

Determining the Role of Single Support Center of Pressure Distance for Characterizing Post-Stroke Walking Impairment and Response to Rehabilitation Training

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Introduction: Stroke is a major cause of balance and walking impairment and is on the rise. The most widely used walking impairment measure is the 10-meter walk test (10-mWT), which provides information about walking speed but does not inform about walking kinematics or neuromuscular control. Herein, we evaluate single support center of pressure distance (SS CoP Dist), a kinematic measure of dynamic postural control and walking stability, as a complementary measure of walking impairment.

Hypothesis: We hypothesize that SS CoP Dist will be closely associated with baseline walking speed, and will improve with Backward Locomotor Treadmill Training (BLTT).

Methods: Thirty-six chronic stroke survivors with residual walking impairment, based on 10-mWT speed [mild >0.8 m/s (n=7); moderate 0.4-0.8m/s (n=18); and severe <0.4 m/s (n= 11)] , underwent six 30-minute BLTT sessions over two consecutive weeks. During testing (10-mWT), participants were instructed to walk as fast as possible over the gait analysis mat to capture SS CoP Dist and walking speed.

Results: At baseline, there was a weak to moderate positive relationship between walking speed and SS CoP Dist ($R^2_{\text{paretic}}=0.22$, $p = 0.0036$; $R^2_{\text{Nonparetic}}=0.44$, $p < 0.0001$). Following BLTT, SS COP Dist increased (more stable) in the mild and moderate groups [mild_{paretic} ($p = 0.0039$)/mild_{Nonparetic} ($p = 0.0034$), moderate_{paretic} ($p = 0.0360$)/moderate_{Nonparetic} ($p = 0.0087$)], with improved interlimb symmetry in the mild group. In contrast, no significant improvement in SS CoP Dist was seen in participants with severe walking impairment ($p = 0.3830$). Training-related changes in walking speed were strongly correlated with change in SS CoP Dist ($R^2_{\text{Nonparetic}}= 0.54$, $p = 0.0007$).

Conclusion: Our preliminary findings suggest that SS CoP Dist compliments walking speed for characterizing walking severity and response to training in chronic stroke survivors. In addition, BLTT significantly improved SS CoP Dist in mild-moderately impaired stroke survivors but not in survivors with severe walking impairment. Future well-powered, prospective studies with BLTT and other training paradigms are needed to validate these findings.

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