

The association between descending pain modulation and autonomic activity in females with knee pain [TU627]

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Background & Aims

- **An interaction between descending pain modulation (DPM) and the autonomic nervous system (ANS)** has been reported in a cohort comprising both healthy participants and patients such as fibromyalgia and irritable bowel syndrome [1-3].
- However, individuals with **chronic knee pain (CKP) have not been examined.**
- This observational study examined the association between DPM and ANS activity. **We hypothesized that sympathetic and parasympathetic nervous system activities are associated with DPM.**

Methods

Recruitment at IUHW hospitals (n=42)

- Women with CKP aged 20-80 y/o were included
- Cardiopulmonary, vascular, or nervous system disorders were excluded

Excluded (n=10)

- Aged >80 y/o (n=3)
- Had no CKP (n=7)

Measurement (n=32)

CPM protocol to measure DPM



- PPT (pressure pain threshold) was measured in the *left upper trapezius*
- HRV (heart rate variability) was expressed as *LF/HF* and *HFnorm* for measuring *sympathetic and parasympathetic activities, respectively* [4]
- Patients characteristics were self-reported

Analysis (n=32)

- *COLD - REST* were calculated for the CPM effect, Δ LF/HF and Δ HFnorm
- Associations between the CPM effect and Δ LF/HF (or Δ HFnorm) were analyzed by *simple linear regression* with statistical significance at $p < 0.05$

