**Dieses Dokument ist eine Zweitveröffentlichung (Verlagsversion) /
This is a self-archiving document (published version):**

Simone Mückel, Jan Mehrholz

**Immediate effects of two attention strategies on trunk control on
patients after stroke. A randomized controlled pilot trial**

Erstveröffentlichung in / First published in:

Clinical Rehabilitation. 2014, 28(7), S. 632 – 636 [Zugriff am: 31.07.2019]. SAGE journals. ISSN 1477-0873.

DOI: <https://doi.org/10.1177/0269215513513963>

Diese Version ist verfügbar / This version is available on:

<https://nbn-resolving.org/urn:nbn:de:bsz:14-qucosa2-354726>

„Dieser Beitrag ist mit Zustimmung des Rechteinhabers aufgrund einer (DFGgeförderten) Allianz- bzw. Nationallizenz frei zugänglich.“

This publication is openly accessible with the permission of the copyright owner. The permission is granted within a nationwide license, supported by the German Research Foundation (abbr. in German DFG).

www.nationallizenzen.de/

Immediate effects of two attention strategies on trunk control on patients after stroke. A randomized controlled pilot trial

Clinical Rehabilitation
2014, Vol. 28(7) 632–636
© The Author(s) 2014
Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/0269215513513963
cre.sagepub.com

Simone Mückel¹ and Jan Mehrholz^{1,2}

Abstract

Objective: To compare the immediate effects of an external focus to enhance lateral body weight shift after stroke.

Design: Randomized controlled trial.

Setting: Inpatient rehabilitation hospital.

Subjects: Twenty patients after stroke (11 males; mean (SD) age 72.2 (7.4) years; duration of illness 56 (14) days; there were 9 (45%) left-sided strokes) with impaired sitting balance were randomly allocated into two groups either external focus ($n = 10$) or internal focus ($n = 10$).

Intervention: Patients in the external focus group, while sitting, were instructed to shift as much weight as they could sideways to an external point next to their hip. Patients in the internal focus group were instructed to shift as much weight as they could sideways to their hip.

Main outcome measures: Immediate lateral body weight shift as well as anterior–posterior deviation was measured in centimetres with a sensor mat.

Results: Patients in the external focus group achieved greater lateral body weight shift than those in the internal focus group (mean shift (SD) 8.7 (2.6) cm vs. 4.5 (3.3) cm, respectively; $P = 0.006$). However, there were no significant differences in anterior–posterior deviation (mean shift (SD) 2.3 (1.3) cm vs. 1.2 (1.2) cm, respectively; $P = 0.08$).

Conclusion: Using an external focus may lead immediately to an enhanced lateral body weight shift while sitting, without increasing anterior–posterior deviation.

Keywords

Stroke, focus of attention, rehabilitation, physiotherapy

Date received: 10 June 2013; accepted: 30 October 2013

Introduction

Instructions play an important role in training motor performance.^{1–4} One important example is to direct the focus of attention when given instructions. Focusing attention on an object or an effect on the environment is called an ‘external focus strategy’, and focusing attention on a subject’s own movement

¹Wissenschaftliches Institut, Klinik Bavaria, Kreische, Germany

²Department of Public Health, Technical University Dresden, Germany

Corresponding author:

Jan Mehrholz, Wissenschaftliches Institut, Private Europäische Medizinische Akademie der Klinik Bavaria in Kreische GmbH, An der Wolfsschlucht 1–2, Kreische 01731, Germany.
Email: jan.mehrholz@klinik-bavaria.de

or body motion is called an ‘internal focus strategy’.⁵ External therapeutic focus strategies are well evaluated with a positive effect on balance in healthy subjects^{5–10} and on optimizing movements in sports (e.g. in golf, tennis, or skiing).^{8,11} There are also a few clinical studies describing positive effects when using external focus strategies in instructions during therapy of patients after stroke.^{12–14} However, these studies after stroke focused on optimizing movements of the upper limb.

