Author's response to reviews

Title: Non-paretic leg orientation as a clinical sign for pusher syndrome
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Author's response to reviews:

We would like to thank both reviewers for their insightful comments on our present manuscript. We truly believe that the suggested modifications which we incorporated into our manuscript improved its quality. We tried to meet the demands of both reviewers to revise our paper as best as we could. The manuscript has been modified in a number of aspects, that are listed and discussed below in the order as stated by the reviewers. Changes and amendments were performed on the Methods, Results, Discussion sections and the Figures.

Editorial changes requested by the BioMed Central Editorial Team:
Action taken (A): On page 4, paragraph 2, a statement makes explicit that informed consent was received from the participants of the current study or their relatives prior to the investigation. Also, it is stated that the study was approved by the local research ethics committee and conducted in compliance to the Helsinki Declaration of 1964. A copy of the participant's written consent to publish, who is shown in Figure 1, will be send by fax to the BioMed Central Editorial Team.

Comments to reviewer Stefan Glasauer:

1.1
Suggested action (S): discussion of the validity of the study's conclusions
A: in the Discussion section, we addressed some aspects of the study that limit the conclusions of the present manuscript. We admit that the head-to-trunk measure is less robust compared to the leg-to-trunk measure because of additional movement degrees of freedom outside the role plane (page 11, paragraph 3). We reformulated our primary conclusions in more tentative terms (page 12, paragraph 1) and mention an alternative interpretation as suggested by the reviewer (page 13, paragraph 1).

1.2
S: change the title (e.g., leg orientation as clinical sign for pusher syndrome)
A: we changed the title of our manuscript as suggested into "Non-paretic leg orientation as a clinical sign for pusher syndrome".

1.3
S: average leg-to-trunk orientation of pushers might be biased by a difference in ipsi- vs. contralateral trunk tilt. It should therefore be investigated.
A: All statistical analyses were repeated with direction of passive trunk tilt as an additional within-subject factor.

1.4
S: discussion of contradiction between average leg-to-trunk orientation and average intercept of leg-to-trunk function
A: the average leg-to-trunk orientation was reanalyzed with tilt direction as an additional factor. The same is true for the linear leg-to-trunk function which was determined separately for each tilt direction. The statistical analyses of average leg-to-trunk orientation in the average intercept of the linear leg-to-trunk function show the same significant ipsilateral deviation of relative leg orientation in pusher patients.

1.5
S: limit the analysis of averages to a smaller range of tilts which has been reached by all subjects on each side.
A: The smallest range of passive body tilt performed was determined for each tilt direction separately.
Subsequent statistical analyses of average limb-to-trunk deviations were restricted to this range.

1.6
S: discussion of the relation between postural responses and perceived body orientation
A: we admit that a relation between postural responses and perceived body orientation can only be established by directly correlating both variables in the same sample of pusher patients (page 12, paragraph 1).

1.7
S: what is completely missing is why the vestibular patients were included in the study
A: the last sentence of the introduction (page 3, paragraph 2) states why vestibular patients were included in the study.

1.8
S: the authors should discuss the effects of acute unilateral vestibular failure on perceived orientation and posture.
A: we disagree that it has been shown that vestibular patients' perceived body orientation is affected by their lesion. An additional paragraph discusses the effects of unilateral vestibular failure on perceived body orientation (page 12, paragraph 3).

1.9
S: discussion of the possibility that pusher patients may suffer from the inability to suppress disturbed vestibular information for leg adjustments.
A: we state that vestibular loss seems unlikely to be the only cause for the impaired leg response in pusher patients. An additional impairment must be represent in pusher patients (page 13, paragraph 1).

1.10
S: comment to the limitations of the linear regression as seen in the NBD-controls as in general. Was this different behaviour (in NBD-controls) linked to the fact that the experimenter always sat on the left side? 
A: concerning our attempt to derive the perceived body orientation of pusher patients from their spontaneous leg response during passive body tilt, we admit that assuming a linear relationship between trunk tilt and leg adjustment might be too simplistic. This effect might be related to the fact that the experimenter was always sitting on the left side of the participant. Clearly, it would have been better if the side the experimenter was sitting on had been randomized. A non-linear regression function might have been more suitable to describe the leg-to-trunk function.

1.11
S: clarify the introduction of velocity gain; difficulty to interpret velocity gain without knowing about the dynamics of leg adjustment
A: we removed the analysis of velocity gain from the manuscript because we agree that the methodology used in the present study is not sensitive enough to enable an appropriate description of the dynamics of leg adjustments in our subjects.

1.12
S: change or omit figure 4 
A: figure 4 has been removed from the manuscript. Also, the paragraph in the results section referring to figure 4 has been changed (page 9, paragraph 2).

1.13
S: delete the sentence "We thus averaged each variable over both viewing conditions"
A: The sentence was deleted.

1.14
S: include the brackets around the gain values
A: this paragraph has been removed when the results section was renewed.

