EFFECT OF BILATERAL REACHING ON AFFECTED ARM MOTOR CONTROL IN STROKE — WITH AND WITHOUT LOADING ON UNAFFECTED ARM

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INTRODUCTION

Bilateral movements are often used to facilitate symmetrical and smoother movements of the hemiparetic arm in stroke patients. Previous research has shown that bilateral movements with inertial loading on unaffected arm may increase interlimb coupling. The goal of this present study is to investigate the effect of bilateral reaching, with/without inertial loading on the unaffected arm, on hemiparetic arm motor control in stroke.

METHODS

Recruited were twenty unilateral stroke patients (17 males, 3 females), aged between 37 to 75 years (mean ± standard deviation, 56.00 ±10.54 years). All subjects scored at least 30 on the upper extremity subtest of the Fugl-Meyer Motor Function Assessment (total score: 66). Taking the difference of upper extremity function level into consideration, we spilt the subjects into two groups according to the score of FMA. Thirteen subjects in group 1 scored between 50 and 66, indicating a mild motor deficit, and seven subjects in group 2 scored between 30 and 49, indicating a moderate motor deficit. A three-dimensional kinematics analysis equipment (VisualeyezTM Hardware, Canada) was used to collect the movement trajectory data of the hemiparetic arm during performing the experimental tasks. Subjects were asked to perform four movement tasks as quickly as possible: (1) reaching forward with the affected limb only (Uni); (2) reaching forward with both limbs simultaneously (Bil); (3) reaching forward with both limbs while adding a load of 25% upper limb inertia to the unaffected limb (Bil+25%). Kinematic parameters were utilized to quantify the reaching performance of the affected arm.

RESULTS AND DISCUSSION

No matter if loading was applied on the unaffected arm, bilateral reaching task did not significantly facilitate smoother and faster movement. Furthermore, during bilateral reaching with loading on unaffected arm, stroke patients showed slower movement, smaller maximal movement velocity, and less smooth movement in affected arm than bilateral reaching without loading. The greatest proximal active upper extremity range of motion was found during bilateral reaching without unaffected arm loading. More trunk movement was adapted during bilateral reaching either with or without loading on unaffected arm. Patients with moderate upper extremity motor impairment level performed more discontinues and less active elbow range of motion than those with mild upper extremity motor impairment level during performing reaching tasks.

CONCLUSIONS

Bilateral reaching tasks with/without loading on unaffected arm could be considered as adding costs and challenges during motor control. Training with bilateral arm movements may be considered as a treatment strategy and can be incorporated in stroke rehabilitation to facilitate greater active movement and improve motor control performance in affected arm.

REFERENCES

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Table 1: Means and standard deviations for dependent variables calculated from the three movement tasks

	Mild Group (N=13)			Moderate Group (N=7)		
Task / Variables	Uni	Bil	Bil+25%	Uni	Bil	Bil+25%
MV(cm/s)	127.95±48.45	113.27±48.10	114.40±48.26	88.78±25.78	79.51±18.70	80.22±21.60
PRMVO (%)	41.20±5.81	38.40±7.87	39.30±7.60	45.84±15.41	39.14±8.81	34.59±8.91
MT(s)	0.66±0.33	0.77±0.43	0.74±0.39	0.92±0.27	0.97±0.26	0.74±0.39
NMU	1.05±0.18	1.05±0.18	1.03±0.09	1.62±1.11	2.10±0.90	2.00±0.94
NJSM	29.43±34.51	43.50±69.86	39.97±67.85	73.81±43.85	97.64±63.26	95.94±55.67
EFER(deg)	59.67±16.25	65.97±16.32	62.29±13.04	44.81±10.21	47.54±14.76	45.13±12.10
SFER(deg)	52.09±14.83	58.81±16.70	55.16±15.15	46.08±7.82	52.89±10.42	49.98±14.47
TLLV(cm)	2.33±1.55	3.77±2.64	3.58±2.45	4.20±1.70	4.16±1.53	5.29±3.14

MV: maximal velocity, PRMVO: percentage of reach where maximal velocity occurs, MT: movement time, NMU: number of movement units, NJSM: normalized jerk score of movements, EFER: elbow flexion-extension range, SFER: shoulder flexion-extension range, TLLV: trunk linear line value.