

# The Effect of Trunk Restraint on Centre of Pressure Displacement when Training using a Virtual Reality System

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## BACKGROUND

- Virtual reality training (VRT) is increasingly used in rehabilitation to improve balance and function in individuals who have had a stroke.
- Sitting balance, assessed by tracking the displacement of the centre of pressure (CoP) under the buttocks and thighs, has been shown to be critical for independence post-stroke. Sitting balance may be trained with VRT.<sup>1</sup>
- Trunk support may be needed in patients who have significant motor impairments. Previous research has used trunk restraint to emphasize movement of the upper extremity while restricting compensatory movements of the trunk when performing reaching and grasping tasks.<sup>2</sup>
- The effect of trunk support or restraint on CoP displacement during the performance of VRT is not known.

## OBJECTIVES

- To determine whether CoP displacement while performing VRT is altered when the trunk is supported and/or restrained compared to when sitting without back support.
- To determine whether age or pathology of individuals produces different amounts of CoP displacement while performing VRT.

## METHODS

- 4 young adults (1 Male; avg. age 21), 4 old healthy adults (1 Male; avg. age 69) and 3 stroke survivors (2 Males; avg. age 61) were recruited to perform VRT under three different sitting conditions while seated in a wheelchair. A convenience sample of older adults & younger adults were recruited through word of mouth. Stroke survivors were recruited from the inpatient stroke rehabilitation unit at Elisabeth Bruyère Hospital.
- Three sitting conditions:
  - Restrained (R)** - the participant was seated with his/her back resting on the chair, with seat belt and arm rests on, and straps placed across their chest
  - Supported Back (SB)** - the participant was seated with his/her back resting on the chair, with seat belt and arm rests on
  - No Back Supported (NBS)** - the participant did not have his/her back resting on the chair; seat belt and arms rests were removed
- A Tekscan CONFORMat was placed under each participant to measure the CoP displacement while playing 5 Jintronix VRT games under each of the sitting conditions (total of 15 VRT games played per participant).
- The order of the sitting conditions were counter balanced among the groups.
- The area of the CoP 95% confidence ellipse (cm<sup>2</sup>) for each game was calculated and compared across conditions and participant groups



Figure 1. Stroke participant sitting in the Restrained, Supported back and No back support sitting conditions playing VRT games

