ROLE OF CUTANEOUS AFFERENTS IN THE CONTROL OF FINE MOVEMENTS

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Abstract

An increase in the quantity of afferents has been observed to be less useful to normal individual, therefore to patients suffering from neurological problems. To determine the effect of reduction of cutaneous afferents in the control of fine movements.Sixty healthy individuals, age between 20 and 25 years, were randomized into 2 groups.Main outcome measures: The speed of movements was measured with a specific device constructed specially to this study, related to digital chronometer that detects 1/100 of the second. T-test was performed for outcome measure and to evaluate individual difference within groups in the presence of significance. The position at the edge of the support show an increase in the speed of the fine movement by 82% than the position completely on the support.

Keywords: Cutaneous Afferents, fine movements

Introduction

Concentration and mental focalization permit to filtrate the huge sensory activity and open widely the access to the mental field of one unique sensation.Many authors talked about the importance of cutaneous afferent in the control of fine movement.Recent experiment were done on healthy individual compare to pathologic cases, results show that somato-proprioception may have effect in the control of movement.Visual target remains the best choice to study the mechanism of coordination and guidance of movement. Time of reaction is an important measure for the speed of treatment of the information.The variations of the quantity of cutaneous afferents induce a variation in the control of finesse movement in two different positions.

Material and methods

Experiment was done on healthy individuals, which permit more to understand the organization of problems and the analysis of sensorial input in pathological cases. It is very difficult to find a homogenous group of individuals, especially in neurological cases.

60 males, age between 20 year and 25 year and of body mass index between 17 and 27 submit to this experiment at the same experimental conditions. They undergo the same movement in 2 different positions where the quantity of cutaneous afferent only changes but the positions of reference does not change. Conditions of the experiment: Positions of the subjects:Position 1: Sitting in a chair, thigh totally touched the surface of the chair, knee flexed 90 degree, trunk redressed, elbow flexed 90 degree, forearm reposed.Position 2: sitting in a chair, thigh partially touched the edge of the chair, knee flexed 90 degree, trunk redressed, elbow flexed 90 degree, forearm reposed.

Position 1

Position 2

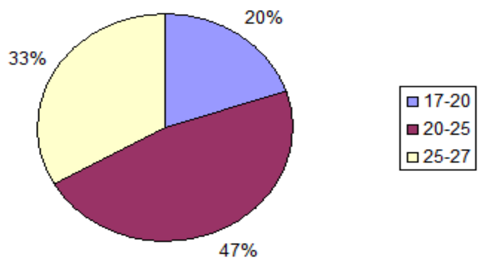
Tools: Digital chronometer (Seiko) that measure a fraction of 1/100 of the second.Special devices produced to measure the speed of movement.

Application:

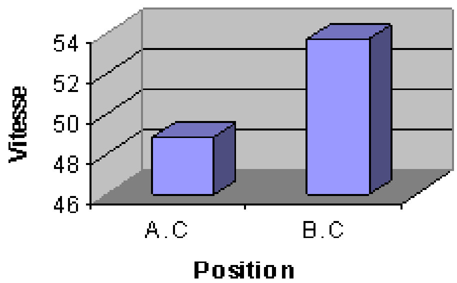
Starting **Ending**

Speed of movement is calculated by the ratio of distance in cm over the time in seconds.

Statistical results: Repartition of subject according to body mass index. (kg/m²)



- Variation of the means: speed of movement (cm/s).



- Statistic tests:

T- test	T	P
Between mean during sitting totally touched and sitting at the edge of the table.	**0.52**	**0,00**

Discussion

The results show that the speed of movement in 82 % of subject sited on the edge of the chair is better than sited in fully contact on chair.These results are not so far from those of Jacque Larue who totally deprives the subject from cutaneous afferents, while we reduce them.

Conclusion

The reduction of 80% of cutaneous afferents from posterior side of the thigh leads to better results in the control of finesse movement.Rehabilitation of neurological cases will get better results when we reduce the quantity of cutaneous afferents.

References:

Larue J, Bard C, Fleury M, Teasdale N, Paillard J(1992). Rôle des afférences proprioceptives et cutanées dans le contrôle des mouvements de pointage en amplitude. *In :* M Laurent, J-F Marini, R Pfister et Therme, Recherches en A.P.S. 3. Paris. Actio. Université Aix-Marseille II (UFR STAPS). 101-109.

