Rapid movement therapy to improve balance recovery in stroke survivors: a randomised controlled trial: abridged secondary publication

RKY Tong *, KCC Cheng, M Junata, HS Man

KEY MESSAGES

1. Both rapid movement therapy and conventional balance training improved overall balance performance and lower limb motor function among stroke survivors.

2. Rapid movement training provided better balance recovery reaction in terms of stepping displacement.

3. However, the effect was not sustained at the 3-month follow-up. Therefore, regular training may be needed to retain the effects for a better balance recovery reaction.

[1] RKY Tong, [2] KCC Cheng, [1] M Junata, [1] HS Man

The Chinese University of Hong Kong:
[1] *Department of Biomedical Engineering, Faculty of Engineering*
[2] *Department of Sports Science and Physical Education, Faculty of Education*

* Principal applicant and corresponding author: kytong@cuhk.edu.hk

Introduction

To prevent falling, it is important to train the ability to maintain or recover the balance.[1] The balance recovery reactions can be achieved by controlling the position and the motion of the centre of mass of the body over the base of the support such as stepping and/or reaching-to-grasp a nearby object to rapidly increase the size of the base of the support.[2] These reactions are found to be impaired in stroke patients.[3] The aim of this study is to train stroke survivors to improve their balance and balance recovery reaction using the Kinect-based rapid movement therapy. The platform provides real-time feedback to the patient, generates a report for healthcare professionals to monitor patient progress, and can be utilised in patient homes or community centres.

Methods

This was a double-blinded randomised controlled trial with 3-month follow-up. A total of 32 patients with chronic stroke were randomly assigned to either rapid movement therapy (RMT) [n=16] or conventional balance training (CBT) [n=16]. Both interventions comprised 20 sessions of 60 minutes of training per day twice a week for around 7 weeks. RMT involved training of the legs in seven directions and of the hands in four directions (Fig. 1).

Outcome measures were Activities Balance Confidence Scale, Activities of Daily Living Scale, Berg Balance Scale, Fugl-Meyer Assessment, and Timed Up and Go Test. Fall assessment involved 'lean-and-release' and included kinematic measures of movement onset time, movement completion time, mediolateral step displacement, anteroposterior step displacement, XY stepping displacement, and number of steps. Assessments were performed at baseline, end of the intervention, and 3 months after the intervention ended.

