International Bobath Instructors Training Association

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I B I T A

FROM THE EDUCATION COMMITTEE – June 2008

RECENT ARTICLES OF INTEREST

1: Brain. 2007 Jan;130(Pt 1):159-69. Epub 2006 Oct 3.

Exaggerated interlimb neural coupling following stroke.

Kline TL, **Schmit BD**, **Kamper DG**.

Neuromechanics Laboratory, Marquette University, Milwaukee, WI, USA.

The patterns of interlimb coupling were examined in 10 stroke survivors with chronic hand impairment. In particular, the potential roles of postural state and motor tasks in promoting the flexed posture of the upper extremity were assessed. Through the use of electromyography analysis, joint angle measurements and a novel biomechanical apparatus to perturb the digits of the hand into extension, measurements of muscle activity and joint position were compared during multiple postural states, locomotion and voluntary muscle activity. The results demonstrated a significant increase in flexion of the digits ($P < 0.001$) and elbow ($P < 0.005$), during walking as compared with standing, sitting or laying supine. These results were indicative of an overall excessive activation coupling between the upper and lower extremities after stroke. Indeed both voluntary finger flexion and voluntary leg extension produced significant activity in the other impaired extremity, leg and arm, respectively, in the stroke as compared with the control subjects. Thus, rectus femoris in the impaired leg was active during finger flexion of the impaired hand in the stroke survivors and all four tested muscles in the impaired arm were active during extension of the legs ($P < 0.05$). These findings suggest an interlimb coupling related to active motor tasks, contributing to an upper extremity flexion bias following stroke.

PMID: 17018550 [PubMed - indexed for MEDLINE]

Comments

This study explores the possibility of enhanced coupling between the upper and lower extremities in individuals following stroke resulting in exaggerated upper limb flexion. They to acknowledge the role of increased excitability of the vestibulospinal pathways contributing to upper limb flexion but discuss the additional possibility of exaggerated interlimb coupling.

The subject matter of this study is particularly interesting for the Bobath therapist but the overall study was difficult to follow introducing different elements without clearly describing the reasoning behind them. Despite this, the study does explore the influence of dynamic tasks on interlimb coupling and presents a reasonable discussion at the end with clinical implications. Limitations of the study were not discussed.

This was a small study of 10 individuals with chronic unilateral motor deficits following stroke. They were all at least 1 year post stroke with a mean age of 64+/- 12 years. There hand function was characterised by stages 2-5 of the hand section of the Chedoke-McMaster Stroke Assessment scale. All subjects were described as having some finger flexor activity but none had individual movement of the digits. An assessment of non-neural versus neural components of the upper limb flexion was not discussed.
Clearly all the neurologically impaired individuals were able to walk although a harness was used for safety during the treadmill walking and a hand rail was used on the non-impaired side. There was no discussion regarding the selection procedure for the subjects in this study.

There were 2 parts to the study. The first explored the influence of 3 different postures (lying, sitting and standing) and 3 different tasks (treadmill walking, finger flexion and leg extension) on the joint range

of the upper extremity digits and elbow of the impaired arm and muscle activity in both arms and legs. The second part of the study explored sustained contractions of the upper and lower limbs in sitting.

There was no discussion relating to why the above elements were being tested.
An additional element to the study involved the patient wearing a pneumatic glove over a wrist splint to test the effect of finger stretch and finger joint angle on the flexion bias of the upper extremity during the different tasks involved in the study.

5 neurologically intact individuals were involved in the first part of the study and 10 in the second. These were not described as being matched to the neurologically impaired subjects.

Measurements of joint angles were taken using goniometers and electrogoniometers. A glove was used to mount the electrogoniometers in order to measure hand posture.

Muscle activity was recorded using surface EMG electrodes. The choice of muscles measured was not discussed.

Data processing was carried out using custom programmes and statistical analysis was completed using SPSS.

