

腦血管疾病病患與正常成人的視覺空間與動量表現分析及其於復健學上之 功能意義(2/2)

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主持人：林克忠 執行機構及單位名稱：國立臺灣大學職能治療學系

一、中文摘要

本計畫旨在探討上肢活動時內在（提供選擇所喜好的活動的機會）與外在（活動目標）情境因素對中風個案及正常人上肢動作的影響。

本研究樣本由二十七位單側腦中風個案組成。其中包括十二位左腦中風和十五位右腦中風病人。受測個案使用健側邊，在四種實驗情境下執行上肢功能性活動。四種測驗情況由功能性目標和個人偏好度兩變項交叉組合而構成。在高層級功能性目標的情況下，參與者啜飲一種飲料，低層級功能性目標僅將飲料拿至嘴邊而無實際飲用。個人偏好度的層級則由對飲料的喜好程度來決定。受測者從實驗者所提供的五種飲料中選取最喜歡與最不喜歡的兩種飲料來執行實驗狀況。研究對象的動作表現透過動作分析系統來測試。

研究結果顯示執行一個較喜歡且功能層級較高的活動能提昇中風病患的動作效率（反應時間或動作時間），此情境效應在併生忽略症的個案上較不明顯。

關鍵詞：偏癱，動作性活動，忽略症，復健

Abstract

Contemporary theories of motor control in rehabilitation focus on how the nervous system responds to many types of external and internal constraints to execute motor behavior for accomplishing a task. This study examined the impact of some aspects of internal (personal preference) and external constraints (functional goal) on motor performance in persons with stroke.

Twelve left cerebral vascular accident (LCVA) patients and 15 right cerebral

vascular accident (RCVA) patients used the uninvolved arm to perform an upper extremity reach task under four experimental conditions.

Four testing conditions were formed by the crossing of functional goals and personal preferences. Under the higher level of a functional goal, participants took a drink from a can of beverage. The lower level of a functional goal, participants involved bringing the beverage to the mouth without drinking. The level of personal preferences was determined by the degree of predilection for a beverage. The participant selected his or her most and least preferred beverages among five options for task performance.

The results show that performing a preferred task with a higher functional goal enhances motor performance in temporal aspect. This finding suggested that providing patients with choices for preferred activities and incorporates functional goal-directedness to therapeutic tasks enhance response rate or movement efficiency.

Keywords: hemiplegia, motor activity, neglect, rehabilitation

二、緣由與目的

Contemporary theories of motor control have focused on how the nervous system responds to various external and internal constraints to develop and execute motor behavior that is efficient to accomplish a task (Charlton, 1992; Newton, 1995). External constraints are the limitations or demands imposed by the environment and the task. Internal constraints arise from the actor's characteristics, being psychological, physiological, or biomechanical (Adam, 1992). The internal and external constraints do not stand alone to explain motor control in

the individual with neurological dysfunction. Rather, they interact and interrelate (Newton, 1995). Despite the emphasis of interplay between internal and external constraints to produce movements, the potential contributions of the systemic relation between these two categories of constraints in evaluation and intervention of clinical populations has been little studied (Dunn, Brown, & McGuigan, 1994). This study examined the impact of some aspects of internal and external constraints on motor performance in persons with cerebral vascular accident (CVA).

Among various types of external constraints, goals which represent what an individual attempts to achieve are proposed to be an important factor to affect movement performance (Jeannerod, 1994; Newell, 1986). Davis and Burton (1991) suggested that task goals interact with the environment surrounding the performer and the performer's attributes to determine the pattern of movement coordination. Reed (1982) further suggested that as the functional importance or the functional level of the task goal increases, the precision of performance or the performance of movements may enhance.

The present study examined the reaching performance using the task of drinking a can of beverage (the higher level of functional goal) and the task of bringing a can of beverage to the mouth without drinking it (the lower level of functional goal) in persons with stroke using the "unaffected" arm. The arm ipsilateral to a unilateral hemisphere stroke is often clinically described as being "unaffected," but substantial evidence indicates that ipsilateral function may be abnormal. Interventions that focus on specific motor control deficits through practice with the ipsilesional upper extremity may result in functional improvements in both limbs and test of the ipsilesional arm will help us obtain useful information for physical rehabilitation in patients with stroke.

A further aim of this study is to examine the effects of internal constraints on movement performance. Previous research

on internal constraints focused on the neurological or biomechanical factors of an individual. The psychological factors have yet to be investigated. The present study used computerized recordings such as kinematic analysis to investigate movement performance when the participant chooses the most preferred and least preferred beverage for performing the drinking task.

Movement kinematics describe the spatio-temporal characteristics of movement which are planned by the central nervous system (Geogopoulos, 1986). Such instrumental measures could minimize variation between examiners and participants, and add power to statistical comparisons by providing a degree of quantitative precision greater than that of rating scales. Measuring the kinematics of movement can detect whether the central nervous system organizes one movement differently from another (e.g., Mathiowetz, & Wade, 1995). Kinematic variables used to measure reaching movement in the present study include reaction time (RT), movement time (MT), total displacement (TD), the amplitude of peak velocity (PV), percentage of movement where peak velocity occurs (PPV), and the number of movement units (MU).