Until now, no study has evaluated the immediate effects of instructions on trunk control, defined as the ability of the trunk muscles to allow the body to remain upright and to adjust weight shift after stroke. Trunk control is, however, an important predictor of motor skills after stroke. Research indicates a robust correlation between trunk control and walking function and motor performance at discharge from hospital^{15,16} and trunk control may also have positive effects on sit-to-stand performance and other functional abilities.¹⁷

The aim of the present study was, therefore, to investigate the immediate effects of using an external focus instruction to improve lateral body weight shift as an important part of trunk control of patients after stroke.

Methods

We included all patients after first stroke aged between 50 and 80 years who were not able to walk without physical assistance of one person (Functional Ambulation Categories, FAC 1 or 2),¹² had reduced muscle strength in the affected hip flexors and abductors (defined as Medical Research Council, MRC grade 2–3), without apparent limitations in proprioception of the paretic leg (defined as 3–6 points in the sensory subtest of the Fugl-Meyer Assessment of the lower limb),¹³ with good to moderate trunk control (defined as more than 48 points in the Trunk Control Test)¹⁴ and with written informed consent.

We excluded patients with neurological diseases such as dementia or brain tumours, with orthopaedic disease causing pain in the lumbar spine and hip area, severe global aphasia and a pronounced neglect (defined as ≤ 100 points in the Behavioural Inattention Test).¹⁵

Based on our a priori sample size calculation, we estimated a required sample size of 20 patients for rejecting the null hypothesis (assumptions were $\alpha = 0.05$, power = 80%) and an assumed difference between groups of 4 cm lateral body weight shift. We therefore prepared 20 lots in sealed and opaque envelopes in an urn (ten lots indicating external and ten lots indicating internal focus group) for randomization.

Patients sat on a sensor mat placed on a therapy bench, back unsupported and hands in lap, hip and knee joints flexed 90 degrees and feet placed on the ground; fossa of knees was set on the edge of the bench.

For patients in the external focus group we placed a green point (diameter 15 cm, see Figure 1, on the journal website only) on the bench 20 cm lateral from the trochanter major of the ipsilesional trunk side (non-affected side of the body). For patients in the internal focus group no such visual focus was provided.

One sample task was used to demonstrate the principle of testing in both groups.

We used the following predefined instructions for the task in the external focus group:

First: ‘Sit comfortably’, second: ‘Shift your body weight as much as possible towards the green circle without using your arms’ and third ‘Please indicate by a clear “yes” when the maximum body weight shift is achieved!’ All patients performed this procedure three times.

We used the following predefined instructions for the task in the internal focus group:

First: ‘Sit comfortably’, second: ‘Shift your body weight as much as possible towards your “healthy side” without using your arms’ and third ‘Please indicate by a clear “yes” when the maximum body weight shift is achieved!’

All patients performed this procedure three times.

We used a sensor mat (Mflex 4.0, Vista Medical Ltd. 2008) to measure (a) the immediate body weight shift to the non-affected side and (b) the anterior–posterior deviation of the centre of mass and (c) the maximum anterior, posterior and horizontal centre of mass in centimetres. We blinded

Figure 2. Flowchart (according to CONSORT, www.consort-statement.org).

the computer screen for patients so that they did not receive feedback on performance. The person undertaking the assessment (collecting the data) of the shift of balance and also the statistician did not know which group the patient was in. However, the therapist who instructed had to know the group allocation for appropriate commands.

Results are presented as means with standard deviation if not stated otherwise, as analysed with the Statistical Package for Social Sciences Version 20. We used always non-parametric tests (e.g. the Mann–Whitney *U*-test) to compare baseline measures and differences between groups. The global alpha level was set at 0.05.

Results

From July 2011 to March 2012 we screened 29 patients for eligibility in our inpatient rehabilitation centre (Figure 2). Twenty subjects were eligible and fulfilled the inclusion and exclusion criteria. Ten patients were randomly allocated to the external focus group and ten patients to the internal focus group. One patient in the internal focus group dropped out due to an early discharge to an acute hospital after recruitment before the intervention started. All other patients completed the intervention (Figure 2).