## RESULTS

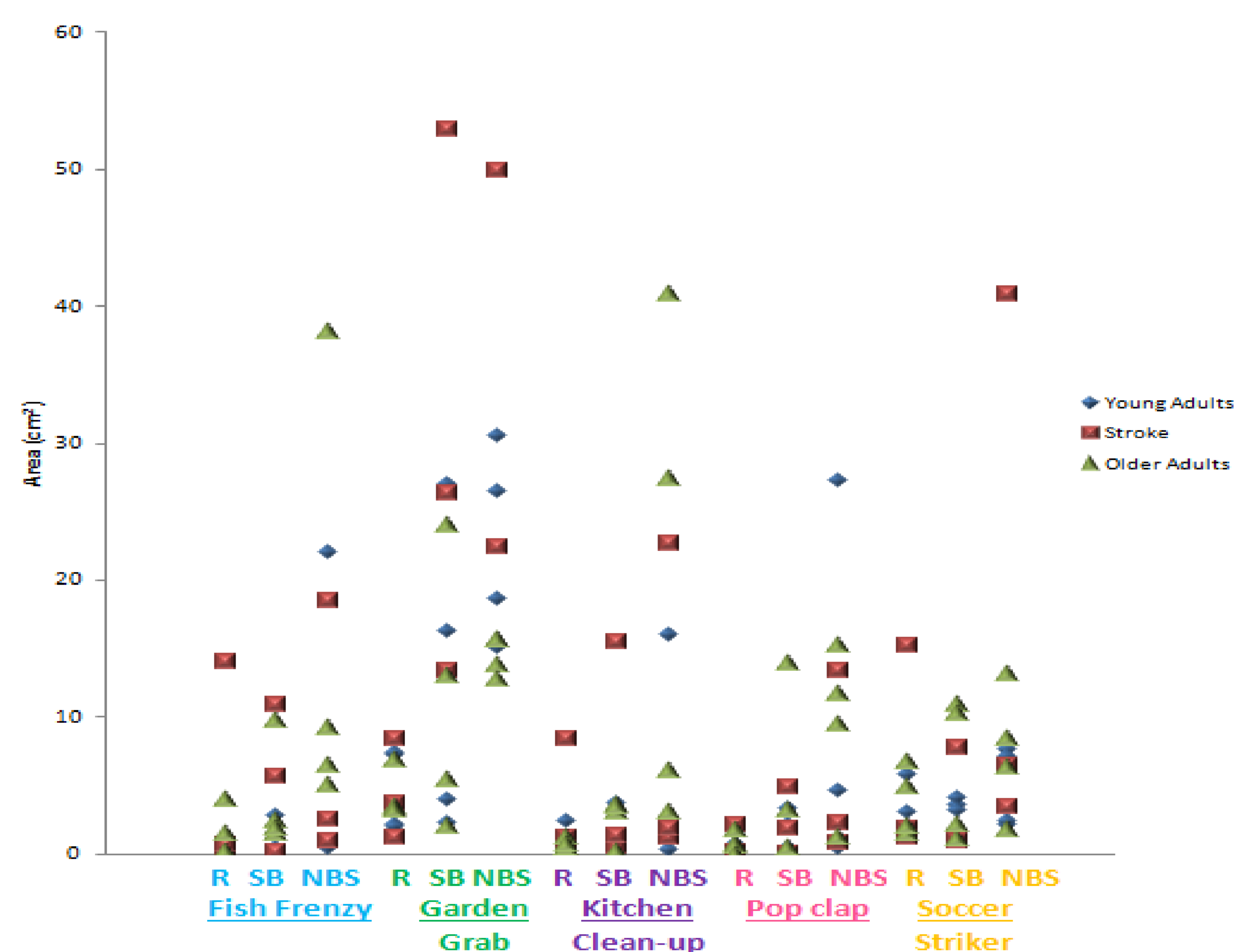


Figure 2: Area (cm<sup>2</sup>) of the 95% confidence ellipse that encloses the CoP movement for each participant under the 3 sitting conditions, Restrained (R), Supported Back (SB) and No Back Support (NBS), while playing 5 VRT games. \*Data from one post-stroke in NBS Garden Grab is not plotted since it is extreme relative to rest of participants (area = 135 cm<sup>2</sup>)