The results highlighted that static postures did not demonstrate an immediate affect on flexion of the digits whereas during locomotion and volitional leg extension there was increased flexion of the impaired upper extremity. There was a discussion relating to the vestibulospinal systems contribution (or lack of it) in the static postures but not the dynamic postures, which was interesting.
Interaction between upper and lower extremity muscles was observed during voluntary contractions, which was not seen in the control subjects. This was postulated to be as a result of disinhibition of the pontine reticular formation due to damage of the corticoreticulospinal tract. The authors also suggested that this could have an influence on the propriospinal pathways which could result in functional grouping of muscle activity into synergy patterns within the arms and legs.

2. Neurorehabil Neural Repair. 2007 Sep-Oct;21(5):388-97. Epub 2007 Mar

Targeted aiming movements are compromised in nonaffected limb of persons with stroke.

Ketcham CJ, **Rodriguez TM**, **Zihlman KA**.

Motor Control Laboratory, Department of Health and Kinesiology, Texas A&M University, College Station, 77843-4243, USA. ketcham@hlkn.tamu.edu

BACKGROUND: Research has shown that movement impairments following stroke are typically associated with the limb contralateral to the side of the stroke. Prior studies identified ipsilateral motor declines across a variety of tasks. OBJECTIVE: Two experiments were conducted to better understand the ipsilateral contributions to organization and execution of proximal upper extremity multisegment aiming movements in persons with right-hemispheric stroke. METHODS: Participants performed reciprocal aiming (Experiment 1) and 2-segment aiming movements (Experiment 2) on a digitizing tablet. In both experiments, target size and/or target orientation were manipulated to examine the influence of accuracy constraints on the planning and organization of movements. RESULTS: Kinematic measures, submovement analysis, and harmonicity measures were included in this study. Declines in organization and execution of multisegment movements were found to contribute to performance decrements and slowing in stroke patients. Furthermore, stroke patients were unable to efficiently plan multisegment movements as one functional unit, resulting in discrete movements. CONCLUSIONS: Results suggest the importance of considering ipsilateral contributions to the control and organization of targeted aiming movements as well as implications for rehabilitation and recovery.

PMID: 17369510 [PubMed - indexed for MEDLINE]

Comments

This was an interesting and well designed study exploring potential movement impairments in the ipsilateral upper limb of individuals with right hemispheric strokes. Although the study was small, involving 6 stroke subjects and 6 age matched controls, it was well written, easy to follow and came

up with some interesting results which could be clinically useful. The limitations of the study were also discussed along with the potential clinical relevance.

Individuals with right hemisphere strokes were chosen as these types of impairments are suggested as being less clear, but having a role during rapid online processing of visual information when precision demands are high.

The researchers specifically wanted to determine the organisation and execution of both continuous and discrete aiming movements in the dominant ipsilesional arm of stroke patients. They also wanted to determine whether changes in task complexity lead to greater decrements.

There were 2 experiments described in this study. The first looked at reciprocal aiming movements and the second 2-segment aiming movements. Each experiment was performed on a Wacom Graphire 3 digitizing tablet which is a movement analysis program designed to measure and analyse fine motor movements. The subjects sat in a chair holding a stylus in the right hand with the digitizing tablet located on the tabletop.

Experiment 1 (reciprocal aiming movement) identified that stroke patients were slower with less distance travelled in the ballistic phase of movement when accuracy demands were high. Stroke patients performed discrete movements regardless of target size, whereas controls produced more continuous movements to large targets and discrete movements to small targets. It was suggested that controls planned movements to large targets as one chunk, whereas stroke patients primarily planned discrete movements.

Experiment 2 (2 segment aiming movements) identified that stroke patients had longer movement times and lower peak velocities. It was also found that stroke patients travelled less distance in the primary sub movement regardless of accuracy demands. They were also unable to plan movements as a single chunk. It was suggested that they used more online sensory feedback control.

In both experiments the decrement in movement control occurred at the final stages as they approached the target with less distance travelled in the primary sub movement. The researchers suggest that the stroke patients had trouble with the accurate execution of a planned movement, not specifically in the initial planning. They suggest that these changes were due to decrements in the ability to modulate accurate forces and efficiently utilise online sensory feedback control. They also suggest that the upper extremity movements are more greatly affected in the closed loop phase of right hemispheric stroke patients.

