
**CLINICAL BOTTOM LINE:**

The article is outside the scope of occupational therapy, but is helpful for understanding pusher behavior. Practitioners can use this information to help understand the immediate effects of the interventions on pusher behavior after a single treatment. The immediate effects for pusher behavior may not be seen with occupational therapy services, but effective treatments have been used to improve patients over time. These treatments include strategies to reduce the fear of falling and incorporate functional tasks done in vertical orientation. More research is needed for pusher behavior and how occupational therapy can be used to reduce the effects shown by pusher behavior.

In the study, the driven gait orthosis showed significant improvements after a single session. Galvanic vestibular stimulation showed improvement but did not reach significance. The driven gait orthosis is an exoskeleton that bilaterally assists in guiding the participant’s legs while walking on a treadmill. The machine can guide the walking force up to 100%, which means the machine provides all the force required to walk. The amount of time walking on the treadmill was 20 minutes. Galvanic vestibular stimulation is constant electrical stimulation provided over each mastoid. The stimulation is provided at a threshold determined on an individual basis. The participant’s stimulation lasted 20 minutes and participants were asked to report if they noticed any tilting sensations.

The study also indicated that the Burke lateropulsion scale has a higher responsiveness to change compared to the scale for contraversive pushing. Practitioners should know that the Burke lateropulsion scale has a higher responsiveness to change and would be a better scale to use to identify pusher behavior. The final implication is that the driven gait orthosis decreased participants’ fear of falling, so they could put weight onto their paretic side. This could have reset their vertical orientation by having them supported upright at midline.

**RESEARCH OBJECTIVE(S)**

List study objectives.
Find effective therapeutic approaches to improve patients’ postural control to shorten the length of hospitalization and examine the immediate effects of galvanic vestibular stimulation, driven-gait orthosis with lokomat, and physiotherapy with visual feedback in rehabilitation of patients with pusher behavior.

**DESIGN TYPE AND LEVEL OF EVIDENCE:**
Level III: Observer-blinded crossover pilot study.

**SAMPLE SELECTION**
How were subjects recruited and selected to participate? Please describe.

Participants were recruited from an inpatient rehabilitation hospital. The participants recruited had hemiparesis caused by left or right hemispheric ischemic stroke or intracerebral hemorrhage.

**Inclusion Criteria**

- Age >18 years
- Height between 1.6 and 1.9 meters
- Weight below 150 kilograms
- Hemiparesis

**Exclusion Criteria**

- Other neurological issues or orthopedic disorder
- Cardiac pacemaker
- Bone fractures or severe osteoporosis
- Contractures or spasticity of lower extremity
- Mental implants
- Epilepsy
- Brain tumors or meningitis
- Vestibular disorder or eye-muscle paralysis

**SAMPLE CHARACTERISTICS**

N= Number of participants taking part in the study

<table>
<thead>
<tr>
<th>#/ (%) Male</th>
<th>N=17/68%</th>
</tr>
</thead>
<tbody>
<tr>
<td>#/ (%) Female</td>
<td>N=7/28%</td>
</tr>
</tbody>
</table>

Ethnicity NR

Disease/disability diagnosis Left or right hemispheric ischemic stroke

**INTERVENTION(S) AND CONTROL GROUPS**

*Add groups if necessary*

Group 1: Galvanic Vestibular Stimulation
### Group 1: Electrodes

<table>
<thead>
<tr>
<th>Brief description of the intervention</th>
<th>Electrodes were placed over each mastoid, with the stimulation performed at a threshold current determined on an individual basis. Threshold was determined by applying different amounts until the patients felt a tilting sensation. The patients sat in their wheelchairs during the stimulation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many participants in the group?</td>
<td>24; all participants took part in this intervention</td>
</tr>
<tr>
<td>Where did the intervention take place?</td>
<td>Single room in an inpatient hospital</td>
</tr>
<tr>
<td>Who delivered?</td>
<td>NR</td>
</tr>
<tr>
<td>How often?</td>
<td>One session for 20 minutes</td>
</tr>
<tr>
<td>For how long?</td>
<td>Three sessions over a period of 1 week.</td>
</tr>
</tbody>
</table>