Results

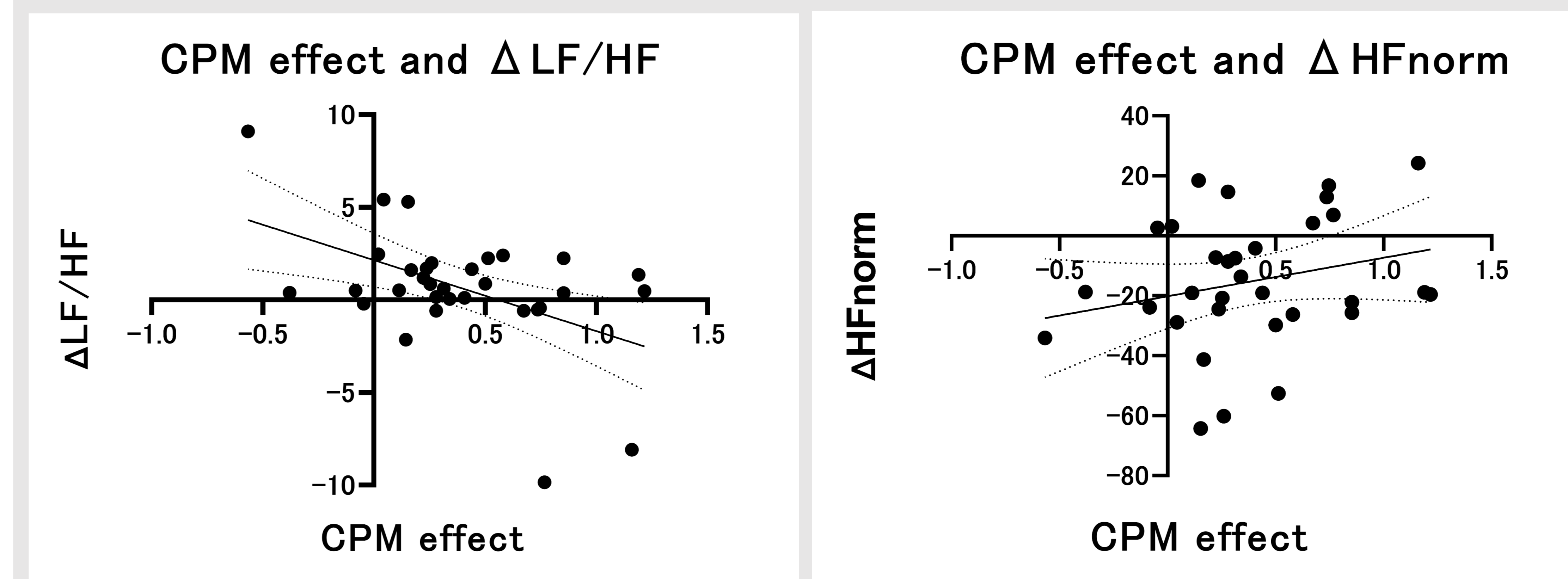
Patient characteristics

	Overall(n=32)	Central sensitization(n=4)	No central sensitization(n=28)	Mann-Whitney U test (p<0.05)
Age	64.4 ± 10.1	65.3 ± 5.1	64.3 ± 10.7	0.934
BMI	23.2 ± 5.5	23.5 ± 3.0	23.2 ± 5.8	0.934
Pain intensity	3.8 ± 1.8	3.3 ± 1.3	3.8 ± 1.8	0.602
PainDETECT	8.3 ± 5.0	11.5 ± 3.4	7.8 ± 5.1	0.188
Central sensitization inventory	26.2 ± 11.5	39.5 ± 7.2	24.3 ± 10.7	0.009*
Pain catastrophizing scale	26.8 ± 9.7	34.0 ± 9.3	25.8 ± 9.5	0.169
International physical activity questionnaire	44.9 ± 56.3	23.0 ± 25.6	48.0 ± 59.1	0.361
HADS (Anxiety)	4.2 ± 2.9	5.8 ± 2.2	4.0 ± 3.0	0.188
HADS (Depression)	6.6 ± 3.3	8.3 ± 5.0	6.4 ± 3.1	0.527
WOMAC	27.3 ± 18.8	36.5 ± 12.9	26.0 ± 19.3	0.135
CPM effect	0.4 ± 0.4	-0.3 ± 0.2	0.5 ± 0.3	<0.001*
Δ LF/HF	0.66 ± 3.28	2.45 ± 4.45	0.41 ± 3.11	0.934
Δ HFnorm	-15.20 ± 22.00	-18.51 ± 15.47	-14.7 ± 22.96	0.680

HADS: Hospital anxiety and depression scale, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index
LF/HF: low frequency / high frequency, HFnorm: high frequency normalized unit

The results of Simple linear regression analysis

- **A significant association between CPM effect and Δ LF/HF** was found $p < 0.01$, $B = -3.83$ [95% CI; -6.38--1.27], $R^2 = 0.238$
- However, **Δ HFnorm was not significant** at $p = 0.178$, $B = 12.8$ [95% CI; -6.18--31.9], $R^2 = 0.060$



Conclusions

- **An association between DPM and sympathetic nervous system activity was found. However, parasympathetic nervous system activity was not.**
- A possible reason is that an association between DPM and elevated blood pressure has been reported [6], only sympathetic nervous system activity may interact with DPM.

Relevance for Patient Care

CKP is globally prevalent; 26% of patients with chronic musculoskeletal pain have CKP [7]. This study [7] suggested that 50% of the patients were not satisfied with their treatment, indicating an ineffective treatment. For an effective treatment, clinicians and therapists must accurately identify the causes of pain CKP may result from the dysfunction of ANS activity because it controls joint homeostasis [8] and possibly the DPM system [2,9]. Our results support the interaction between DPM and the ANS in individuals with CKP. Further studies are required to explore the causes of CKP and determine its optimal treatment.

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Ethical permissions

This observational study was approved by the Institutional Review Board of the International University of Health and Welfare (approval number: 22-Im-011). The Declaration of the World Medical Association was complied. Written informed consent was obtained from all the participants. This study was registered in the UMIN Clinical Trials Registry (ID: UMIN000048356). The authors declare no competing interests. Furthermore, the funder had no role in any of the study procedures, while this study was granted by the JSPS Grants-in-Aid for Scientific Research, Challenging Research, Explorator (21K19733).

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