1.15
S: change the statement that "a good correspondance exists between"
A: the statement was deleted after the conclusions were reformulated.

1.16
S: change the statement that the results imply a disturbed representation of body orientation
A: we used the expression "may suggest" for now.

1.17
S: Figure 2, caption: Line computed from average regression parameters?
A: Yes, the broken line representing the group average in Figure 2 is derived from the average regression parameters of all individuals composing each group and who fulfilled the criterion of explained variance. The caption of the figure was slightly modified to emphasize this fact.

Comments to reviewer Ann Ashburn:

2.1
S: more information is need in the current paper of how the diagnostic decisions were made, who made the diagnosis and at what time post-stroke.
A: the paragraph describing the criteria for the assessment of pusher syndrome was extended slightly also stating who of the three authors made the assessment (page 4, paragraph 3). For further information, another sentence was added referring to Table 1.

2.2
S: there is considerable debate between assessors over who meet the criteria; ideally more than one assessor should independently rate subjects.
A: the reliability of the SCP scale is currently still under investigation. This study is not performed by our group but by [...] at [...]. Preliminary results have shown that the SCP scale shows a high interrater reliability.

2.3
S: those people with stroke who did not present with "pushing" should be of equal stroke severity as those who did.
A: We added a paragraph in the Methods section analyzing the demographic and clinical data of the four groups of subjects (page 3, paragraph 4).

2.4
S: discussion of the interindividual differences of the passive body tilt applied to participants
A: paragraph 6 on page 4 addresses the issue of interindividual differences in body tilt between the groups of subjects. Many different factors might have influenced the characteristics of body tilt: eg. the patient's body weight and size, also the patient's health status and severeness of symptoms. The pusher patients were the participants that received the slowest and most gentle passive body tilt. We tried to match the other groups accordingly. As for the lack of an external pacer signal, variation of the tilt stimulus was to be expected. We took care that the participant's body was sideways tilted and not horizontally pushed sideways. The movement was neither performed suddenly nor abruptly. We are not aware of any evidence that the way the experimenters placed their hands on the subjects under the particular conditions of the present experiment influences the postural responses of the subjects. Therefore, we assume that the null hypothesis is true and this interindividual variation does not matter except for increasing the measurement noise.

2.5
S: discussion of the restrictions to the head angle measure
A: we state in the discussion that we consider the head angle measure to be less robust than the leg measure (page 11, paragraph 4).

2.6
S: discuss the reliability of marker placement and data extraction
A: Further information on the visual marker tracking software can be found under the following URL: http://www.mikromak.com/en/products/en_winanalyze.htm. The tracking of the markers was online exclusively supervised by L.J. Whenever the tracking of the markers failed, the process was halted and the extracted positions reset to the most recent correct marker positions of previous video frames. After this the tracking process was continued. All later stages of data processing and analysis was also performed by L.J alone.

2.7
S: a greater explanation of the angles adopted for analysis and why they were adopted is required.
A: from the extracted positions of the two markers belonging to each body segment, we computed the
orientation of the segment with respect to the earth vertical. These data are the basis for the linear regressions calculated to achieve the parameters of the respective leg- or head-to-trunk function. The relative segment-to-trunk orientations were computed to integrate the relation between leg or head segment to trunk across a greater body tilt range in a larger number of subjects. The intercept of the linear regression just gives the leg to trunk relation for an upright posture.

2.8 S: justify the use of velocity
A: see action stated above under point 1.11

2.9 S: comment on the photograph (Figure 1) that the patient seen is fixing and not pushing
A: in Figure 1 a pusher patient is seen during the body tilt maneuver. The patient does not show pushing behaviour because he is not able to do so; his feet are not touching the ground and his hands are held in his lap. We agreed that from the left panel one gets the impression that he still shows a resistance against the passive tilt into the ipsiversive direction.

2.10 S: comment on the robustness of the data with respect to the interpretation of results
A: It would have been better from a data analysis perspective to have used a more sophisticated motion capture system that would allow a reconstruction of movements in 3D space. Unfortunately, these systems are not feasible for investigating pusher patients because the patients would need to leave the ward which is excluded because of the patients' medical conditions early after stroke when the disorder is most prominent. Therefore, highly mobile equipment in the form of a single camera setup is the only possible solution. Of course that means that mobility is traded for accuracy. Nevertheless, we believe that with the current study we have shown ways of how to investigate such a severe postural disorder like pusher syndrome early after stroke quantitatively in a gentle manner with relatively little technical effort. Future studies might optimize the procedure for tracking recovery early after stroke in order to improve the treatment approaches which are currently employed.

2.11 S: discuss the limitations of the study
A: a paragraph was added to the discussion stating the limitations of the present study (page 14, paragraph 2).