### Group 2: Driven Gait Orthosis

<table>
<thead>
<tr>
<th>Brief description of the intervention</th>
<th>Locomotion training, which helps drive the hip and knee joints, and used on a treadmill on which the device can do up to 100% of the guiding force to walk. Support was set to 50% and the treadmill set to 2 km/h. The cadence of the step performed by the machine was set individually based on leg length.</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many participants in the group?</td>
<td>All participants took part in this intervention.</td>
</tr>
<tr>
<td>Where did the intervention take place?</td>
<td>Single room in an inpatient hospital</td>
</tr>
<tr>
<td>Who delivered?</td>
<td>NR</td>
</tr>
<tr>
<td>How often?</td>
<td>One session for 20 minutes, plus preparation time.</td>
</tr>
<tr>
<td>For how long?</td>
<td>Three sessions over a period of 1 week.</td>
</tr>
</tbody>
</table>

### Group 3: Physiotherapy

<table>
<thead>
<tr>
<th>Brief description of the intervention</th>
<th>Physiotherapy focused on spatial orientation with activities that would change the participant’s position and shifting of weight. Participants were presented with an external vertical reference in which they had to line themselves up with an external vertical reference, such as a doorframe.</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many participants in the group?</td>
<td>All participants took part in this intervention.</td>
</tr>
<tr>
<td>Where did the intervention take place?</td>
<td>Single room in an inpatient hospital</td>
</tr>
<tr>
<td>Who Delivered?</td>
<td>NR</td>
</tr>
<tr>
<td>How often?</td>
<td>One 30-minute one-on-one session; 10 minutes to set up and 20 of training.</td>
</tr>
</tbody>
</table>
For how long? Three sessions over a period of 1 week.

**Intervention Biases:** Check yes, no, or NR and explain, if needed.

- **Contamination:**
  - YES ☐
  - NO ☒
  - NR ☐
  - *Comment:* Each participant received the same interventions for the same amount of time.

- **Co-intervention:**
  - YES ☐
  - NO ☐
  - NR ☒
  - *Comment:* It was not stated whether the participants received additional therapy outside of the study.

- **Timing:**
  - YES ☐
  - NO ☒
  - NR ☐
  - *Comment:* The interventions lasted a total of 1 week for all participants, which prevented the possible decrease of the severity of pushing behavior due to natural progress. Although the interventions lasted for a short duration, it was enough time to yield noticeable outcome.

- **Site:**
  - YES ☐
  - NO ☒
  - NR ☐
  - *Comment:* It was all conducted at the same location, which eliminates biases caused by the intervention happening at different sites.

- **Use of different therapists to provide intervention:**
  - YES ☒
  - NO ☐
  - NR ☐
  - *Comment:* One experimenter, but the article did not state who provided the therapy for the participants.

**MEASURES AND OUTCOMES**

Complete for each measure relevant to occupational therapy:

**Measure 1:**

- **Name/type of measure used:** Scale for Contraversive Pushing (SCP)

- **What outcome was measured?**
  - The SCP measures the symmetry of spontaneous posture, the use of the arm or the leg to extend the area of physical contact to the ground, and resistance to passive correction of posture. The total score ranges from 0–6. Participants who met all three criteria (a score greater than 0 on each criterion) are considered to show contraversive pushing.

- **Is the measure reliable?**
  - YES ☒
  - NO ☐
  - NR ☐
Is the measure valid? | YES ☒ | NO ☐ | NR ☐
--- | --- | --- | ---
When is the measure used? | Pre and post intervention in the same room as the therapy session.

Measure 2:
Name/type of measure used: Burke Lateropulsion Scale (BLS)
What outcome was measured? The BLS rates the participant’s resistance to passive rolling, passive postural correction when sitting and standing, and assistance in transfer and walking. The total score range is from 0–17. The participants with a score ≥2 are considered to show lateropulsion.
Is the measure reliable? | YES ☒ | NO ☐ | NR ☐
--- | --- | --- | ---
Is the measure valid? | YES ☒ | NO ☐ | NR ☐
--- | --- | --- | ---
When is the measure used? | Pre and post intervention in the same room as the therapy session.

