

Development of a Phased Protocol of Biofeedback via Pressure Map when Treating a Subject with Pusher Syndrome: A Case Report

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INTRODUCTION

Pusher syndrome following a stroke is characterized by “leaning towards the hemiplegic side with no compensation for instability and resistance to passive correction towards midline.”^{6,7} The rate of recovery following a stroke is slowed for those presenting with pusher syndrome. Those with pusher syndrome required 3.6 weeks longer than other subjects with stroke to achieve the same degree of function.⁶

The most commonly supported intervention for management of pusher syndrome in the literature is re-establishing earth-vertical via environmental visual cues. Recently studies have attempted to incorporate technology with biofeedback capabilities into therapeutic management to reduce the reliance on external cues and improve carryover. The below described protocol was developed based off a study by Yang et al which utilized a Wii balance board for biofeedback.⁸

CASE DESCRIPTION

- 81 y.o. white female
- Subarachnoid hemorrhage and successful embolization
- Post-Operative day 4 developed new left sided weakness
- Imaging revealed a new frontal and parietal CVA
- PMH: Pacemaker implantation (2018), previous right rotator cuff tear, and arthritis and psoriasis usually managed through monthly remicade infusions.
- 34 day length of stay in inpatient rehabilitation

PT EVALUATION

- Left upper extremity flaccidity
- Left lower extremity tone with adductor/inversion synergy
- Pusher behaviors present with functional mobility (Table 1 and 2)
- Total to dependent level assistance for all functional mobility
- Mild sensation impairment: proprioceptive mid-range
- See Tables and Figures for initial outcome measure evaluation

METHODS

Seven 20-minute biofeedback trainings were implemented with use of a pressure map in the seated position. The phases below were identified following the natural flow of intervention, and are not held to time. They are progressed based off of the clinician’s judgement with regards to established phase goals and patient presentation. Within each session all phases were worked through in order. As the subject improved a shorter duration of time was spent in phase one, allowing more time in the more demanding second and third phases.

For all of the phases the subject is positioned with feet flat on the floor in the seated position without upper extremity support with 1/2 of bilateral femurs supported on a flat surface.



Phase 1

- Goal: the subject transitions to the true limits of stability in one plane and maintains this position for 10 seconds before transitioning to the opposite end within the same plane
- Sagittal training, followed by frontal plane.

Phase 2

- Goal: the subject is able to transition simultaneously in frontal and sagittal planes towards a corner quadrant to the limit of stability, and return in the opposite direction.
- Transverse plane segmental execution followed by quadrant and rotational training (posterior quadrant).
- Cones were used for visual cues during this phase.

Phase 3

- Goal: the subject and therapist develop verbal cues associated with movements performed with biofeedback to be able to transition performance to daily activities with reduced external cues.
- Lateral scooting: “Forward, lift, and shift.”
- Sit to stand: “Forward, lift”

In session progress was monitored via elicitation of the non-paretic side extension or abduction moment in either UE or LE, as well as the duration of time spent in earlier phases as compared to later more functional phases. Assessment of the effectiveness of treatment was assessed pre- and post-pressure map intervention and at discharge with the Contraversive Pushing Scale, Burkelateropulsion scale, and the FIST.

RESULTS

Figure 1. Function in Sitting Test out of a total score of 56. (*) identified changes in score greater than the identified MCID > 6.5.⁴

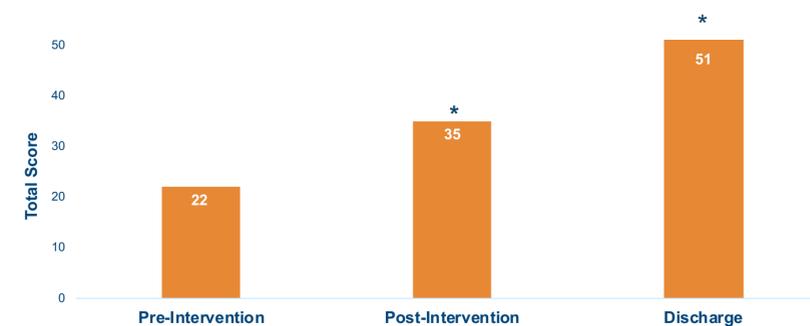


Table 1. Contraversive Pushing Scale at pre- and post-intervention, and discharge scores by positional sub-group and total score. (*) identifies scores = 0 for subgroup and overall scores identifying resolution of pusher behavior below the established cut-off score.^{1,2}

	Sitting	Standing	Total
Pre-Intervention	2.75	3	5.75
Post-Intervention	0 *	1.75	1.75
Discharge	0 *	1.5	1.5

Table 2. Burkelateropulsion Scale at pre- and post-intervention and discharge scores by positional sub-group and total score. (*) identifies statistically significant changes in sub-groups (= 0) and total scores < 3 cut-off score for identifying resolution of pushing behavior.³

	Supine	Sitting	Standing	Transfers	Walking	Total
Pre-Intervention	2 *	3	4	3	3	15
Post-Intervention	0 *	0 *	1	3	3	7
Discharge	0 *	0 *	1	1	1	3

CONCLUSIONS

The findings of this study provide low level support that using a pressure map for positional feedback might reduce pushing behavior in the seated position. This study indicates statistically significant evidence for improving seated functioning following this intervention.

The biofeedback system was limited by nature of the slick pressure map surface. The pressure map was not able to be safely transitioned to a standing position due to the subject’s imbalance, and goal of protecting the equipment. Due to these difficulties the intervention was only utilized seven times over a month-long inpatient rehabilitation stay.

Further studies on the proposed phased protocol could increase generalizability and feasibility of the protocol within the clinic. These studies could recommend therapeutic parameters and appropriate clinical progression to improve the use of the pressure map as a proprioceptive biofeedback tool.

SUMMARY

Typical functional recovery time is increased as much as 64% following a stroke if a person presents with pushing syndrome.^{5,6} Identifying interventions to decrease pushing behaviors earlier is vital to supporting earlier mobility and reducing rehabilitation time. This study suggests that using a pressure map might be a feasible way to provide increased quantitative biofeedback early in the rehabilitation process and should be used in conjunction with established earth-vertical and TENS training methods to reduce pusher syndrome.^{6,9,10}

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