3. Neurorehabil Neural Repair. 2007 Sep-Oct;21(5):398-411. Epub 2007 Mar

Improvement of arm movement patterns and endpoint control depends on type of feedback during practice in stroke survivors.

Cirstea MC, **Levin MF**.

Department of Physiology, Faculty of Medicine, University of Montreal, Montreal, Quebec, Canada.

BACKGROUND: A major challenge in stroke rehabilitation is restoration of arm motor function. Therapy-induced improvements in arm function may occur via restoration of premorbid movement patterns (recovery) or development of compensatory movement strategies. However, it is unclear whether the learning benefits of practice might be enhanced by incorporating different forms of feedback, focusing on movement outcomes or on specific arm movement patterns. OBJECTIVE: To determine if manipulation of attentional focus by providing either knowledge of results (KR) feedback, focusing on movement outcomes, or knowledge of performance (KP) feedback, focusing on arm movement patterns during repetitive practice of a pointing movement, may lead to arm motor recovery. METHODS: Twenty-eight chronic stroke survivors were randomly assigned to 2 groups that practiced 10 sessions of 75 pointing movements. During practice, groups received either 20% KR about movement precision or faded (26.6% average) KP about arm joint movements. A nondisabled control group (n = 5) practiced the same task with KR. RESULTS: Motor patterns recovered only in KP, as evidenced by immediate and long-term increases in joint range, better interjoint coordination in early movement phases, and generalization of gains. Improvements in clinical impairment and function were related to decreases in compensation (trunk rotation) and recovery of interjoint coordination in mid-movement phases.

CONCLUSIONS: In stroke survivors, when the learners' attention was directed to the movements themselves (KP), motor improvements reflect recovery compared to when attention was directed toward movement outcomes (KR).

PMID: 17369514 [PubMed - indexed for MEDLINE]

Comments

This study focused on an important issue relating to feedback in upper limb recovery following stroke. It is particularly pertinent to the Bobath concept and draws some interesting and important conclusions. The researchers highlight the importance of quantity and task specificity of practice in upper limb rehabilitation but identify that defining and assessing movement recovery is ambiguous. They state that movement performance outcome has been measured but not the quality of movement performance. In the introduction there is an interesting discussion relating to recovery and compensatory strategies. They state that although compensatory movements may help in the short term they may cause problems in the longer term.
They go on to say that rehabilitation interventions should specifically address the individual's impairments, be sufficiently difficult to challenge the motor system, and should incorporate strategies to enhance transfer of performance gains from the training situation to everyday life.
The hypothesis for this study was clearly stated.
28 stroke patients were used in this experiment. They were matched for age, stroke severity and length of time since stroke and then randomly assigned to 2 groups.
Each group participated in 10 daily interventions (I hour/session) for 2 weeks.
The intervention consisted of repetition of a pointing movement with the impaired (dominant) arm to a target located in the contralateral workspace. Movements were made without vision to minimise visually guided corrections. One group received terminal visual knowledge of results feedback. The other group received concurrent verbal knowledge of performance feedback about movement precision.

The selection criteria for the participants was clearly identified.
Assessors were blinded to group assignment. They used the Fugl-Meyer scale and the composite spasticity index to measure motor impairment and the TEMPA test to assess the functional level of the impaired arm. These were all described in the study.
Kinematic analysis was carried out using a 3-D optical tracking system.
3 major movement variables were analyzed: angular motions, interjoint coordination and trunk recruitment.
The statistical analysis was clearly described.
The main inding of the study was that knowledge of performance may affect true motor recovery measured at a behavioural (quality of movement) level, even in the chronic phase of stroke. This group also demonstrated transfer of motor gains to a novel test situation. The gains persisted for 1 month following the intervention. There were also some improvements seen in the knowledge of results group 1 month later but they were less than those seen in the other group.
The researchers suggest that treatment of stroke survivors should emphasize lost movement patterns before practice based on end effector movement is done. The researchers develop a sound in depth discussion