Pressure-Controlled Treadmill Training in Chronic Stroke: A Case Study With AlterG

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Background and Purpose: Body-weight–supported treadmill training has been shown to be an effective intervention to improve walking characteristics for individuals who have experienced a stroke. A pressure-controlled treadmill utilizes a sealed chamber in which air pressure can be altered in a controlled manner to counteract the effects of gravity. The focus of this case study was to assess the immediate and short-term impact of a pressure-controlled treadmill to improve gait parameters, reduce fall risk, improve participation, and reduce the self-perceived negative impact of stroke in an individual with chronic stroke.

Case Description: The subject was an 81-year-old man (14.5 months poststroke). He had slow walking speed, poor endurance, and multiple gait deviations.

Intervention: The subject trained 4 times per week for 4 weeks (40 minutes per session) on a pressure-controlled treadmill (AlterG M320) to counter the influence of gravity on the lower extremities.

Outcomes: Following training, self-selected gait speed increased from 0.50 m/s to 0.96 m/s, as measured by the 10-meter walk test. Stride length increased from 0.58 m to 0.95 m after training and to 1.00 m at 1-month follow-up. Peak hip flexion increased from 3.7° to 24.6° after training and to 19.4° at 1-month follow-up. Peak knee flexion increased from 19.4° to 34.3° after training and to 42.7° at 1-month follow-up. Measures of endurance, fall risk, and percentage of perceived recovery also were found to improve posttraining.

Discussion: Training with a pressure-controlled treadmill may be a viable alternative to traditional body-weight-supported treadmill training for persons poststroke. Additional studies with larger sample sizes are needed to elucidate the role of pressure-controlled treadmill training in this population.

Video Abstract available for more insights from the authors (see Supplemental Digital Content 1, http://links.lww.com/JNPT/A97).

Key words: stroke, body-weight-supported treadmill training, gait (JNPT 2015;39: 127–133)

INTRODUCTION

One of the most common and significant causes of long-term disability for individuals following stroke is impaired walking ability. Studies have shown that walking speed and endurance are predictors of an individual’s independence, community mobility, and participation. In addition, both walking speed and endurance have been correlated with fall risk and energy cost of walking. Abnormal gait kinematics following stroke increase fall risk and energy cost during gait. For these reasons, standard rehabilitation care following stroke includes gait retraining as a primary focus.

Body-weight–supported treadmill training has been shown to be an effective intervention to improve walking function for individuals in both the acute and subacute phases following stroke. Gait speed, endurance, and kinematics have been shown to improve with this form of training. The use of body-weight–supported treadmill training prior to overground gait training may be more effective in establishing symmetrical and efficient gait than traditional gait training methods.

Standard body-weight–supported treadmill training utilizes a harness suspended from an overhead frame. While this approach allows unweighting of the user’s body mass, gravity continues to influence the user’s lower extremities. Consequently, in persons with reduced lower extremity motor control, assistance during the swing phase of gait is often required to advance the limb. A pressure-controlled treadmill employs differential air pressure technology, which produces unweighting by way of a pressure-controlled chamber to counteract the influence of gravity on the legs. The differential air pressure technology unweights the entire lower extremities, as compared to just the trunk in the traditional harness system. Similar to the traditional harness system, the lift created by the air pressure chamber benefits the stance phases of gait by decreasing ground reaction forces (Figure 1). However, an additional and innovative advantage of this technology is the...
Relative unweighting of the lower extremities during the swing phases of gait due to the decreased gravitational forces in the pressurized environment.

Within the pressurized chamber the legs are able to move with relatively less gravitational force. For example, given that normal atmospheric pressure is 15 pounds per square inch, increasing the air pressure to 16.5 pounds per square inch within the chamber would decrease body weight by 80%. This novel technology presents an alternative body-weight support mechanism for treadmill training in individuals with neurologic deficits following stroke, who commonly use atypical gait strategies to compensate for impaired ability to move the weight of the hemiparetic lower limb against gravity. The purpose of this case study was to assess the immediate and long-term impact of a pressure-controlled treadmill to improve gait parameters, reduce fall risk, improve participation, and reduce the self-perceived impact of stroke in an individual with chronic stroke.