Results

Using intention-to-treat analysis and two-way repeated-measures ANOVA, both RMT and CBT improved overall balance performance (Berg Balance Scale) and lower limb motor function (Fugl-Meyer Assessment) among stroke survivors. Post-hoc analysis (univariate 2-way ANOVA) showed that RMT resulted in significantly better improvement in anteroposterior stepping displacement ($F_{(1.840, 44.172)}=3.551$, P=0.041) and XY stepping displacements ($F_{(1.812, 43.485)}=3.586$, P=0.040), compared with CBT. In addition, RMT resulted in significant improvement in both the range of motion and movement completion time (Fig. 2). Larger range of motion means that stroke survivors can reach and step further to recover their balance. Faster movement time means that stroke survivors
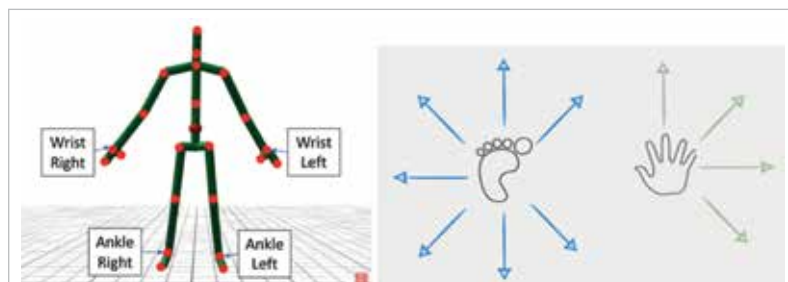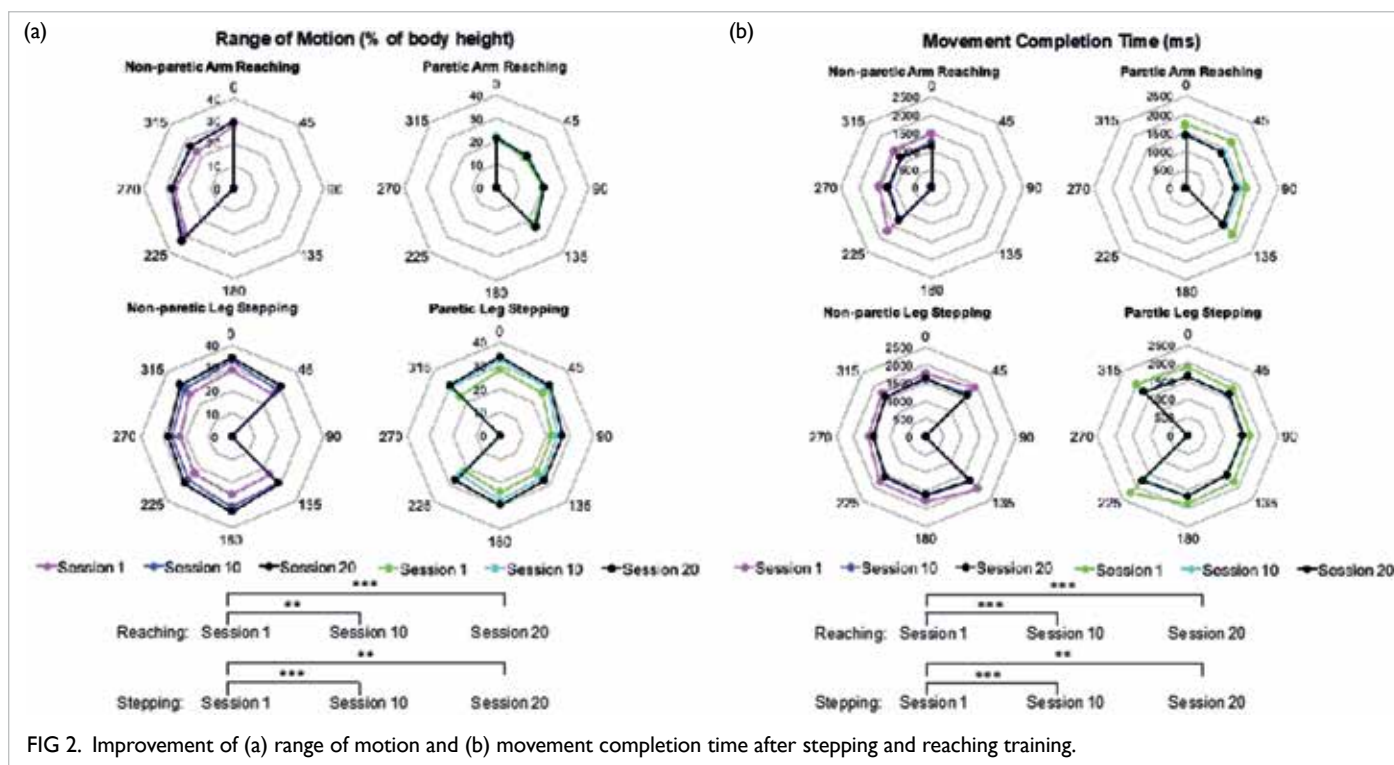

FIG 1. Microsoft Kinect skeleton tracking and the seven training directions for legs and four training directions for hands.

FIG 2. Improvement of (a) range of motion and (b) movement completion time after stepping and reaching training.

can complete the grasping and stepping balance reaction in a shorter time. However, the effect was not sustained at the 3-month follow-up. Therefore, regular RMT is needed to retain the effects for a better balance recovery reaction.

Conclusions

Both RMT and CBT improved overall balance performance and lower limb motor function among stroke survivors. RMT requires less manpower than CBT. RMT resulted in better balance recovery reaction in terms of anteroposterior and XY stepping displacement. However, the effect was not sustained at the 3-month follow-up. Therefore, regular RMT is needed to retain the effects for a better balance recovery reaction.

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Disclosure

The results of this research have been previously published in:
1. Junata M, Cheng KCC, Man HS, Wang X, Tong RKY. Development and evaluation of a Kinect-based rapid movement therapy training platform for balance rehabilitation. Annu Int Conf IEEE Eng Med Biol Soc 2018;2018:2345-8. doi: 10.1109/EMBC.2018.8512822

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