Mouchnino, L., Aurenty, R., Massion, J., & Pedotti, A. (1992). Coordination between equilibrium and head-trunk orientation during leg movement. a new strategie built up by training. Journal of Neurophysiology, vol. 67. n° 6: 1587-1597.

Forget, R., and Lamarre, Y. (1987). Rapid elbow flexion in the absence of proprioceptive and cutaneous feedback. Hum. Neurobiol. n°6: 27-37.

Bossom, J. (1974). Movement without proprioception. Brain Research, *71*, 285-296.

Jeannerod, M., Michel, P., & Prablanc, C. (1984). The control of hand movements in a case of hemianaesthesia following a parietal lesion. *Brain, 107,* 899-920.

Forget, R., & Lamarre, Y. (1987). Rapid arm flexion in the absence of proprioceptive and cutaneous feedback. *Human Neurobiology, 6,* 27-37.

Straube A., Botzel K., Hawken M. Paulus W. Brandt T.(1988). Postural control in the ederly. differential effect of visual, vestibular and somatosensory inputs. In : Posture and gait : development, adaptation and modulation. B. Amblard, A. Berthoz and F. Clarac Eds, Elsevier, 105-114.

Bonan I, Yelnik A., Laffont I., Vitte E. et Freyss G. (1996). Sélection des afférences sensorielles dans l'équilibration de l'hémiplégique après accident vasculaire cérébral. Ann. Réadaptation Méd. Phys. 39, 157-163.

Forget, R. (1986). Pertes des afférences sensorielle et fonction motrice chez l'homme. Thèse de doctorat. Université de Montréal, pp.172.

Gandevia, S.C., & McCloskey, D.I. (1976). Joint sense, muscle sense, and their combination as position sense, measured at the distal interphalangeal joint of the middle finger. Journal of Physiology, 26O, 387-407.

Redon, C., Hay, L. & Velay, J.-L. (1991). Proprioceptive control of goal-directed movements in man, studied by means of vibratory muscle tendon stimulation. *Journal of Motor Behavior, 23,* 101-108.

Roll, J.P., Vedel, J.P., & Ribot, E. (1989). Alteration of proprioceptive messages induced by tendon vibration in man: A microneurographic study. *Experimental Brain Research, 76,* 213-222.

Meyer, D.E., Abrams, R.A., Kornblum, S., Wright. (1988). Optimality in human motor performance: Ideal control of rapid aimed movements. *Psychological Review, 95,* 340-370.

Gandevia S. C., Et Burke D. (1992). Does the nervous system depend on knesthetic information to control natural limb movements?, Behai,ioral and Brain Sciences, 15, 614-632.

Grossman G. Leigh R. Abel L. (1989). Frequency and velocity of rotational head perturbations during locomotion. Exp. Brain Res. 70: 470-476.

Paillard J. (1991). Motor and representational framing of space. In: Brain and Space, J. Paillard (ed). Oxford University Press, Oxford. Pp 163-182.

Schmidt k. m. (eds), Motor behavior : Progratw ming, control, and acquisition, Berlin, Springer-Verlag. SCHMIDT R. A. (1975), A schema theory of discrete motor skill leaming, Psychological Review, 86, 225-260.

Mesure S. les theories de l'apprentissage moteur.

Adams, J.A. (1977). Feedback theory of how joint receptors regulate the timing and positioning of a limb. Psychol. Rev. 84 (6): 504-523.

Debu Betina. (2004). Theories de l'apprentissage et processus mnésiques. Université Joseph fourier. 25-29.

Dizio P, Lackner Jr (1995). Motor adaptation to Coriolis force perturbations of reaching movements: endpoint but not trajectory adaptation transfers to the nonexposed arm. J Neurophysiol 74: 1787-1792.

Paillard J. (1986), Itinéraire pour une psychop&vsiologie de l'action, Paris, Editions Actio.

Schmidt, R.A., Zelaznik, H., Hawkins, B., Franks, J.S., & Quinn, J.T., Jr. (1990). motor-output variability : A theory for the accuracy of rapid motor acts. *Psychological Review, 86,* 415-451.

Jami L. 2000 - Les organes tendineux de golgi sont-ils des capteurs de force ? In Pied équilibre et mouvement. coordination Ph Villeneuve et Weber B. Masson 7-13.