# INFLUENCE OF HARDNESS OF BED ON HIP JOINT WITH USE OF TRUNK TREMOR

[1]Maya Kawabata, [1]Kazuyuki Mito, [2]Hitoshi Makabe, 3Byung- Chan Min, [4]Kenichi Kaneko, [1]Kazuyoshi Sakamoto
[1]The University of Electro-Communications, Japan, [2]Yamagata Prefectural University of Health and Science, Japan,
[3]Hanbat National University, Korea, [4]Fuji University, Japan; [1]email:sakamoto@se.uec.ac.jp

## INTRODUCTION

Researches of tremor, which is invisible mechanical vibration of body parts, have been published for finger and upper limb. The mechanism of tremor was resolved that the generation was caused by both central nervous and reflex nervous systems [1,2]. The study for trunk, however, has not been reported. Therefore, in the study, the function of hip joint was evaluated by trunk tremor after sleep with use of beds with different hardness.

## METHODS

In the first place, the characteristics of trunk tremor by the change of bend angle of trunk were measured as fundamental data. In the next place, the influence of sleep on the trunk tremor was researched with different kinds of bed.

Subject slept for eight hours (night sleep) and 90 minutes (day sleep). The former sleep started at 0:00 and latter sleep started from 13:00. The day sleep period was adopted due to one cycle of sleep period. Subject used two kinds of bed, that is, soft and hard beds which rate of the hardness of beds was 1.35. The soft bed made of material with low elasticity, while the hard bed was on the market. Tremor of trunk under the bent posture was measured before and after the sleep.

Measurement system for trunk tremor is shown in Fig.1. Subject gazed a target point P to hold a bent angle $\theta$ chosen in the experimental protocol, in which the bent angles were taken to be 0, 20, 40, and 60 degrees. Tremor was detected by accelerometer (9G111BW, NEC Sanei) glued with both sides adhesive tape on upper part of the back around vertebra thoracica I. The resultant raw wave was sampled by 100Hz, transformed by AD converter, and stored to computer. The power spectrum was obtained by FFT (Fast Fourier Transform). The tremor was evaluated by total of power spectra (TP) in frequency range from 2.5 to 40 Hz. The frequency range was also divided into two frequency bands, i.e., lower band of 2.5 to 6 Hz and higher band of 6 to 40 Hz. The former and the latter bands showed the reflex nervous component and the central nervous component, respectively [1,2]. The subjects were ten aged 21 to 64 years old.

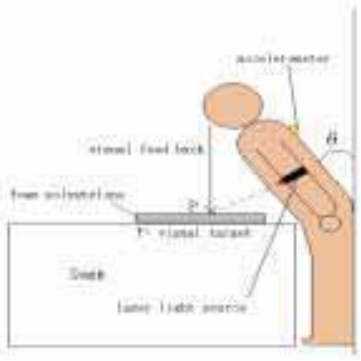

**Figure 1:** Experimental system for measurement of trunk tremor.

## RESULTS AND DISCUSSION

The total power for the change of bent angle was evaluated, since larger angle gave larger load to hip joint for the maintenance of posture. The results showed that larger bent angle was charged, the larger total power was obtained. The tendency was obtained remarkably for the lower frequency band (2.5 to 6 Hz). Namely, the reflex nervous contributed predominantly for the hold of bend posture.

The influence of day sleep for two kinds of beds on the total power of tremor was not recognized significantly, but the influence of the night sleep was recognizeed significantly for the bent angles of 40 and 60 degrees as shown in Fig.2. The sleep with soft bed denoted lower amplitude of tremor as compared the sleep with hard bed. Especially, the bent angle 60 for soft bed showed the value less than unity. The case meant the amplitude of trunk tremor after sleep decreased as compared with the value before sleep. Analyzing the influence of trunk tremor due to sleep, the function of hip joint could be revealed.

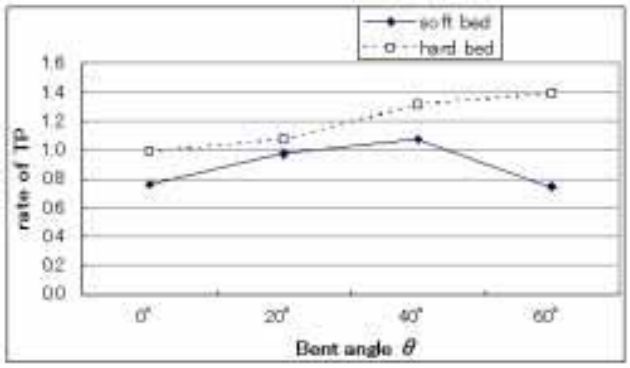


**Figure 2:** Rate of total power (TP) after night sleep based on TP before the sleep with sue of soft and hard beds for bent angle $\theta$. Unity of the rate value denotes the value before sleep

## CONCLUSIONS

Characteristics of tremor in bent posture for normal subjects were elucidated. The results could be applied to evaluate the degree of hip disorder. The influence of night sleep with beds of different materials due to trunk tremor was recognized, so the relax of muscles for hip joint could be evaluated with use of trunk tremor

## REFERENCES

1. .Miao T and Sakamoto K *Electromyogr. Clin. Neurophysiol.,* **37**, 343-357, 1997.
2. Sakamoto K et al. *Electromyogr. Clin. Neurophysio.,,***38**, 103-313,1998