CASE DESCRIPTION

Participant

The participant in this case study was an 81-year-old man who sustained a multifocal stroke (14.5 months prior) in the left middle cerebral artery territory due to occlusion of the left carotid artery. His previous medical history was significant for hyperlipidemia and borderline hypertension. The participant gave written informed consent to participate in the study, which had been approved by the institutional review board of the University of Southern California. The participant’s medications at the time included the following: lisinopril 20 mg, Plavix (clopidogrel bisulfate) 75 mg, finasteride 5 mg, simvastatin 40 mg, Tamsulosin HCL 4 mg, baclofen 10 mg, Colace (docusate) 100 mg, and famotidine 20 mg twice a day.

Poststroke management for this individual involved both inpatient and outpatient rehabilitation, which ended several months before the start of the training program described later. The participant was a retired sales representative who enjoyed travelling and playing tennis 3 times per week prior to his stroke. At the time of this case report, he was no longer engaging in those activities and was not undergoing formal therapy although he inconsistently performed a lower extremity strengthening home exercise program. He was independent with all activities of daily living. However, he reported multiple falls in the past year while using a polypropylene ankle-foot orthosis and a single point cane. In addition, he reported that fatigue limited his walking and participation in his home exercise program. The participant’s goals were to increase walking speed and endurance, discontinue the use of assistive devices, and improve his overall quality of life and related psychological well-being.

Examination

The patient had no significant cognitive deficits or other health issues preventing him from participating in any of the procedures described later. The selection of outcome measures in response to the intervention was based on the patient’s stated goals described previously. Data were obtained at 3 time points: baseline; immediately following the 4-week training program; and 1 month postintervention. During the testing sessions described later, the patient did not use orthoses or assistive devices.

One week prior to the start of the training protocol, instrumented gait analysis was performed as the subject walked over ground. An 11-camera motion-capture system (Qualysis, Inc, Gothenburg, Sweden) was used to measure spatiotemporal parameters (gait speed, stride length, step length, and stance time) and lower extremity kinematics (peak hip flexion during swing, peak knee flexion during swing, peak ankle dorsiflexion during swing, and peak hip extension during stance). Reflective markers and clusters were placed to define and track the lower extremity and pelvis. Tracking clusters were placed on bilateral thighs, legs, and heel counters of the shoes. Additional calibration markers were placed on the bilateral trochanters, medial and lateral femoral epicondyles, medial and lateral malleoli, and the first and fifth metatarsal heads. The pelvis segment was tracked using bilateral iliac crest and L5/S1 markers. Kinematic data were low pass filtered using a 12-Hz forth-order Butterworth filter using Visual 3D software (C-Motion, Inc, Rockville, Maryland). ATMI force plates (Model #OR6-6-1, Newton, Massachusetts) collecting at 1500 Hz were used to define the stance phase of walking. A trial was deemed acceptable if the foot landed completely on the force plate. Three walking trials at a self-selected walking speed were obtained. The variables of interest were averaged across the 3 trials.

Following the instrumented gait analysis, additional functional assessments were performed. Self-selected free and fast walking velocities were quantified as the time required to traverse the middle 10 m of a 14-m walkway. The 6MW test has shown acceptable reliability (ICC = 0.86; 95% confidence interval [CI] = 0.68-0.94) in persons with stroke.21,22

The Timed Up and Go (TUG) test was measured as an average of three trials according to standard procedure and specifications.23 The TUG test has excellent reliability (ICC = 0.95; 95% CI = 0.84-0.99) and concurrent validity in individuals with chronic stroke.23,24 The 6-Minute Walk (6MW) test was measured as the subject walked along a straight 100-foot walkway. The 6MW test has shown acceptable reliability in persons with stroke (ICC = 0.74).25 The Fugl-Meyer lower extremity (LE-FM) examination, the Stroke Impact Scale...
Clinical Impression

Baseline gait analysis revealed that gait speed was diminished compared to age-matched values for healthy individuals. On the paretic side, stance time was noticeably shorter than that on the nonparetic side. During swing phase, the subject had difficulty with toe clearance and used compensatory patterns such as contralateral vaulting and pelvic elevation. These gait deviations are common poststroke, and as mentioned previously, body-weight–supported treadmill training has been shown to be effective at improving gait mechanics.18,19 As such, we deemed the patient to be appropriate for the proposed intervention.