Study Hypothesis

The condition of higher functional goal with most preferred task object was hypothesized to elicit the best performance of movements and that of lower functional goal with least preferred task object the worst performance among the four conditions. The condition of higher functional goal with the least preferred object would lead to better performance relative to the condition of lower functional goal with most preferred target. The latter prediction was made based on the position that engagements in tasks directed to a goal of functional meaningfulness would considerably enhance task performance. Enhanced performance of movements would be evident on kinematic variables including shorter reaction time, shorter movement time, less total displacement, higher peak velocity, greater percentage of reach where peak velocity

occurs, and less movement units.

三、結果與討論

Table 1 shows the means and standard deviations associated with some of the dependent variables and experimental conditions by types of stroke patients.

The contrast analysis was performed based on the obtained omnibus F . Results of the contrast analysis testing the a priori hypotheses described earlier showed significant and large effects for reaction time and movement time for three types of stroke patients. Non-significant and small effects were found for the other dependent variables.

However, the means of reaction time and movement time for the four conditions, shown in table 1, were not fully congruent with the hypotheses. To search for a more robust theory, further exploratory analysis of the data was attempted. Table 2 summarizes the results of the post hoc contrast analysis. Large effects in favor of the new direction in the group of RCVA patients without neglect were found: for reaction time, focused $F(1, 12) = 4.43, r = .72$; for movement time, focused $F(1, 12) = 5.72, r = .77$. Results for the group of RCVA with neglect showed large effects for reaction time, focused $F(1, 9) = 5.38, r = .80$; and movement time, focused $F(1, 9) = 8.18, r = .86$. Results for the group of LCVA patients are as follows: reaction time, focused $F(1, 24) = 7.26, r = .69$; and movement time, focused $F(1, 24) = 6.90, r = .68$.

This study supports the idea that the external and internal constraints play a role in movement planning and production. It shows that functional goal and personal preference have an impact on the temporal aspects of movement output. These findings suggested that subtle changes in instructions relevant to functionality of task goal and preference of the task object can lead to very different results related to reaction time and movement time.

For the groups of RCVA patients without neglect and LCVA patients, the condition of providing a preferred task with functional goal facilitated more efficient movement than

the other conditions, as shown by MT . A functional task perceived as familiar might evoke efficient completion of the task movement, which can not be achieved when the goal was less functional. The conditions of higher functional goal with least preferred task and lower functional goal with most preferred task yielded the same movement time, suggesting that functionality and preference of task play equal roles in temporal control of movement. Reversed trends were found in the variable of reaction time. It seems that there is reaction time-movement time trade off when the tasks to be performed keep similar.

For the RCVA patients with neglect, the task with higher functional goal and most preferred target elicited the least reaction time and that with lower functional goal and least preferred target the most RT among four conditions. Neglect patients were defined as failure to oriented to stimuli presented to the side opposite to a brain lesion. Although the target was presented at the midline of the participant in this study, patients with neglect may be still difficult in attending to the target, which lead to slow initiation of movement. Functional goal and preferred task may provide strong motivation to attend the task, and, therefore, lead to shorter reaction time.

四、計畫結果自評

This study revealed the differential improvement in temporal control of reaching of various subtypes of stroke patients. The implication of this study for stroke rehabilitation is enormous. Similar treatment strategies may have different impacts on stroke patients with different symptoms. One of the undesirable characteristics of neglect patients, difficulty initiating a movement, may be reduced by use of functional goal and preferred task. In contrast, the application of functional goal and preferred task in LCVA patients and RCVA patients without neglect cannot reduce response time. Rather, they may facilitate the movement efficiency in terms of shortening time for execution.

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Table 1. Means and standard deviations for the kinematic variables for each condition for patients with RCVA without neglect, RCVA with neglect, and LCVA

Kinematic variables/ conditions	Mean (standard deviation)		
	RCVA without neglect	RCVA with neglect	LCVA
Reaction time			
Condition A	0.683 (0.14)	0.564 (0.16)	0.776 (0.18)
Condition B	0.550 (0.15)	0.654 (0.17)	0.654 (0.14)
Condition C	0.587 (0.072)	0.595 (0.18)	0.657 (0.17)
Condition D	0.522 (0.12)	0.714 (0.17)	0.645 (0.17)
Movement time			
Condition A	1.511 (0.47)	1.885 (0.72)	1.295 (0.40)
Condition B	1.623 (0.36)	1.825 (0.60)	1.351 (0.37)
Condition C	1.592 (0.39)	1.686 (0.65)	1.368 (0.36)
Condition D	1.767 (0.42)	1.534 (0.46)	1.620 (0.51)

Table 2. Results of post hoc contrast analysis

Kinematic variables/ types of stroke group	Post hoc hypotheses	Effect size <i>r</i>
RCVA without neglect		
Reaction time	A>B=C>D	.72
Movement time	A<B=C<D	.77
RCVA with neglect		
Reaction time	A<B=C<D	.80
Movement time	A>B=C>D	.86
LCVA		
Reaction time	A>B=C>D	.69
Movement time	A<B=C<D	.68