

Aging and Disability

Wearable Ultrasound Visual Feedback Training Improves Gait in Chronic Stroke: An 8-Week Randomized Controlled Trial Y.-Y. Luo, M. Pang, L.-Y. Jia, F.-Y. Wang, H.-B. Liang, Z. Song, W.-T. He, C.Z.-H. Ma*. *Gerontechnology* 25(s)

Purpose As a leading cause of disability and reduced quality of life in older adults, stroke often results in paretic limb weakness, particularly reduced ankle dorsiflexor strength, which increases gait variability, impairs dynamic stability, and elevates the risk of falls [1]. One recent study reported that single session of a novel real-time wearable ultrasound-imaging-based visual feedback (UVF) training improved paretic ankle dorsiflexor strength during isometric contractions in chronic stroke survivors, however, whether these training effects generalize to overground walking has remained unclear [2]. The present study aimed to investigate the potential effects of an 8-week UVF training program on dynamic stability and walking performance in community-dwelling stroke survivors. **Method** Twenty-four chronic stroke survivors were randomized (12 control, 12 experimental). Both groups performed isometric tibialis anterior (TA) dorsiflexor training in a natural sitting position three times per week for eight weeks, with the experimental group receiving additional UVF. A wearable wireless ultrasound-imaging device that placed over the paretic TA provided real-time visual feedback of muscle contraction patterns on a laptop. Outcomes were assessed during overground walking at self-selected speed at baseline (pre-intervention), after 12 sessions (mid-intervention), and after 24 sessions (post-intervention). The minimum mediolateral margin of stability (MOS) during stance phase quantified dynamic stability, and TA EMG activation duration quantified the proportion of time the TA was active within each gait subphase. Two-way mixed ANOVAs were conducted separately for each subphase to examine between- and within-group training effects. **Results and Discussion** Time-by-group interactions were significant for mediolateral MOS (Figure 1a) and TA activation duration (Figure 1b) ($\eta^2 \geq 0.132$; $p \leq 0.033$). MOS increased in the experimental group from pre- to post-intervention during loading response (MD=-0.014, 95% CI -0.027 to -0.001) and pre-swing (MD=-0.017, 95% CI -0.033 to -0.001), and across stance ($p \leq 0.045$), while the control group decreased from pre- to mid-intervention ($p \leq 0.020$). In the experimental group, TA activation duration increased from pre- to post-intervention during loading response (MD=-18.7%, 95% CI -35.4% to -2.1%; $p=0.024$) but decreased during swing, resulting in shorter activation than control at mid-intervention (MD=-22.4%, 95% CI -36.2% to -8.5%) and post-intervention (MD=-22.9%, 95% CI -36.1% to -9.6%) ($p \leq 0.003$) and shorter than baseline ($p \leq 0.009$). These improvements were observed in a small sample of community-dwelling chronic stroke survivors under supervised, equipment-based training, which may limit generalizability to frailer older adults (e.g., cognitive impairment or limited access to training). Clinically, better mediolateral stability and phase-specific TA control may translate to safer everyday walking and more confident community ambulation, supporting independence and quality of life after stroke.

References

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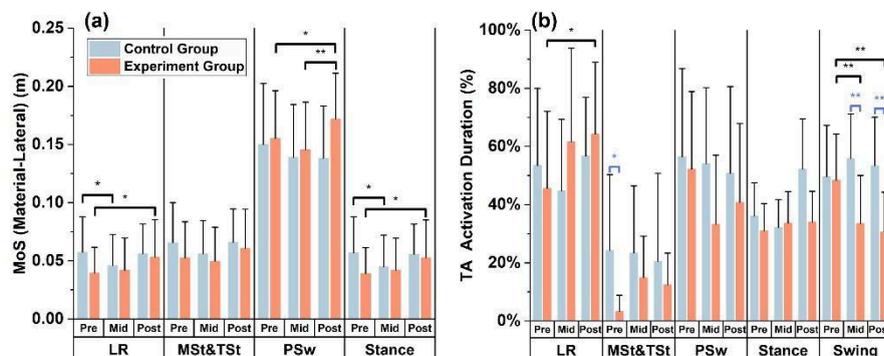


Figure 1. UVF training effects on MOS and TA activation duration (n = 24).

Note: LR: loading response; MSt: midstance; PSw: pre-swing; TSt: terminal stance.

Black asterisks denote significant within-group differences, and blue asterisks denote significant between-group differences (with Bonferroni adjustments).

*: $p < 0.05$, **: $p < 0.01$.