Intervention

The participant trained 4 sessions per week for 4 weeks. Each session lasted approximately 1 hour, including warmup on the treadmill and rest periods. Consistent with consensus statements on regular aerobic exercise and with the rationale of achieving target duration and intensity to improve cardiovascular health after stroke, the training program had a target total duration of 40 minutes of treadmill walking at 65% to 85% heart rate maximum.29 Although heart rate maximum is best calculated with a cardiac stress test, heart rate maximum was determined according to the methods described by Jackson,30 in which the most accurate relationship between heart rate and age was established: \( HR_{max} = 205.8 - (0.685 \times \text{age}) \).

Training was performed using a commercially available pressure-controlled treadmill (AlterG M320 Antigravity Treadmill; AlterG; Freemont, California) (figure 1). This device has a unique ability to unweight the subject’s lower extremities during swing phases of gait via differential air pressure technology in a pressure-controlled chamber. Precise calibration allows for unweighting from 0 to 80% of the subject’s body weight in 1% increments. Weight support was decreased in parallel with improved gait kinematics over the 4-week training period. The training was designed so the participant would walk on the treadmill for 2 training bouts totaling 40 minutes. Treadmill training was followed by over-ground walking bringing the session time to 1 hour.

For initial training sessions, the participant was unweighted to 50% of his body weight. During the first week of training, the participant walked on the treadmill for an average of 35 minutes per session with verbal cueing focused on achieving maximal hip flexion to optimize swing limb mechanics. Visual feedback was provided with a mirror. The mirror was placed such that the participant could access a sagittal view of the reference limb. The mirror was consistently placed in the same location in each session.

Session 1 consisted of a 2-minute warm-up followed by a 15-minute training bout with 50% BWS at 1.0 mph. This was followed by a 3-minute rest period and a second training bout. The session was completed with a 2-minute cool-down at 0.3 mph and 50% BWS (see Video, Supplemental Digital Content 2, http://links.lww.com/JNPT/A98, which demonstrates a cool-down at 0.6 mph), and 5 minutes of over-ground walking. However, during the first session of training, the participant’s blood pressure exceeded indicated precautions, systolic blood pressure greater than 180 and diastolic blood pressure greater than 100, and he was referred to his primary physician. For all subsequent sessions, the participant was able to complete all bouts within indicated cardiac precautions. During each training bout, heart rate, blood pressure, and rate of perceived exertion (RPE) were recorded. Safety guidelines were followed such that if RPE was to have exceeded 8 on the modified Borg scale31 or heart rate exceeded 85% of age-predicted heart rate maximum, the participant was to be given a rest break. However, the measured parameters remained within a safe range during the training, and scheduled rest breaks were sufficient. During rest periods, heart rate and blood pressure were monitored.

Three parameters were scaled in difficulty throughout the training: (1) treadmill speed; (2) percentage of body weight support; and (3) walking duration. Clinical decision-making for scaling of difficulty was informed by observational gait analysis conducted while the participant was on the treadmill. Treadmill speed was progressed in an attempt to achieve age-predicted normal walking velocity. It has been demonstrated that practice at faster than self-selected walking speeds on a treadmill is more effective in improving gait velocities as compared with self-selected walking speeds over ground.16 Percent body weight support was adjusted on the basis of the participant’s ability to demonstrate adequate hip flexion for foot clearance without compensating with contralateral limb vaulting or ipsilateral pelvic elevation. Walking duration was progressed toward the target total duration of 40 minutes based on RPE and vital sign responses, specifically heart rate maximum. During all treadmill training sessions, the participant wore the pressure-controlled treadmill shorts, provided by the manufacturer, to optimize the differential air pressure technology for precise calibration of unweighting. The participant was allowed to use the front and side handrails of the treadmill for comfort but was encouraged not to use these to support body weight. Each day following completion of all treadmill training bouts, the participant practiced walking over ground for 5 minutes with verbal cueing from the physical therapist to reinforce improved hip flexion in swing limb advancement.

