Novel Treatment Approach to Contraversive Pushing after Acute Stroke: A Case Report

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ABSTRACT

Purpose: The purpose of this case report is to provide an alternative treatment approach to pushing behavior (PB), adapting widely used equipment for persons with stroke demonstrating such behaviour. The aim is to change their graviceptive experience during interventions while performing repeated stepping and righting practice to resolve PB more quickly. **Client Description:** The subject is a man aged 56 years who sustained a right middle-cerebral-artery ischemic stroke. He entered in-patient rehabilitation from an acute care hospital 7 days post-stroke. **Intervention:** Lateral stepping with body weight-supported treadmill training (LS-BWSTT) was used such that the subject stepped laterally toward the uninvolved side. **Measures and Outcome:** Scores on the Scale for Contraversive Pushing and the FIM were recorded at regular intervals. After intervention, the subject demonstrated decreased PB and improved function. **Implications:** The individual's PB improved after LS-BWSTT. LS-BWSTT is a novel treatment intervention that could be considered in future clinical decision making using evidence-based principles.

Key Words: case report; perceptual disorders; rehabilitation; stroke; treatment outcomes.

RÉSUMÉ

Objectif : le présent rapport de cas vise à proposer une autre approche thérapeutique qui consiste à adapter du matériel largement utilisé pour les personnes qui ont subi un accident vasculaire cérébral et démontrent un comportement de poussée (CP—*pushing*). On cherche ainsi à modifier leur expérience de graviception pendant les interventions, tout en exécutant des pas et des redressements répétés afin de régler le CP plus rapidement. **Description du client :** le patient est un homme de 56 ans qui a souffert d'un accident ischémique de l'artère cérébrale moyenne droite. Il a été hospitalisé en réadaptation à sa sortie d'un hôpital de soins aigus sept jours après son accident ischémique. **Intervention :** les pas latéraux avec entraînement sur tapis roulant soutenu par le poids corporel (LS-BWSTT) ont été utilisés de manière que le sujet fasse des pas latéraux vers le côté non touché. **Mesures et résultats :** à intervalles réguliers, les chercheurs ont enregistré les résultats de l'échelle de poussée de contraversion et de la mesure d'autonomie fonctionnelle. Après l'intervention, le sujet a démontré une diminution du CP et une meilleure fonction. **Implications :** le patient a réduit son CP après la LS-BWSTT. Cette nouvelle intervention thérapeutique pourrait être envisagée dans le cadre des prochaines décisions cliniques faisant appel à des principes fondés sur des données probantes.

Pushing behaviour (PB) is an impairment resulting from stroke in which a person actively pushes toward the hemiparetic side and resists passive correction of the body to vertical. The literature varies on its incidence but describes it as ranging from 9.4% to 63%;^{1,2} this variability stems from assessing PB using clinical judgement rather than a standardized scale as well as varying time from stroke onset.

Both Pérennou and colleagues³ and Karnath and colleagues⁴ likened PB to a graviceptive neglect, in which somesthetic information is impaired in spite of intact vestibular and visual systems. *Subjective visual vertical* (SVV) refers to an individual's ability to identify whether an object is vertical, regardless of the position of his or her body. Currently, there is no consensus in the litera-

ture as to whether SVV is intact in people with PB,^{4–7} but it is widely accepted that the subjective postural vertical (SPV) is impaired and that subjects are unable to detect whether their body is vertically oriented.^{4,5,7}

Danells and colleagues² looked at the natural history of recovery of 39 individuals with PB who received standard intervention. They found that, in some cases, resolving PB took more than 90 days. Therapists treating individuals with PB understand the challenges, including the increased time and physical assistance needed to perform interventions. Individuals strongly resist efforts at righting, making gait training extremely difficult.

This case report outlines an intervention using body weight-supported treadmill training (BWSTT). This intervention increases the ease of promoting upright and

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Contributors: All authors designed the study; or collected, analyzed, or interpreted the data; and drafted or critically revised the article; and approved the final draft.

Physiotherapy Canada 2017; 69(4):313–317; doi:10.3138/ptc.2016-28

Figure 1 Set-up of LiteGait1 for lateral stepping using body weight-supported treadmill training with person in harness.

weight-bearing positions while at the same time giving repetitive righting and stepping opportunities, with the aim of resolving PB more quickly.

