Walking With PERPOS

Gait analysis is critical to functional recovery in post-acute brain injury rehabilitation

By Christy Troegle, PT, MS, CBIS, and Rachel Atkins, PT, DPT, CBIS

According to the American Stroke Association, about 795,000 Americans annually suffer a stroke. For the majority of those people, life will never again be the same. Most survivors have some type of serious and permanent disability as a result of damage to areas of the brain that control speech, memory or movement.

Significantly, two-thirds of survivors have difficulty walking immediately after a stroke, and six months later, more than 30 percent still cannot walk without assistance. We now have strong evidence to support that with the proper combination of purposeful gait analysis and appropriate gait intervention, some survivors can achieve a near normal recovery of gait quality, independence and function.

Many people who have had an acquired brain injury (ABI), which includes stroke, are observed to demonstrate abnormal walking mechanics. Their gait can be marked by asymmetry, improper joint kinematics, a lack of stability, shortened step length and decreased speed. The social stigma of walking with a limp, compounded with the increased energy expenditure and orthopedic stress that compensations place on the body have raised concerns, and highlight the importance of relearning and regaining proper gait mechanics. In addition, impaired gait is cited as a factor in nearly three-quarters of all falls after a stroke.

Historically, physical therapists have been largely focused on evaluating gait and implementing treatment with the prioritized goals of restoring balance and creating early independence, often regardless of the gait quality produced. However, we now have promising research that demonstrates an early focus on restoring symmetry and normal kinematics acutely followed by a focus on gait speed and functional training in the post-acute stage that will produce improved dynamic balance and walking independence.

There is also emerging evidence that suggests gait speed, not balance, is one of the best indicators of a patient’s functional recovery.

New technology and equipment are available as tools to assist physical therapists with generating objective evaluative data when performing gait analysis. For example, gait trainer treadmills and sensor mats have the capability to measure many of the components of gait, such as stance times, amount of lateral weight shifting, step length and cadence.

Therapists are often unable to accurately measure these gait parameters by visual observation alone. This technology provides quantitative, objective measures that can also compare the data to norms for height, weight and sex. Most importantly, once treatment has begun, these tools can provide therapists and patients with a true measure of their gait changes to assess whether meaningful functional progress is being made for each individual. Finally, these tools provide both audio and visual feedback, which helps promote positive neuroplasticity and motor learning in many patients with ABI.

Equipment can provide valuable data and can be used to improve walking speed, endurance and other gait parameters, but objective analysis alone will not correct the way a patient walks. This is where a significant amount of therapist-guided repetition, practice and motivation combined with objective feedback is required in order to successfully make changes during the recovery process.

PTs are increasingly implementing the use of standardized outcome measures to evaluate gait. These measures are an inexpensive alternative to pricey equipment, yet allow for more objectivity than visual observation alone, while continuing to allow for comparison to norms and tracking of progress throughout treatment.

As supported by the APTA’s StrokEDGE Task Force recommendations, outcome measures are often the most clinically useful form of gait analysis. Common standardized outcome measures for neurological gait analysis include, but are not limited to, the 6-minute Walk Test, which measures overground walking speed and functional exercise capacity; the Dynamic Gait Index, which incorporates balance, functional gait task performance and independence; the gait analysis section of the Tinetti, which takes into account the quality of movement, and the Functional Gait Assessment, which analyzes high-level gait functions and transitional movements. These assessments help...
PTs to determine a patient’s level of community or household ambulation capability.

In the end, analyzing the factors of gait has little direct impact on a patient’s walking function. However, it is an integral part of guiding treatment selection, determining the effectiveness of interventions and in objectively noting progress.

**Purpose of PERPOS**

Pate Rehabilitation, a post-acute therapy provider, aims to help people with ABI maximize cognitive function and regain mobility and independence, so they can successfully re-integrate into society. PTs play an important role at Pate to promote functional ambulation in this particular setting of the recovery continuum. To that end, Pate has created its own unique systematic assessment program called PERPOS (Pate Environmentally Relevant Program Outcome System) as the basis for much of its research and treatment models.

PERPOS is a measurement tool that focuses on the importance of environmental and ability in the treatment of people with ABI. It is comprised of three items: two primary environmental ratings (the amount of structure needed and distraction tolerated) and one rating of overall functioning or deficit. Lower PERPOS scores represent a greater degree of impairment, while higher scores represent a lesser degree of impairment. Scores are determined for each client during regular multidisciplinary team meetings.

