

Kinematic and Kinetic Analysis of Sit-to-Stand with and without a Cane in Hemiplegic Subjects

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INTRODUCTION

Sit-to-stand (STS) is a requisite activity for most daily activities. The incidence of fall in stroke patients usually occurs during postural transition, and the use of cane is suggested to increase the standing stability [1]. However, the influence of cane on STS has not been well studied yet. The purpose of this study was to determine the effect of cane support on the movement pattern of rising from a chair in hemiparetic patients and the healthy adults.

METHODS

This was a cross-sectional experimental design. The mild-moderate hemiplegic patients with cerebrovascular accident (CVA) were recruited. Nine hemiplegic patients (mean age: 61.00±13.51 years old; 4 left hemiparesis and 5 right hemiparesis) were chosen as the experimental group, and eleven healthy adults (61.45±12.14years) were the control group. Participants performed rising from a chair in two conditions: (1) arm hanging by sides (no cane; NC), and (2) supported on a regular cane (with cane; WC). The data of 3-dimensional motion analysis (Vicon 250, Oxford, USA) and force (AMTI, USA) were recorded. A symmetry index (SI) was calculated [2] by the differences between the vertical ground reaction forces of the right and left limb (i.e., $SI = (Fz_R - Fz_L) / (Fz_R + Fz_L) \times 2$).

RESULTS AND DISCUSSION

The movement time (MT) in CVA group was longer than normal controls ($p < 0.01$) during STS with and without a cane. Compared with no support, the maximal extension moments of affected knee in CVA patients during STS with a cane were significantly increased (Table 1). In addition, the maximal knee extension moments in the sound side of CVA patients were significantly greater than those of the dominant side of healthy adults ($p < 0.05$) during STS with no support, but no significant difference between 2 groups during STS with a

cane. There was a significant improvement in the symmetry of CVA subjects during STS with a cane, because SI decreased significantly from 31 % to 26 % (Figure 1).

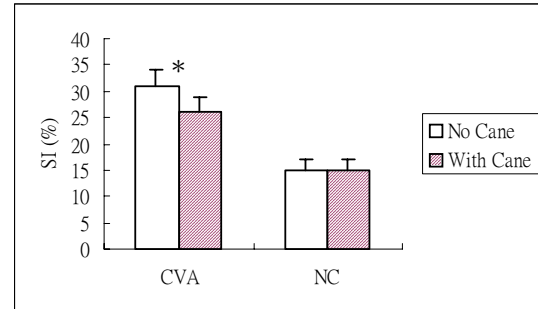


Figure 1. Symmetry index (SI) of stroke (CVA) and normal controls (NC) during sit-to-stand with and without a cane.

* $p < 0.05$.

CONCLUSIONS

Hemiplegic patients could exert more force on affected leg during STS with a cane comparing with STS without any support. Using a cane may increase the stability to use the affected side for hemiplegic patients, as well as to reduce the motion time and symmetry during sit-to-stand task [3]. The psychological effect of using a cane to hemiplegic patients needs further studied.

REFERENCES

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Table 1: Knee extension moment during sit-to-stand with and without a cane.

	CVA patients (n=9)		Normal Controls (n=11)	
	No Cane	With Cane	No Cane	With Cane
Sound (Dominant) side				
Knee extension moment (NT · M / Kg)	1.00 (0.26) *	0.92 (0.23)	0.86 (0.20)	0.89 (0.24)
Affected (Non-dominant) side				
Knee extension moment (NT · M / Kg)	0.56 (0.19)	0.80 (0.25) †	0.79 (0.27)	0.89 (0.24)

Data were Mean (SD). * Difference between CVA and normal control groups ($p < 0.05$).

† Difference between with and without a cane ($p < 0.05$).