Outcomes

Total time of training in the pressure-controlled treadmill over the entire course of the intervention was 619 minutes; average training time per session in the pressure-controlled treadmill was 38.7 minutes. The total time for the entire course of the intervention for overground training following each treadmill session was 80 minutes; average time of the overground training per session was 5 minutes. At the end of the 4-week intervention, the participant had progressed such that during his treadmill sessions he could support 90% of his body weight at a speed of 2.5 mph (1.12 m/s) for 2 bouts of 18 minutes (see Video, Supplemental Digital Content 3, http://links.lww.com/JNPT/A99). Results for all assessments performed at baseline, completion of training (4 weeks), and 1 month after the end of training are included in Table 1.

Walking Speed

Change in comfortable gait speed between baseline and immediate postintervention, was 0.46 m/s as measured by the 10-m walk test and 0.41 m/s as measured during the 10-m walk test and 0.41 m/s as measured during the
Table 1. Clinical Outcome and Temporal Gait Measures

<table>
<thead>
<tr>
<th></th>
<th>Pretraining, Mean (SD)</th>
<th>Posttraining, Mean (SD)</th>
<th>1-Month Follow-up, Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-selected walking speed, m/s</td>
<td>0.50 (0.08)</td>
<td>0.96 (0.07)</td>
<td>0.89 (0.08)</td>
</tr>
<tr>
<td>Fast walking speed, m/s</td>
<td>0.73 (0.03)</td>
<td>1.33 (0.02)</td>
<td>1.32 (0.03)</td>
</tr>
<tr>
<td>Timed Up and Go, s</td>
<td>25.79 (4.77)</td>
<td>13.5 (2.08)</td>
<td>12.66 (1.28)</td>
</tr>
<tr>
<td>6-minute walk distance, feet</td>
<td>500</td>
<td>920</td>
<td>1054</td>
</tr>
<tr>
<td>Fugl-Meyer LE total score</td>
<td>23/34</td>
<td>27/34</td>
<td>24/34</td>
</tr>
<tr>
<td>Stroke Impact Scale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>participation</td>
<td>26</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>% of full recovery</td>
<td>40</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Geriatric Depression Scale</td>
<td>8</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

Gait Characteristics (instrumented gait analysis)

<table>
<thead>
<tr>
<th></th>
<th>Pretraining, Mean (SD)</th>
<th>Posttraining, Mean (SD)</th>
<th>1-Month Follow-up, Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity, m/s</td>
<td>0.34 (0.02)</td>
<td>0.75 (0.12)</td>
<td>0.87 (0.004)</td>
</tr>
<tr>
<td>Stride length, m</td>
<td>0.58 (0.05)</td>
<td>0.95 (0.09)</td>
<td>1.00 (0.10)</td>
</tr>
<tr>
<td>Cadence, stride/min</td>
<td>35.07 (1.90)</td>
<td>49.68 (4.73)</td>
<td>49.74 (1.02)</td>
</tr>
<tr>
<td>Gait kinematics involved limb peak hip flexion (Swing), °</td>
<td>2.0 ± 2.3</td>
<td>24.9 ± 3.9</td>
<td>22.2 ± 1.8</td>
</tr>
<tr>
<td>peak hip extension (Stance), °</td>
<td>10.3 ± 1.3</td>
<td>9.3 ± 0.9</td>
<td>15.2 ± 1.7</td>
</tr>
<tr>
<td>peak knee flexion (Swing), °</td>
<td>23.0 ± 0.5</td>
<td>42.0 ± 8.2</td>
<td>42.9 ± 7.8</td>
</tr>
<tr>
<td>peak ankle dorsiflexion (Swing), °</td>
<td>−1.6 ± 1.3</td>
<td>3.3 ± 3.1</td>
<td>2.3 ± 1.2</td>
</tr>
</tbody>
</table>

Fugl-Meyer Lower Extremity Examination

The participant improved his score on the LE-FM test by 4 points from 23/34 at baseline to 27/34 at the end of training; however, at 1-month posttraining the participant scored 24/34. While the Fugl-Meyer assessment is a widely used clinical assessment tool, and preliminary evidence suggests that it is responsive to change, there is currently no strong evidence quantifying a minimal clinically important difference (MCID) in the score for the lower extremity.48

Stroke Impact Scale

For the SIS, 2 domains were identified as being of high importance to the participant: “participation” and “percent of full recovery.” The SIS score in the participation domain improved from a baseline score of 26 out of a possible 40 points to 32 at the end of training, but declined at 1 month posttraining to 28. The score in the percentage of full recovery domain improved from a baseline score of 40% to 60% at the end of training, but also demonstrated a 1-month posttraining decline to 50%. Duncan et al39 have proposed that a 10- to 15-point change in a single domain of the SIS represents a real and meaningful change. Similarly, Fulk et al40 estimated the range of values for MCID for the SIS-16 to be 9.4 to 14.1.