Specific functional domains are rated including community mobility or “functional ambulation” skills. Patients are assessed in the areas of visual motor reaction, motor programming, visual scanning, motor speed/dexterity, attention/coordination, judgment/reasoning, topographical orientation and gait. Patients receive a current score for community mobility and then a goal score, based on evaluative findings, their prognosis and their discharge date.

Researchers at Pate Rehabilitation have found that function-based therapy has the highest success rate with motor recovery. Treatment must be developed on an individual basis, and in addition, must be engaging, relevant and realistic.

For example, when looking specifically at the goal of improving an individual’s gait function, walking successfully through a busy hallway, walking while talking on the phone, or navigating curb steps, has more benefits for that patient in the long term than does focusing on traditional motor training that might include rote strengthening, stretching and static standing activities.

The intricacies of gait quality may not necessarily impact reintegration into the community as much as gait speed and distance do. Thus, if survivors of ABI want to improve their walking skills at this post-acute stage of recovery, their treatment plan of care should be task-specific, compromised of a heavy focus on performing functional walking training via treadmill, over-ground walking and community-based training. It should also have less emphasis placed on traditional mat exercises and static standing balance activities.

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At Pate, treatment is focused on daily walking routines that are incorporated throughout six-hour treatment days, five days per week in the clinic as well as outside of therapy when at home or in the community. This intensity of training has shown to improve ambulatory function and also naturally result in improving strength, flexibility, balance and endurance.

Pate also found that daily therapeutic walking helps patients to improve symmetry and speed, thus reducing the number of falls. A recent study published in *Physical Therapy* showed that faster treadmill walking facilitates a more normal walking pattern after stroke, without increases in common gait compensations. We know that increasing gait speed improves quality of life and that although there may be asymmetry in one’s gait, patients can still make functionally meaningful gains in walking speed, independence and function even in the chronic stages post ABI. This idea was also recently supported in an article published in 2010 in *Stroke*.

While gait symmetry has previously been shown to have a big impact on stability, by the time most patients begin post-acute rehabilitation, they have unfortunately already developed improper walking habits. Once patients have learned to walk with these maladaptive patterns, it can be extremely challenging to make changes to their gait pattern.

Previously, research had not determined the best method for restoring gait following stroke. However, in an article that appeared in *Topics in Stroke Rehabilitation*, using the 6-minute Walk Test and three-dimensional gait analysis as a measure, researchers found that patients who received early standardized treadmill then over-ground gait training showed the best outcomes in kinematics, balance, endurance, independence, safety and speed when compared to those who received traditional gait rehabilitation.

It takes between 1,000 to 10,000 task repetitions per day to achieve positive neuroplastic changes in the brain. Therefore, patients with the best prognosis to change gait quality and function after having formed maladaptive walking patterns are those who are very motivated and cognitively able to focus and practice. Thus, within a post-acute setting, a focus placed on improving efficiency with gait through improved independence and speed and through repeated task-specific functional practice will optimize functional outcomes and motor learning.

**The ‘Gold Standard’**
Treadmill and sensory mats as well as standardized outcome measures provide important data that let therapists know whether the interventions are effective, but these factors can only become meaningful once incorporated into a functional treatment. Clinical observation and other rating scales are equally important in tracking progress but may provide skewed results due to the observer’s interpretation or the reporter’s own personal assessment of change.

We must take into account the stage of recovery in order to optimize the approach to gait training with overall functioning as the goal. We must also consider that motor recovery is task specific. To have the most direct effect on improving walking skills, one must train in an environment and perform activities that are functionally relevant. Strengthening, stretching and balance training are all vital components of stroke rehab, however, the improvements here do not have as direct of an impact on gait recovery as does time spent in skilled functional gait training.

Gait speed has been referred to as the gold standard of walking ability. For stroke survivors in the post-acute stages of stroke recovery, a focus on the ability to walk efficiently with improved speed and independence, is supported as one of the most effective approaches to enable them to best interact in their communities and regain a sense of autonomy, thereby having a tremendous positive impact on quality of life. By taking a more functional approach and using a combination of performance measurements, therapists can maximize patient interventions and outcomes.

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**References**

Christy Troegle and Rachel Atkins are certified brain injury specialists and physical therapists for Pate Rehabilitation’s Villa Creek outpatient and transitional Day Rehab Center in Dallas, TX.

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