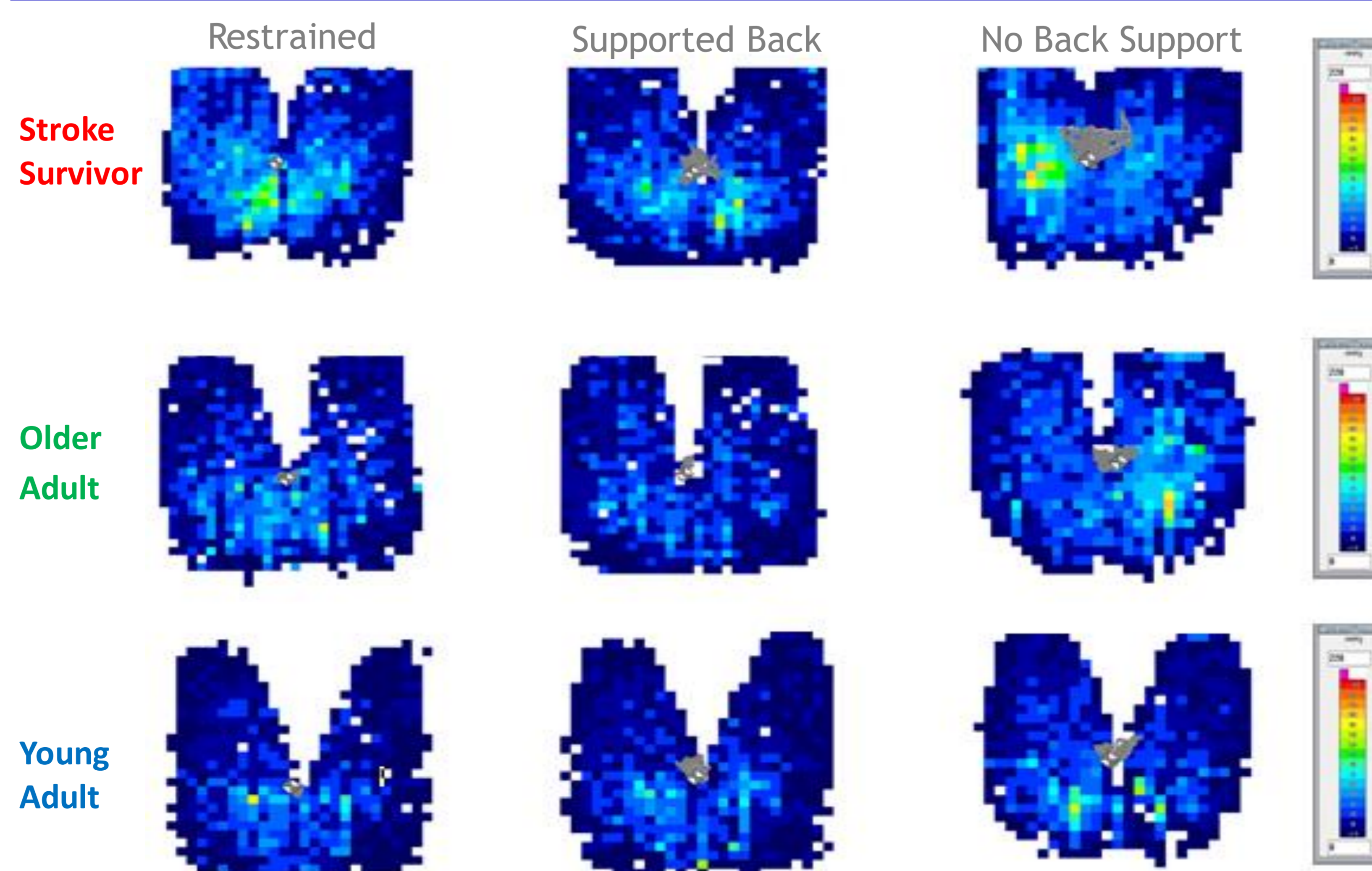


Figure 3. Plot of the displacement of the CoP recorded with a Tekscan CONFORMat of a stroke survivor, older adult, and young adult playing "Garden Grab", under the restrained, supported back and no back support sitting conditions. The grey line indicates the displacement of the CoP for 100 seconds of game play

## DISCUSSION

- Upon observation, the restrained condition generally limited the centre of pressure displacement more than either the supported back or no back support sitting conditions.
- Out of the five games, the game "Garden Grab", elicited more movement from each of the participants than the other games.
- There was large variability in the centre of pressure movement within groups, and also between the groups. It seems that on average stroke patients had more movement than the young adult and older adult groups. Possible explanation for the variability could be due to the participants performing the games in different orders of sitting conditions, thus causing a learning effect which may have affected their subsequent performance in each sitting condition and game. Another reason could be as a result of not standardizing instructions to participants.
- Due to the small sample size, statistical significance between groups was not analyzed.

## FUTURE WORK

- Participants will further be recruited for this study in order to achieve more accurate results, and the data will be statistically analyzed.
- The results support the use of restraints to minimize CoP displacement for the control group in an upcoming randomized control trial investigating if the addition of VRT to a standard programme of inpatient rehabilitation improves sitting balance ability and function after stroke.

## REFERENCES

- <sup>1</sup>Sandin KJ, Smith BS. The measure of balance in sitting in stroke rehabilitation prognosis. Stroke 1990;21:82-6
- <sup>2</sup>Schneiberg S, McKinley PA, Sveistrup H et al. Dev Med Child Neurol 2010; 52(11):e245-e253

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