Geriatric Depression Scale

The participant demonstrated improvement in the short-form GDS from a baseline score of 8/15 to 6/15 at the end of treatment, with continued improvement at 1 month posttraining to a score of 5/15. While a score of 5 or more suggests depression in this 15-item self-assessment, an MCID has not yet been established for this measure.51

Kinematic Measures

Instrumented gait speed increased from 0.34 m/s at baseline to 0.75 m/s following treatment and to 0.87 m/s at 1-month follow-up. As mentioned previously, the baseline and posttreatment velocities were relatively slower than when measured using the 10-m walk test (Table 1). This difference may
be due to the participant’s attention to the force plate during the instrumented gait assessment, in contrast to the typical floor surface on which the 10-m walk test was administered (please see the “Discussion” section below). Stride length, the interval between 2 sequential initial floor contacts by the same limb—the equivalent of a full gait cycle, almost doubled from 0.58 m at baseline to 0.95 m posttreatment and this increase was maintained at the 1-month follow-up. In addition, average peak sagittal plane motion of the involved lower extremity tended to increase across testing sessions. Peak hip flexion of the involved limb increased from 2.0° at baseline to 24.9° posttreatment and then decreased slightly to 22.2° at 1-month follow-up (Table 1, Figure 2). Kesar et al reported MDC of 11.5° for hip angle at toe off, collected during treadmill walking in individuals poststroke. Wilken et al reported MDC of 5.8° for hip flexion during swing in healthy adults. Peak hip extension was similar at baseline and posttreatment (10.3° vs 9.3°) and increased at 1-month follow-up (15.2°) (Table 1); MDCs of 3.8° and 5.2° have been reported for this angle. Peak knee flexion increased across sessions (23.0°, 42.0°, and 42.9°, respectively) (Table 1, Figure 3); MDCs of 5.7° and 7.3° have been reported for peak knee flexion. Finally, peak ankle dorsiflexion during swing increased from −1.6° to 3.3° and then decreased slightly to 2.3° at 1-month follow-up; MDCs of 4.9° and 3.7° have been reported for this angle (Table 1, Figure 4).

DISCUSSION

This case study examined the impact of training with a pressure-controlled treadmill to improve walking function, fall risk, participation, and the self-perceived impact of stroke in an individual with chronic stroke. In addition, maintenance of short-term changes following training was assessed at a 1-month follow-up. Improvements in gait speed, endurance, and gait kinematics were observed after training, as were scores indicating reduced fall risk, and these improvements were maintained 1 month later. In addition, measures of participation and psychosocial well-being improved with training. The outcomes for this participant are encouraging, especially considering the relatively small dose of training that was utilized.

Gait speed and endurance have been shown to be predictors of an individual’s independence and community mobility and participation, and have been correlated with fall risk. The patient improved his self-selected walking speed from baseline to the end of training as evidenced by both the 10-m walk test and the data obtained utilizing the motion capture system. Wade has described the 10-m walk test as the “almost perfect” measure for assessing function in neurological population, because of its simple clinical application, and its robust psychometric properties. Richards et al showed it to be more responsive than functional scales to changes in mobility following stroke. As such, we determined it important to evaluate the participant’s gait speed using this measure. Conversely, the complex environment of an instrumented gait laboratory with floor-mounted force plates provides a level of complexity. Patla and Shumway-Cook have noted that mobility in a complex environment is the norm, not the exception; it is important for persons with disability to be able to walk in complex environments. In addition, McGinley et al describe 3-dimensional instrumented gait analysis as the gold standard for gait evaluation in persons with gait abnormalities. Therefore, in addition to kinematic data, we considered the instrumented measure of gait speed to be important as well. Not surprisingly, gait speeds in the complex environment were slower at baseline and posttreatment (however, at 1-month follow-up speeds were similar). That kinematics can be affected by gait speed had been established and it is possible that our participant’s kinematics were different during the 2 measures. However, as Patla and Shumway-Cook indicate, our participant’s kinematics and speed in this complex environment may be more indicative of his gait in daily life, and as such, this measure may carry more importance and relevance to our participant. Therefore, both sets of data are presented for consideration.

