

A DEVELOPMENTAL STUDY OF BILATERAL DEFICIT OF HAND GRIP REACTION TIME IN CHILDREN

Reiko Sasaki

Institute of Physical Education, Keio University, Yokohama, Japan
sasaki@hc.cc.keio.ac.jp

INTRODUCTION

The bilateral deficit has been defined as the reduction in force that accompanies maximal two limb efforts of the homologous limbs relative to single performance. Reaction time is known to be longer for simultaneous bilateral responses than for unilateral ones. This phenomenon is also called bilateral deficit in movement speed. It has been mediated by neural mechanisms such as interactions between the cerebral hemisphere or spinal reflexes. However, the underlying mechanism is still for from clear. The purpose of this study was to confirm those phenomena in children whose nervous system was not yet completely matured, and to clarify the developmental characteristics of those movements.

METHODS

Children aged 5 to 10 participated as subjects, and compared with adult subjects aged 18 to 22. All the subjects were right-handedness. They performed simple reaction time tasks of grasping a grip bar after an auditory stimulus. They carried out the tasks under three conditions: with the right hand (dominant); with left hand (non-dominant); and with both hands simultaneously. Each task involved over 20 trials. The time differences between grip force onset and indication of auditory stimuli (reaction time; RT) were measured. Furthermore, the grip force was measured during the tasks (Figure 1). The variables under three conditions, unilateral-right, unilateral-left, and bilateral simultaneously, were analysed statistically.

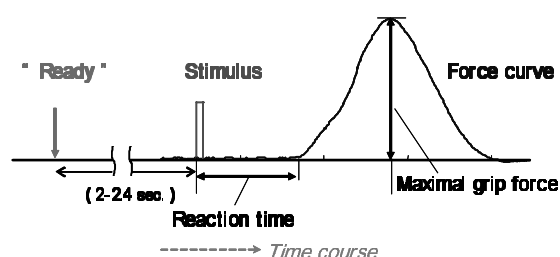


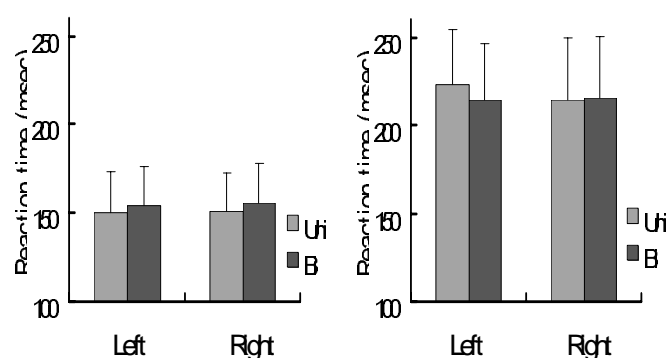
Figure 1: Experimental layout

RESULTS AND DISCUSSION

Whether left or right, the reaction time of the children was significantly slower than that of the adults under both unilateral and simultaneous bilateral response conditions. In the adult subjects, when comparing the simultaneous bilateral and unilateral reaction times, the bilateral response tended to be longer than the unilateral (right; a 3.7 % increase, left; a 2.5 % increase) (Figure 2: left). This

tendency was clearly observed for the right (dominant) hand. However, the differences were not statistically significant. However, bilateral deficit was not necessarily observed in the children as adult subjects. It was rather facilitated for bilateral simultaneous responses. Mean reaction time unilateral-bilateral difference was 1 msec for the right hand, corresponding to a 0.5 % increase, and 8.6 msec for the left hand, corresponding to a 3.9 % decrease (Figure 2: right). There may be a lateral difference, e.g. bilateral deficit was observed in the right hand, and bilateral facilitation in the left.

In previous research, it has been reported that simultaneous bilateral reaction time was longer than for unilateral movement (Di Stefaro, et al, 1980, Taniguchi, 1999). This phenomenon, called bilateral deficit in movement speed, has been mediated by neural mechanisms such as interactions between the cerebral hemisphere or spinal reflexes as for bilateral deficit in strength (Ohtsuki, 1994). However, those results in this study indicated different tendencies in children



from those researches. It is assumed that different mechanisms may operate for that fast bilateral movements in children.

Figure 2: Overall mean hand grip reaction time of adults (left side) and children (right side). Uni: unilateral, Bi: bilateral simultaneous

REFERENCES

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