

# 頭部姿勢對心率變異及皮膚血流的影響探討

## Effects of Different Head Positions on Heart Rate Variability and Blood Flow in Young Healthy Subjects

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### 摘要

長時間頭頸部不良的姿勢，不只會造成肩頸痠痛和僵硬；也可能因為改變心血管調節，而造成心臟血管的負擔。本實驗主要探討不同頭部姿勢，對心率變異(heart rate variability)和皮膚微循環(microcirculation)調控機制的影響。十六位沒有相關心血管疾病的年輕人參與，在平躺下執行共五種頭部姿勢；使用心電圖(Electrocardiography, EKG)，來收集心率變異資料，利用頻域分析法，來代表其自主神經狀態；使用杜卜勒微流器(Laser doppler flowmetry, LDF)，來收集皮膚微循環資料，利用頻域分析法，來代表其微循環調控方式。實驗結果顯示不同頭部姿勢，會明顯影響受測者自主神經狀態；頭部後仰時，對副交感有明顯的活化，而當頭部前傾時，則對交感神經產生活化。不同頭部姿勢，也會明顯影響受測者微循環調控方式；頭部後仰時會明顯增加血管平滑肌、呼吸和心臟等方式對皮膚血流的貢獻，但加上轉頭動作時，此效應即消失。相關發現，可提供臨床治療人員，注意患者長時間頭部姿勢問題，是否可能已影響其自主神經和血液循環調節功能。

關鍵字：頭部姿勢、心率變異、皮膚微循環、杜卜勒微流器

### Introduction

Nowadays people tend to sit comfortably on the front of the computer or television for a long-period time with poor posture. Poor head postures not only could affect the neck muscle or result in shoulder stiffness, but also may induce a burden for cardiovascular system. Clinicians always pay attention to treat this kind of musculoskeletal problem, but the poor posture may also influence autonomic nervous system and the circulatory system. This current study aimed to examine the effect of different head positions on heart rate variability and skin blood flow.

### Materials and Methods

Sixteen healthy volunteers (8 men and 8 women, age:  $22.1 \pm 2.3$  year) were recruited. Five head positions were tested: neck neutral(NL), neck extension  $30^\circ$  (EX), neck extension combined rotation  $60^\circ$ (ER), neck flexion  $30^\circ$ (FX) and neck flexion combined rotation  $60^\circ$ (FR). EKG was used to monitor heart rate variability to analyze the frequency domain divided to high frequency (HF: 0.15~0.5 Hz) and low frequency (LF: 0.04~0.15 Hz). HF represented parasympathetic activity, LF/ HF represented sympathetic activity. LDF was a continuous, non-invasive and real-time tool to measure cutaneous blood perfusion. The spectral analysis (Fig. 1) of the LDF signal from a middle finger skin has revealed five characteristic frequencies, i.e. endothelial (0.009-0.02 Hz), sympathetic (0.02-0.06 Hz), vascular myogenic (0.06-0.2 Hz), respiratory (0.2-0.6 Hz) and heart activity (0.6-2.3 Hz).

Repeated measured ANOVA was used to determine whether the HRV and LDF spectrums among different head positions indicated the significant level, with p value was set as 0.05. Post-hoc test was used to examine where the difference existed.

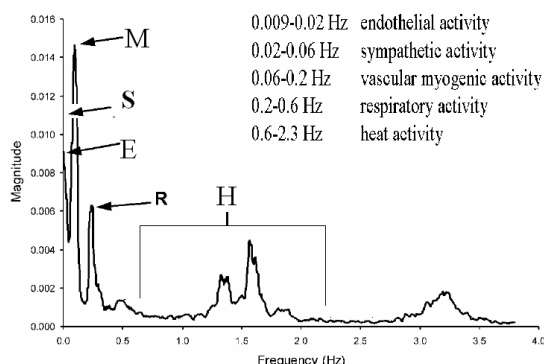


Fig. 1: Power spectrum of skin blood flow

### Results and Discussions

The HF value of NL was significantly ( $p < 0.05$ ) smaller than that of EX and ER (Table 1). In contrast, The LF/HF value of NL was significantly ( $p < 0.05$ ) larger than that of EX. It is implied that sympathetic nerve may restrain at neck extension position.

Heart activity of FX was significant smaller than that of EX and NL ( $p < 0.05$ ). Respiratory activity of ER and FR were significant smaller than that of EX and FX ( $p < 0.05$ ). Vascular myogenic activity of EX was significant larger than EX and ER ( $p < 0.05$ ).

### Conclusion

Head and neck positions have effect on sympathetic activity and skin blood flow modulation. Sympathetic nerve activity may be restrained at neck extension position. The patients with improper head and neck posture for a long period could negatively affect their autonomic nervous system or the circulatory system.

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## Reference

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Table1. Frequency domain analysis of heart rate variability for different head positions

	ER	EX	NL	FX	FR	Post-hoc
LF	33.4 (20.2)	35.5 (16.8)	45.5 (17.8)	44.0 (20.6)	39.4 (20.5)	
HF	58.9 (21.1)	58.3 (17.1)	45.0 (14.2)	48.0 (21.7)	53.37 (22.1)	EX>NL ER>NL
LF/HF	0.8 (0.9)	0.8 (0.8)	1.3 (0.9)	1.6 (1.9)	1.6 (2.8)	NL>EX

Table 2: Percentage of spectrum distribution of skin blood flow for different head positions

	ER	EX	NL	FX	FR	Post-hoc
Endothelial	86.4 (6.8)	80.7 (16.0)	84.9 (6.2)	84.3 (7.8)	85.9 (7.6)	
Sympathetic	12.4 (6.5)	16.0 (12.8)	13.6 (5.9)	14.3 (7.6)	12.6 (7.3)	
Myogenic	1.0 (0.5)	2.8 (5.3)	1.3 (0.6)	1.1 (0.4)	1.3 (0.7)	EX>FX EX>ER
Respiratory	0.1 (0.0)	0.3 (0.5)	0.1 (0.0)	0.1 (0.1)	0.1 (0.1)	EX>ER FX>FR
Heart	0.1 (0.1)	0.23 (0.3)	0.1 (0.1)	0.1 (0.1)	0.1 (0.1)	NL>EX EX>FX