Measurement Biases
Were the evaluators blind to treatment status? Check yes, no, or NR, and if no, explain.
YES ☒ | NO ☐ | NR ☐ | Comment: Single evaluator who was blinded to the administered therapy
--- | --- | --- | ---

Recall or memory bias. Check yes, no, or NR, and if yes, explain.
YES ☐ | NO ☒ | NR ☐ | Comment: Each participant was provided one therapy session of each intervention, which would eliminate recall bias.
--- | --- | --- | ---

Others (list and explain):
The researchers accounted for instrumentation bias by staying consistent with using both scales before and after intervention to measure the changes in pusher behaviors. Another bias would be a sampling bias. The researchers only chose participants from a single hospital to have a small sample size, as a pilot study to see if there would be a need for a larger study that would include participants from multiple locations and a larger sample size.

RESULTS
List key findings based on study objectives
Include statistical significance where appropriate (p < 0.05)
Include effect size if reported
There was no significant difference with the three interventions in the pusher behaviour group according to the SCP (Kruskall-Wallis test, $p = .221$). A significant difference with the three interventions in the pusher behavior group found with the BLS (Kruskall-Wallis test, $p = .019$). Participants with pusher behavior showed significant improvements with the driven gait orthosis compared to physiotherapy (Mann-Whitney U-test, $p = .009$). There was no significant difference between the galvanic vestibular stimulation and physiotherapy (Mann-Whitney U-test, $p = .093$) and no significant difference found between the galvanic vestibular stimulation and driven gait orthosis (Mann-Whitney U-test, $p = .228$). Wilcoxon test supported the results, with the Lokomat therapy resulting in significant improvements ($p = .011$), no significant change for physiotherapy ($p = .557$), and no significant changes for the galvanic vestibular stimulation ($p = .150$).

Was this study adequately powered (large enough to show a difference)? Check yes, no, or NR, and if no, explain.

<table>
<thead>
<tr>
<th>YES ☒</th>
<th>NO ☐</th>
<th>NR ☒</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comment:</strong> Small sample size, but the researchers were able to draw conclusions with the sample size they had. The study was a pilot study, which could attribute the small sample size.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Were appropriate analytic methods used? Check yes, no, or NR, and if no, explain.

<table>
<thead>
<tr>
<th>YES ☒</th>
<th>NO ☐</th>
<th>NR ☐</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comment:</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Were statistics appropriately reported (in written or table format)? Check yes or no, and if no, explain.

<table>
<thead>
<tr>
<th>YES ☒</th>
<th>NO ☐</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comment:</strong> The statistics were reported in written form and had a graph on the BLS pre- and posttest.</td>
<td></td>
</tr>
</tbody>
</table>

Was the percent/number of subjects/participants who dropped out of the study reported?

<table>
<thead>
<tr>
<th>YES ☒</th>
<th>NO ☐</th>
</tr>
</thead>
</table>

Limitations:

What are the overall study limitations?

The researchers reported that the participants had to endure the time that was needed to attach the orthosis for the gait driven orthosis. This had the participants in a prolonged secured standing position that increased the net therapy time. Another limitation is the ability to generalize the findings to the population because it was such a small sample size in one location.

**CONCLUSIONS**

State the authors’ conclusions related to the research objectives.
Forced upright orientation during locomotion is an effective method for immediately reducing pushing behavior. Because it was a single session, the long-term effects could not be inferred. With the small sample size and participants recruited from one location, the results cannot be generalized to the general population. The scale to assess pusher behavior that is more effective is the BLS because it was able to detect smaller changes using a graduated scale. The two scales used measured different aspects that could have caused a lack of significant findings. Key features of effective treatments for pusher behavior include eliminating the fear of falling and incorporating functional tasks. Eliminating the fear of falling gives the patients confidence and improves their willingness to try new tasks. Incorporating task-oriented activities that have patients in vertical orientation allows them to do functional activities that bring meaning to the patients.

This work is based on the evidence-based literature review completed by Justin Hanson, OTS, and Kelly Erickson, PhD, OTR/L, Faculty Advisor, College of St. Scholastica.


For personal or educational use only. All other uses require permission from AOTA.