

EVALUATION OF FUNCTION OF KNEE JOINT BY PHYSIOLOGICAL TREMOR IN LOWER LEG

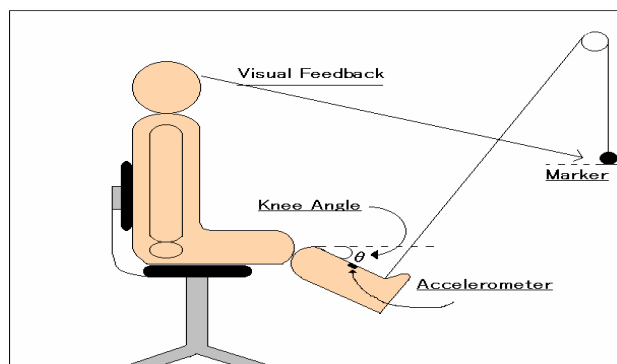
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INTRODUCTION

Physiological tremor is invisible mechanical vibration of body part. Finger and upper limb have been studied, but the other body parts like lower limb has not reported. The purpose of the study is to elucidate the function no knee joint by physiological tremor under various conditions.

METHODS

Measurement system of physiological tremor of lower leg is shown in Fig.1. The knee angle θ was hold by gazing on the marker connected to ankle with string. The ankle was fixed with use of equipment fastened the ankle (AFO). Tremor was detected by accelerometer (9G111BW, NEC Sanei) glued with both sides adhesive tape on the middle point between knee joint and ankle joint. Tremor was evaluated by total of power spectrum (TP) in frequency range from 0.5 to 50 Hz. The frequency range also divided into two frequency bands, lower band of 0.5 to 5 Hz and higher band of 5 to 50 Hz. The former and the latter showed reflex nervous component and central nervous component, respectively [1, 2]. Three kinds of experiments were performed: (1) Experiment of holding posture of lower leg in knee angle from 10 to 90 degrees, (2) Experiment of weight load of 5% to 40% MVC (Maximum Voluntary Contraction). (3) Experiment of muscular fatigue. The measurement time was 35 seconds for all the experiments. The subjects were ten aged 21 to 24 years old.



RESULTS AND DISCUSSION

Results of (1) experiment of holding posture were presented in Fig. 2. The amplitude of the tremor shown in total power increased linearly as the knee angle θ decreased and the change in lower band was larger than the higher one, but the peak frequencies for various angle remained constant. The function of reflex component was dominant in holding posture. The results of (2) experiment under weight load revealed the contribution of higher band when weight load was more than 20 % MVC. The peak frequency decreased significantly at the load more than 20% MVC. The results meant that the central nervous

component predominated under higher load. The results of (3) are shown in Fig.3. The relative total powers in both frequency bands after all out increased significantly compared with the value before the load. And the value of higher band was significantly larger than that of lower band. Just after the all-out state, the tremor holding posture was controlled by higher band component. The result revealed that the fatigue of central nervous was recognized predominantly.

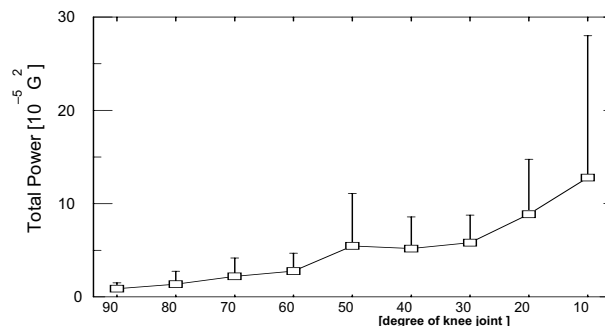


Figure 2: Total power (TP) in full frequency band (0-50Hz) for knee joint angle θ .

CONCLUSIONS

Characteristics of tremor of lower leg under the conditions of knee angle and weight load were obtained. Fatigue of knee joint was evaluated by the total power of the tremor. It was recognized that these results could be applied to the function of knee joint for disease person of knee joint as compared with the fundamental data evaluated in the study.

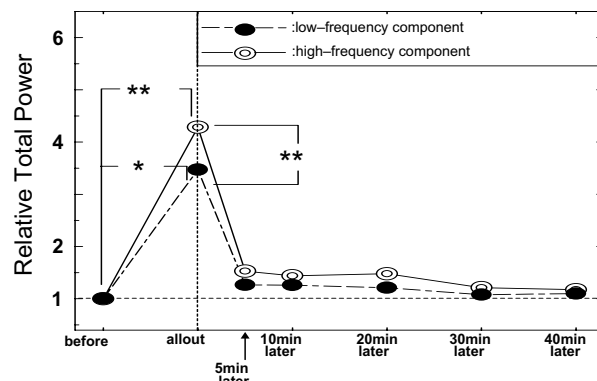


Figure 3: Total power in lower frequency and higher frequency bands before load, at all-out, and after load

REFERENCES

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2. Takanokura M, et al. *Electro. Clin. Neurophysiol.* **14**, 297-304, 2001.