METHOD

Case description

The individual described is a man aged 56 years with no documented past medical history. Neuroimaging studies confirmed right middle-cerebral-artery ischemic stroke. He was admitted to an acute care hospital for 7 days, spent 29 days in acute rehabilitation, and was discharged home with family support and outpatient therapy.

When this individual presented to the rehabilitation setting, he presented with impairments in strength, balance, range of motion, muscle tone, sensation, coordination, perception, and vertical alignment. These impairments led to deficits in transfers, gait, wheelchair propulsion, self-care, and stair navigation.

Intervention

We modified BWSTT to address this individual's PB and impaired SPV. LiteGait1 (Mobility Research, Tempe,

Figure 2 Yolk and strap set-up of LiteGait1 for lateral stepping with body weight-supported treadmill training.

AZ) was used for lateral stepping using BWSTT (LS-BWSTT) toward the non-paretic side. The harness was donned in typical buckle-forward arrangement. The individual was positioned laterally on the treadmill with his right, non-paretic side facing the treadmill controls. The anterior overhead straps were placed through the top of the yolk to help keep the straps from encroaching on his head and face. The anterior straps were buckled to his right hip, and the posterior straps were attached to his left hip (see Figures 1 and 2). When he moved, the treadmill passively moved his lower extremities to the left, causing him to lean to the right and take a right step. This compelled him to place weight on his left lower extremity (LLE) and use active abduction to maintain his stance.

Two caregivers helped the individual don the harness and set it up; afterward, a single therapist executed the intervention. A mirror provided visual feedback to the subject, and a plastic slider placed over his left hemiparetic foot reduced friction and allowed him to advance his limb by sliding it along the treadmill.

During LS-BWSTT, the therapist facilitated LLE advancement (i.e., adduction); stance phase; and hip, shoulder, and trunk alignment. Periodic verbal instructions relating to cadence, amplitude of movement, and body alignment were given as appropriate so the individual could better self-correct. He was instructed to keep his head and shoulders aligned between the harness straps.

The individual received 11 sessions of LS-BWSTT over 15 days during in-patient rehabilitation admission. Duration, velocity, and un-weighting were based on his ability to maintain a lateral stepping pattern while promoting maximal challenge (see Table 1). Adjunct equipment was used in the same capacity as would have been for BWSTT or over-ground gait training (Table 1). Sessions not using LS-BWSTT addressed transfers, over-ground walking, wheelchair propulsion, stair navigation, and balance and postural interventions, some using mirrors

Table 1 Intervention Description

Day from onset (days from in-patient rehabilitation admission)	Duration	Speed (m/s)	Adjunct equipment
16 (5)	2 min 20 s, 2 min 20 s	0.089–0.224*	Slider, mirror
17 (6)	4 min	0.179–0.268*	Slider, mirror
17 (6)	5 min 30 s	0.224–0.313*	Slider, mirror
18 (7)	3 min 40 s, 2 min	0.313	Slider, mirror
18 (7)	5 min	0.268	Slider, mirror
20 (9)	7 min	0.268	Slider, mirror
25 (14)	4 min 30 s	0.313	Slider, mirror
26 (15)	3 min 45 s, 1 min	0.313	Slider, mirror
27 (16)	4 min	0.224–0.313*	Slider, mirror, ankle weight
30 (19)	6 min, 4 min 30 s	0.268	Slider, mirror, ankle weight
31 (20)	1 min 12 s, 17 min	0.313	Slider, mirror, ankle weight, FES to left quadriceps in stance phase

*Speed increased during trials

FES = functional electrical stimulation.

Table 2 Subject's Outcome Measures

Measure	Outcome					
Days from admission to in-patient rehabilitation setting	2	5	8	14	21	29
Days from symptom onset	12	16	19	25	–	40
SCP raw score (out of 6)	–	3.75	3.75	3.0	–	0.75
SCP > 0 each subsection	–	Yes	Yes	Yes	–	No
FIM	33	–	–	–	–	77
Left MMT: Hip flexion/knee extension/ankle dorsiflexion	2–/2–/1	–	3–/3–/0	3–/3–/0	4/3–/2+	–
Left MAS: hamstring/quadriceps/gastrocnemius–soleus	2/1+/1+	–	2/2/1	2/2/1+	2/1+/1+	–

Note: Dashes indicate that no data were gathered on that metric on that particular date.