At study onset groups did not differ in important prognostic variables (as shown in Table 1). Both

Table 1. Patients characteristics at baseline.

	External focus group	Internal focus group	P-value
Age in years (mean $\pm$ SD)	71.67 $\pm$ 9.94	72.7 $\pm$ 4.62	0.55
Gender (male/female)	6/4	5/5	0.46
Type of stroke (ischaemic/haemorrhagic)	7/3	7/3	1.0
Side (left/right)	5/5	5/5	1.0
Body height (mean $\pm$ SD)	168.78 $\pm$ 7.26	164.4 $\pm$ 6.43	0.18
Body weight (mean $\pm$ SD)	70.89 $\pm$ 9.13	71.6 $\pm$ 8.03	0.86
Duration of illness in days (mean $\pm$ SD)	59.0 $\pm$ 7.81	53.6 $\pm$ 17.4	0.40
Trunk Control Test (mean $\pm$ SD)	8.56 $\pm$ 5.43	11.6 $\pm$ 8.34	0.17
Functional Ambulation Categories (mean $\pm$ SD)	1.33 $\pm$ 0.50	1.6 $\pm$ 0.52	0.26
Fugl-Meyer Sensory Subtest lower limb (mean $\pm$ SD)	4.22 $\pm$ 1.48	4.5 $\pm$ 1.43	0.96
Behavioural Inattention Test (mean $\pm$ SD)	140.89 $\pm$ 11.3	140.9 $\pm$ 10.1	0.86

groups showed improved lateral body weight shift. However, the external focus group improved their maximum distance in lateral body weight shift significantly more compared to the control internal focus group (8.7 cm $\pm$ 2.6 versus 4.5 cm $\pm$ 3.3; $P = 0.006$). We did not find significant differences between the groups in anterior–posterior deviation during the task (2.3 cm $\pm$ 1.3 versus 1.2 cm $\pm$ 1.2; $P = 0.085$). In a post-hoc regression analysis we did not find any association (at level $R^2 > 0.2$) of baseline variables with the effect of immediate lateral body weight shift.

Discussion

Our study indicates that an external focus may improve the immediate maximum lateral body weight shift in patients after stroke while sitting. This means that patients are more able to shift their own body weight on the affected side while sitting when an external focus instruction is given by a physiotherapist. Surprisingly, the effect of such instruction seems quite large (e.g. patients using an external focus could double their maximum lateral body weight shift).

Because the anterior–posterior deviation during the task did not differ between groups, we think that the external focus instruction does not lead to a more so-called ‘compensatory’ pattern (or sometimes called by physiotherapists ‘loss of movement quality’).

Our results are in one line with the described effects of external focus instructions used in other

motor performance tasks after stroke.^{8–10} However, this study describes for the first time the immediate effects of an external focus to improve the body weight shift while sitting after stroke.

On the one hand it is known that focusing attention on an external point may allow a more automatic control of movement without interferences in motor control processes as assumed by using an internal focus.⁴ On the other hand, the optimal distance of the external focus has not been fully investigated. In our study we placed a green circle just 20 cm from the hip. Nevin and colleagues, studying healthy subjects standing on a seesaw, used a greater distance and showed significantly improved balance ($P < 0.01$).¹⁸

One could argue that the sample size ($n = 20$) is small. However, we argue that this sample size was calculated earlier and was large enough to detect both a statistical and a clinically relevant result. Whereas patients, assessor and statistician were blinded, the therapist who instructed the patients was not blinded to group allocation. However, it is still unclear in which direction this might have biased the results of the study.

One has to keep in mind that it is not clear whether our results are applicable to more severely affected patients after stroke and whether immediate improvements have implications for motor learning and improvements of activities in the long term. It may be that our described external focus strategy would be a better way of treating body

weight shift over the longer term, but we must emphasize that this has not yet been proven.

