Objective:
The diagnosis of insomnia is still based on phenomenology as the diagnostic criterion but not physiopathological etiologies. The recall bias of the patient's history and symptoms often lead to high diagnostic instability and imprecise treatment. This study is based on the major physiopathologies of insomnia: dysregulation of the circadian system, homeostatic system, and arousal system, to integrate a clinical sleep physiological signal translation model by using information engineering technology. This system converts physiological signals into digital signals and physiopathological models to assist clinicians in diagnostic evaluation.

Methods:
Wearable devices were used, including the eye-mask measuring sleep electroencephalograph to analyze the arousal system, sleep index and stages; the actigraphy measuring activity levels and illumination to analyze the homeostatic and circadian rhythm system, as well as the electroencephalograph for alpha rhythm, autonomic nervous system(ANS) function test and salivary melatonin. Good sleepers and poor sleepers were enrolled. All of them used the wearable devices at home during their daily life, including 2 days eye-mask and 14 days actigraphy. The above biological signals were analyzed by ANOVA in these two different groups.

Results:
There were 20 normal sleepers and 20 poor sleepers enrolled in. In normal sleepers, arousal system showed no significant difference in the LF/HF between resting and maintenance phase by ANS test, and more rapid alpha rhythm declining before sleep. The circadian rhythm showed better inter-daily stability(IS) with 0.83. The homeostatic system showed better intra-daily variability(IV) with 0.64, and more theta rhythm accumulation before sleep. In poor sleepers, the significant difference in the LF/HF between resting and maintenance phase, and slower alpha rhythm decade showed the dysregulation of arousal system. Lower IS(0.34) was indicated the dysregulation of circadian system. Higher IV(0.83) and lower theta rhythm accumulation showed dysregulation of homeostatic system. Both groups showed flatted change of salivary melatonin level, possible related to light exposure at night.

Conclusion:
This system could offer a poly-signal, more precise and personalized evaluation in the naturalistic setting for insomniac patients. By specifying the physiopathology of insomnia, the precise interventions could be applied more efficiently.

中文題目：_開發以失眠症生理病理學為基礎的居家睡眠偵測系統

英文題目：Development of the Integrated Home Sleep Detection System Based on the Physiopathology of Insomnia

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