Fast walking speed also improved from baseline to the end of training as measured by the 10-m walk test...
Stride length and peak sagittal plane motion at the hip, knee, and ankle of the involved limb demonstrated marked improvement from baseline to posttraining, with the exception of peak hip extension. However, peak hip extension improved at 1 month posttraining. This may suggest that the training regimen enabled the participant to capitalize on the experience and further improve. The training equipment is such that the entire surface area of the lower limb and pelvis specifically benefit from the decreased air pressure within the chamber, whereas traditional body weight support systems primarily support the weight of the trunk. The advantages of the pressure-control treadmill design are tangible in swing phase of gait. In line with the participant’s goal, swing mechanics were the primary focus of the intervention. Thus, the participant was able to eliminate the use of the cane and ankle-foot orthosis within the home, however, continued to use a cane in the community per preference.

Hip flexion was used as a primary verbal and visual cue to drive passive knee flexion and ankle dorsiflexion for adequate foot clearance during later swing phases. The participant was able to train this behavior while on the treadmill with the benefit of decreased demand due to the relative unweighting of the paretic lower extremity in the pressurized environment.

Studies have indicated that stance phase parameters can improve with body-weight–supported treadmill training in participants with stroke. Specific stance phase measures, such as single limb support time, might not have been as evident in the presented case because the emphasis during training was placed on the swing phase. Future studies are indicated to investigate whether similar improvements in stance would occur with equal training emphasis on stance phase parameters.

The timed-up and go has been shown to indicate fall risk. The baseline results of the timed-up and go indicated that the participant’s scores fell within the range of increased risk for falls. By the end of training, our participant was below the timed-up and go cutoff for fall risk, representing an important change for the patient in terms of safety and participation.

Self-perceived recovery, as measured by the “percent of full recovery” subscale of the SIS, and psychosocial domains, as measured by the GDS, also demonstrated improvements from baseline to posttraining. These outcomes are potentially related to the changes observed in walking speed and endurance, known to be powerful predictors of an individual’s participation. It should be mentioned that although the patient exhibited meaningful changes with respect to the selected outcome measures, his self-perceived improvements were not remarkable. One of the patient’s goals was to improve his overall quality of life. The selected recovery and psychosocial domains identified meaningful change with respect to a decrease in the impact of stroke and decreased depression; however, the outcomes did not reflect the patient’s specific definition of quality of life. For this patient, quality of life was defined as a return to full participation in activities that were done prior to the stroke. Although there were clinically meaningful changes identified in the selected participation outcome measures, the patient identified this goal as not met because he was still unable to play tennis, run, and travel as he did before the onset of his stroke.

There are several limitations of this case study that should be acknowledged. The outcomes represent a single case and would need to be replicated in a larger sample size to draw conclusions about the relationship between the intervention and the outcomes. Accordingly, the intervention was extended over 4 weeks and, therefore, changes could have been the result of experience/practice outside of the training protocol. However, this is unlikely as the participant maintained the same level of activity at home throughout the training period. Also, changes could have been due to natural recovery; however, this seems less likely given the time since onset of the stroke to the beginning of training (14.5 months). Finally, because of the design of the pressure-controlled treadmill used in this study, natural arm swing during gait was limited. Studies have shown that there is increased energy expenditure when walking without normal arm swing due to the increased muscular power demand from ground reaction forces in stance. The increased demand usually results in a decreased self-selected gait speed due to atypical coordination of upper and lower body segments at higher velocities. Thus, the outcomes may have been altered by this limitation.

Summary
Training with a pressure-controlled treadmill was associated with improved gait parameters, reduced fall risk, improved participation, and reduced the self-perceived negative impact in an individual with chronic stroke. While this case study did not directly compare the pressure-controlled treadmill with conventional body-weight–supported treadmills, the outcomes suggest that a pressure-controlled treadmill may be an alternative to traditional body-weight–supported locomotor training.

REFERENCES