For daily clinical physiotherapy the use of instructions is a very important aspect of therapy. A recent observational study found that physiotherapists used only 22% externally and 67% internally focused instructions in stroke rehabilitation.¹⁹ Future studies should find out whether instructions using an external focus can be translated into faster motor learning and improving activities of daily living.

Clinical messages

- An external focus may improve the immediate maximum lateral body weight shift in patients after stroke while sitting.
- This does not affect movement quality.

Acknowledgements

We gratefully acknowledge the assistance of Thorsten Zipfel and Holm Thieme during the study time.

Conflict of interest

The author declares that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

1. Beilock SL and Carr TH. On the fragility of skilled performance: what governs choking under pressure? *J Exp Psychol Gen* 2001; 130: 701–725.
2. Beilock SL, Carr TH, MacMahon C and Starkes JL. When paying attention becomes counterproductive: impact of divided versus skill-focused attention on novice and experienced performance of sensorimotor skills. *J Exp Psychol Appl* 2002; 8: 6–16.
3. Gray R. Attending to the execution of a complex sensorimotor skill: expertise differences, choking, and slumps. *J Exp Psychol Appl* 2004; 10: 42–54.
4. Wulf G, McNevin N and Shea CH. The automaticity of complex motor skill learning as a function of attentional focus. *Q J Exp Psychol A* 2001; 54: 1143–1154.
5. Wulf G, Weigelt M, Poulter D and McNevin N. Attentional focus on suprapostural tasks affects balance learning. *Q J Exp Psychol A* 2003; 56: 1191–1211.
6. Wulf G and Shea CH. Principles derived from the study of simple skills do not generalize to complex skill learning. *Psychon Bull Rev* 2002; 9: 185–211.
7. Wulf G, Shea C and Park JH. Attention and motor performance: preferences for and advantages of an external focus. *Res Q Exerc Sport* 2001; 72: 335–344.
8. Wulf G, Hoss M and Prinz W. Instructions for motor learning: differential effects of internal versus external focus of attention. *J Mot Behav* 1998; 30: 169–179.
9. Shea CH, Wright DL, Wulf G and Whitacre C. Physical and observational practice afford unique learning opportunities. *J Mot Behav* 2000; 32: 27–36.
10. Riley MA ST, Grochi MJ and Turvey MT. Postural stabilisation for the control of touching. *Hum Mov Sci* 1999; 18: 795–817.
11. Wulf G, McNevin NH, Fuchs T, Ritter F and Toole T. Attentional focus in complex skill learning. *Res Q Exerc Sport* 2000; 71: 229–239.
12. Fasoli SE, Trombly CA, Tickle-Degnen L and Verfaellie MH. Effect of instructions on functional reach in persons with and without cerebrovascular accident. *Am J Occup Ther* 2002; 56: 380–390.
13. Wu CY, Trombly CA and Lin KC. The relationship between occupational form and occupational performance: a kinematic perspective. *Am J Occup Ther* 1994; 48: 679–687; discussion 88.
14. Spatt J and Goldenberg G. Speed of motor execution and apraxia. *J Clin Exp Neuropsychol* 1997; 19: 850–856.
15. Morgan P. The relationship between sitting balance and mobility outcome in stroke. *Aust J Physiother* 1994; 40: 91–96.
16. Loewen SC and Anderson BA. Predictors of stroke outcome using objective measurement scales. *Stroke* 1990; 21: 78–81.
17. Dean CM, Channon EF and Hall JM. Sitting training early after stroke improves sitting ability and quality and carries over to standing up but not to walking: a randomised trial. *Aust J Physiother* 2007; 53: 97–102.
18. McNevin NH and Wulf G. Attentional focus on suprapostural tasks affects postural control. *Hum Mov Sci* 2002; 21: 187–202.
19. Johnson L, Burrige JH and Demain SH. Internal and external focus of attention during gait re-education: an observational study of physical therapist practice in stroke rehabilitation. *Phys Ther* 2013; 93: 957–966.