EDITORIAL

Gait Rehabilitation After Stroke

Should We Re-Evaluate Our Practice?

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The path up and down is one and the same.

—Heraclitus

Stroke is a leading cause of long-term disability. Of the individuals who survive, more than 80% have gait impairment[1] that recovers with some extent in the first 2 months after stroke.[2] Yet, community ambulation often remains compromised in most survivors.[3] Gait ability has major implications for health; it is an essential predictor for functional independence[4,5] and long-term survival[5,6] after stroke. Unsurprisingly, regaining gait ability is one of the most common goals of stroke survivors.[7] Although most treatment sessions during stroke rehabilitation are directed at gait training and mobility practice, current options are unfortunately of limited effectiveness.[8] As the result of increased life expectation in our country, paired with an improved acute stroke phase survival rate, the number of stroke survivors with such impairment will increase in the next decade (3.9% of the US population older than 18 years of age is projected to have had a stroke by 2030[9]), and the resulting growth in related expenses will place a future pressure on our healthcare system (an increase by 129% of total annual costs of stroke[9]). To proactively address this concern, maximizing gait recovery is of high priority.

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High-intensity practice is critical for producing long-lasting changes in motor system networks and motor learning.[10,11] Since these changes underpin gait recovery from stroke, a recent focus has been placed on increasing the intensity of rehabilitation practice. In this context, high-intensity practice has been explored in 2 ways: increasing the number of repetitions included during a therapeutic intervention or increasing the total time of the therapeutic intervention. Despite a range of robust evidence[12–18] in support of high-intensity training in gait recovery, the reality is that most patients in stroke rehabilitation wards still spend as little as 20% of their time in physical therapy[19] doing activities related to gait recovery. For instance, the daily dose of lower limb exercise after stroke is ≈300 repetitions (mean 288; SD, 240).[20] This number is insufficient in terms of repetitions to drive neuroplastic changes and accelerate recovery.[12–15] Indeed, a daily increase of only 100 repetitions results in improved walking speed.[20] Likewise, increasing the therapy time by an additional 16 hours (during the weekend for example) improves activities of daily living.[21] So why is there so much controversy? Why has high-intensity training not been widely clinically implemented? Simply put, there is a lack of translation of research findings into clinical practice. To date, there are no evidence-based guidelines to inform rehabilitation practice relative to exercise intensity, timing, and duration for this population.[22]

For instance, exercise intensity is the most critical parameter to maximize gain after stroke but is also the most challenging parameter to establish in clinical settings. Standard guidance related to exercise intensity would benefit functional gait outcomes in stroke survivors. The article by Hornby et al[23] in this journal sheds light on this issue in a large sample of 144 stroke survivors evaluated at >1 month after the acute event. Pooling data from different walking training paradigms (high-intensity stepping performing variable, difficult tasks; high-intensity stepping performing forward

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walking; low-intensity stepping of variable tasks; conventional walking exercises), Hornby and colleagues used validated assessment techniques and advanced analysis methods to determine the relative contributions of demographic, clinical, and training variables to outcomes. The authors revealed that the number of steps per session and number of sessions are the strongest predictors of primary gait outcomes, defined here as improvement in both speed and quality of ambulation. They also showed that higher functional and younger patients are likely to achieve greater amount and intensities of stepping practice. Overall, these data provide approximate amounts and intensity of stepping practice (mean 2460 [SD 1057] steps/session, 30 [SD 7] sessions) that can be achieved in this population and also explicitly show that specific patients may demonstrate larger gains with such training. The authors were also very explicit regarding key components of the intervention and what can be adapted to ensure implementation of such training, that is, greater amounts of practice at higher cardiovascular intensities, into regular clinical rehabilitation protocols.

Importantly, particular consideration should be paid to the lack of serious adverse events during the training. This suggests that stroke survivors, at least in the late subacute and chronic phases of stroke, can perform higher intensity walking exercises and more difficult tasks than previously thought possible. This finding corroborates well with preliminary results from an on-going clinical trial (URL: https://www.clinicaltrials.gov. Unique identifier: NCT01915368) showing that subacute stroke survivors can tolerate doses that are more than 2 to 7 times the amount of conventional therapy. Given the comorbidities usually present in this population, Hornby et al rigorously monitored the vitals to ensure safe participation to such training. Since all eligible participants were studied, ambulatory and nonambulatory, ischemic and hemorrhagic stroke, cortical and subcortical stroke, right and left paresis, the sample is likely to be representative of people with stroke. In sum, these findings highlight that high-intensity gait training may be feasible clinically with appropriate safety considerations. Future work should also extend the promising results of Hornby and collegues' study into those under 1-month post-stroke, when immobility peaks[24] and in which larger gains could be obtained with rehabilitation.[25,26]

The past 20+ years of neuroscience research has resulted in the consensus that rehabilitation that does not challenge the central nervous system is insufficient to make a clinically significant difference in a patient's recovery trajectory after stroke. Ideal rehabilitation involves repetitive and intensive practice, which is continually incremented in difficulty according to the tolerance of the patient. To improve mobility even in the community settings, it is time to move beyond traditional low-intensity/low-demanding rehabilitation. Obviously, this is not a stress-free process. System-level changes (eg, access to resources and staff), changes in therapists' knowledge/beliefs, along with innovative methods are required to make these high-intensity trainings accessible, cost-effective, and feasible to implement in clinical practice. These challenges are well worth considering. However, the immediate and far-reaching implications for the development of evidence-based guidance for such training vastly outweigh these potential barriers. For the million Americans expected to suffer stroke in the next decade,[9] these changes are imperative.

ARTICLE INFORMATION

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