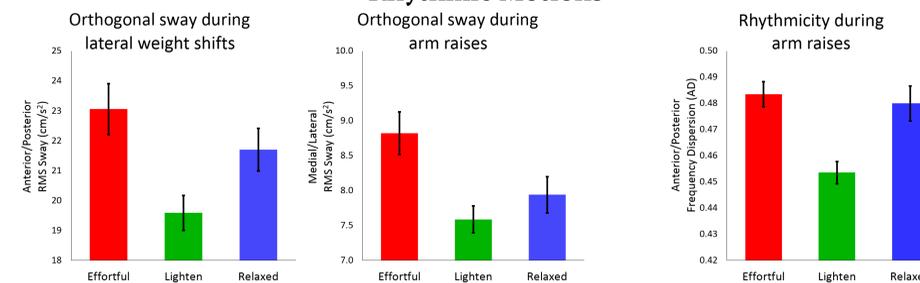
### Discrete Foot Lifts



Total neck length was greater following Lighten Up instructions than following Relax instructions at the neck length maximum ( $p=.02$ ), at its minimum ( $p=.03$ ), and at the end of the movement ( $p=.047$ ). This suggests that Lighten Up instructions reduce spinal compression.

At the end of the movement, the center of mass was farther forward in the Relax condition in than in the Lighten Up condition ( $p=.03$ ). There was also a tendency for the center of mass to be farther forward at its maximum in both the Relax ( $p=.07$ ) and Effortful ( $p=.06$ ) conditions, compared to Lighten Up. This suggests that Lighten Up instructions may improve balance.

### Rhythmic Motions



During weight shifts and arm raises, sway in the axis orthogonal to the motion was lowest during the Lighten Up condition. Medial/lateral motion for arm raises ( $p=.03$ ), anterior/posterior for weight shifts ( $p=.02$ ).

During arm raises, participants kept time best in the light posture ( $p=.01$ ).

### Subject Impressions

Subjects reported that the Lighten Up condition required less physical and mental effort than the Effortful condition ( $p=.0001$  and  $.02$  respectively), and that it felt more balanced and stable than the Relax condition ( $p=.003$ ).

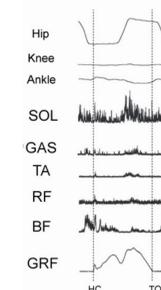
## Conclusion

Movements performed following the Lighten Up instructions were coordinated in ways consistent with lower fall risk.

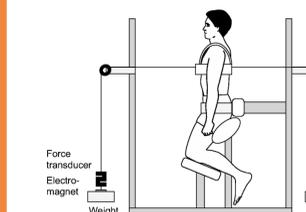
## Next Steps

### EMG

To better understand how muscle coordination is affected by postural instructions, the next study will measure muscle activity in the legs and back with electromyography.



### Stiffness Measurement



To help us understand the contribution of stiffness to coordination, a team of senior capstone engineering design students is building us a custom measurement device.

### Collaborators



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WSU bioengineering  
Axial EMG



Craig McGowan  
UI Biology  
Limb EMG



Joel Perry  
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## References

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2. Kado D, Huang M, Nguyen C, Barrett-Connor E, Greendale G. Hyperkyphotic Posture and Risk of Injurious Falls in Older Persons: The Rancho Bernardo Study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*. 2007;62(6):652-657. doi:10.1093/gerona/62.6.652.
3. Cohen R, Gurfinkel V, Kwak E, Warden A, Horak F. Lighten Up: Specific Postural Instructions Affect Axial Rigidity and Step Initiation in Patients With Parkinson's Disease.

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