SCP = Scale for Contraversive Pushing; MMT = manual muscle testing; MAS = Modified Ashworth Scale.

and visual vertical markers. After the last LS-BWSTT session, the individual received four forward-facing BWSTT sessions at speeds of 0.358–0.671 metres per second and lasting 2–13 minutes.

Outcome measures

The primary objective measure was the Scale for Contraversive Pushing (SCP).^{4,7} The SCP measures pushing tendencies using the parameters posture, extension, and resistance. Each of these parameters is scored from 0 to 1 for both sitting and standing, allowing for a maximum score of 6; a higher score indicates increased severity of PB.^{4,7} The SCP has been widely investigated with respect to its reliability and validity.^{8,9} Baccini and colleagues⁹ concluded that a score of more than 0 in each of the three categories optimizes the sensitivity of the scale.

We also used the FIM to measure the individual's function.¹⁰ The FIM correlates with the number of hours per day of care that a patient needs. Secondary measures included manual muscle testing (MMT) and the Modified Ashworth Scale (MAS) to measure strength and spasticity.^{11,12}

RESULTS

The individual's SCP score decreased from 3.75 out of 6 to 0.75 out of 6 during the course of the intervention (see Table 2). His FIM score improved from 33 to 77 and is also reported in Table 2, along with MMT and MAS scores. At his initial evaluation, the individual required maximal assistance for transfers, ambulated 10 feet with maximal assistance, and was unable to perform stairs. By the time he was discharged, he was able to transfer with minimal assistance, ambulate 50 feet with moderate assistance, and perform stairs with minimal to moderate assistance, depending on the severity of pushing.

CONCLUSION

To compare normative recovery times, Danells and colleagues² provided us with their raw data and granted us permission to use it. Trend lines were compared between the individual presented here and the Danells and colleagues' data set. A graphical representation of their total SCP score data projected that, on average, a patient would reach a total score of 0 around day 81. A trend line representation of the individual presented

Figure 3 Trend lines for resolving PB: Normative data compared with LS-BWSTT data.

here indicates that he would reach a total score of 0 by day 46 (see Figure 3). Of the subjects studied by Danells and colleagues, 61% reached a score of 0 on the SCP by day 45 and, of the remaining 39%, more than half had not resolved PB by day 90.²

Persons with stroke with PB require a longer length of stay (LOS) [up to 161 days in rehabilitation] display more impaired activities of daily living, take longer to reach the same functional levels, and are less likely to be discharged home than individuals with stroke without PB.^{2,13,14} The in-patient rehabilitation LOS of the individual reported here was 29 days. Further research would be required to determine whether the resolution of his PB, his SCP score, and his LOS were affected by receiving LS-BWSTT.

The focus of LS-BWSTT is on the graviceptive sensory experience and SPV, while incorporating visual feedback, and it uses equipment widely available in rehabilitation settings. Our approach is the first to use such equipment to incorporate lateral stepping, emphasizing active abduction with weight bearing through the paretic leg, forcing the individual to weight-shift opposite to his PB. In line with current motor control concepts, we used massed practice, intensity, task specificity, and compelled weight bearing on the paretic limb in a safe, supportive environment.¹⁵

The limitations to this case report include few data points for comparison; a lack of single-subject design; a restricted time course; and a non-uniform protocol. Also, no data were available for the SCP relating to responsiveness; the Burke Lateropulsion Scale may be more sensitive and should be considered for future research.¹⁶ Finally, no comparison data are available for forward BWSTT for persons with PB. Future clinical decision making using evidence-based principles could consider

LS-BWSTT as a treatment intervention. Further research is needed that compares the effectiveness of LS-BWSTT to BWSTT for persons with PB.

KEY MESSAGES

What is already known on this topic

Pushing behavior (PB) after stroke presents significant challenges in the rehabilitation setting. Efforts at righting are actively resisted, and postural impairments require increased physical assistance and time to resolve. Individuals with PB have longer length of stay in rehabilitation, are more seriously impaired in their activities of daily living, and are less likely to be discharged home than those without PB.

What this study adds

Lateral stepping with body weight-supported treadmill training provides an alternative use for equipment readily available in the rehabilitation setting that targets the graviceptive experience for persons with PB. Using a safe and supportive environment, massed practice, intensity, task specificity, and compelled weight bearing are emphasized.

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