Effect of Sleep and Physical Activity on Chronic Myalgia

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Introduction

Central sensitization syndrome proposed by Yunus is a group of disease to develop central irritation as a cause. The chronic myalgia of masticatory muscles which are difficult to treat is thought to be included in this disease concept. Also, the possibility that sleep problem has an influence on the chronic pain has been reported in a recent study. The objective of this study is to clarify how sleep and physical activities affect chronic pain.

Material and Method

1. Subject
➢ Female TMD patients (n=7, 39.3±9.9 years old)
➢ Female non-TMD patients (n=9, 41.2±10.2 years old)
➢ TMD was diagnosed by the board certified specialist using the RDC/TMD protocol.
➢ Exclusion criteria
  1. those who works on the late-night shift
  2. those who have mental disorders
  3. those who are pregnant

2. Measurement
➢ Sleep condition and daytime activities were recorded with the Actigraph (Figures 1, 2 & 3). The Actigraph provides an accurate assessment of the sleep-wake patterns.
➢ Subjects were directed to wear the Actigraph for 14 consecutive days and to fill in the following 100 mm visual analogue scales (VAS) everyday.
  1. subjective jaw pain intensity at every three hours after awakening
  2. subjective assessment of sleep quality

3. Statistical analysis
The following parameters were statistically analyzed using a **linear mixed effect model*(see below)** in which age and the presence of menstruation were compensated. The paradoxical covariates in time series were excluded.

Analysis 1

Covariates
• Total sleep time during last night (min)
• Subjective assessment of the quality of sleep during last night (VAS)
• The median number of the physical activity on the previous day (unit)

Dependent variables
• The maximum jaw pain within 6 hours after awakening (VAS)
• The maximum jaw pain after more than 6 hours from awakening (VAS)

Analysis 2

Covariates
• The maximum jaw pain within 6 hours after awakening (VAS)
• The maximum jaw pain after more than 6 hours from awakening (VAS)

Dependent variables
• Total sleep time during last night (min)
• Subjective assessment of the quality of sleep during last night (VAS)

* Linear mixed effect model: A statistical model containing both fixed and random effects. These mixed models are useful in settings where repeated measurements are made (longitudinal study) to suggest the causal relationship.
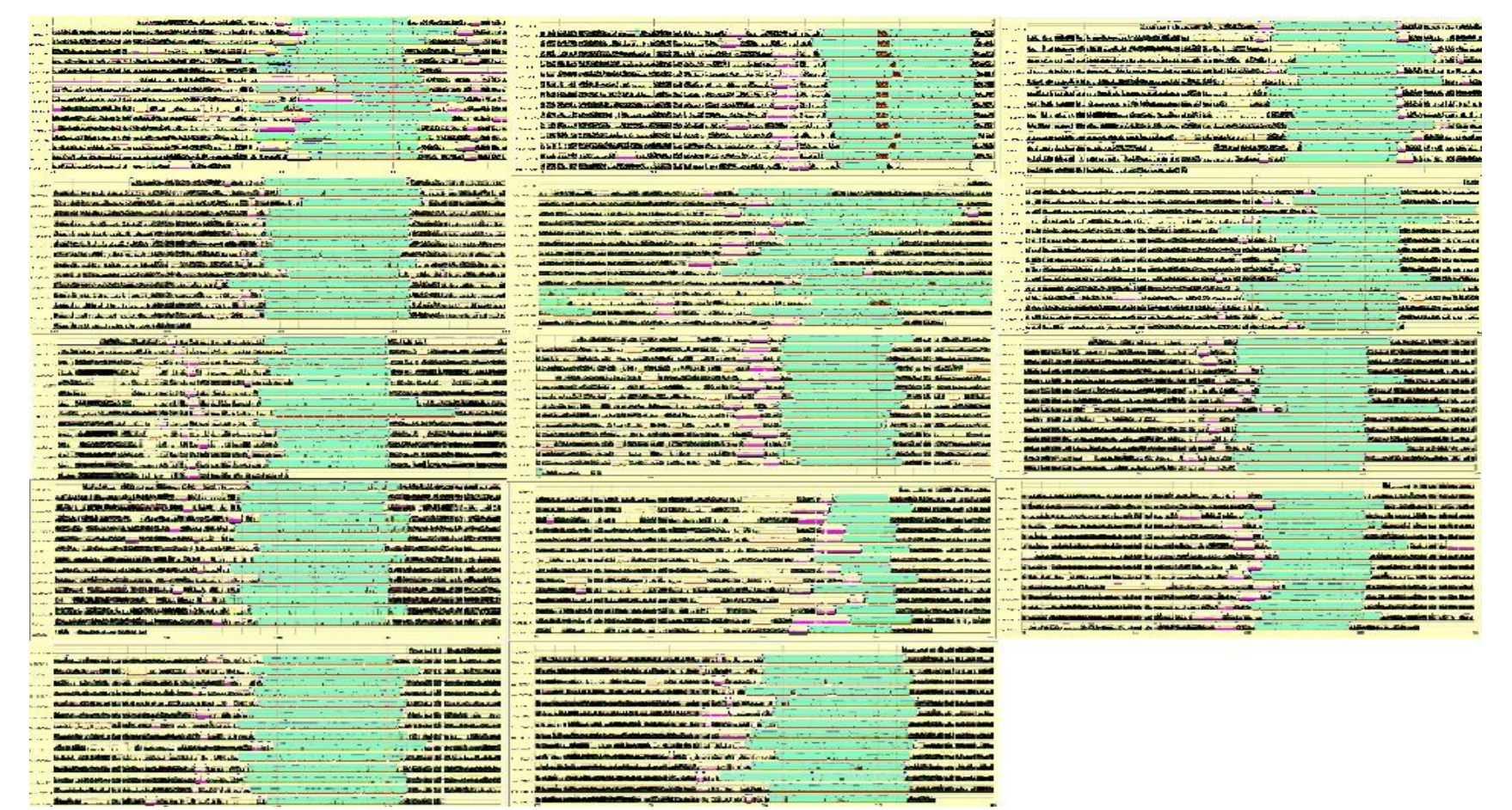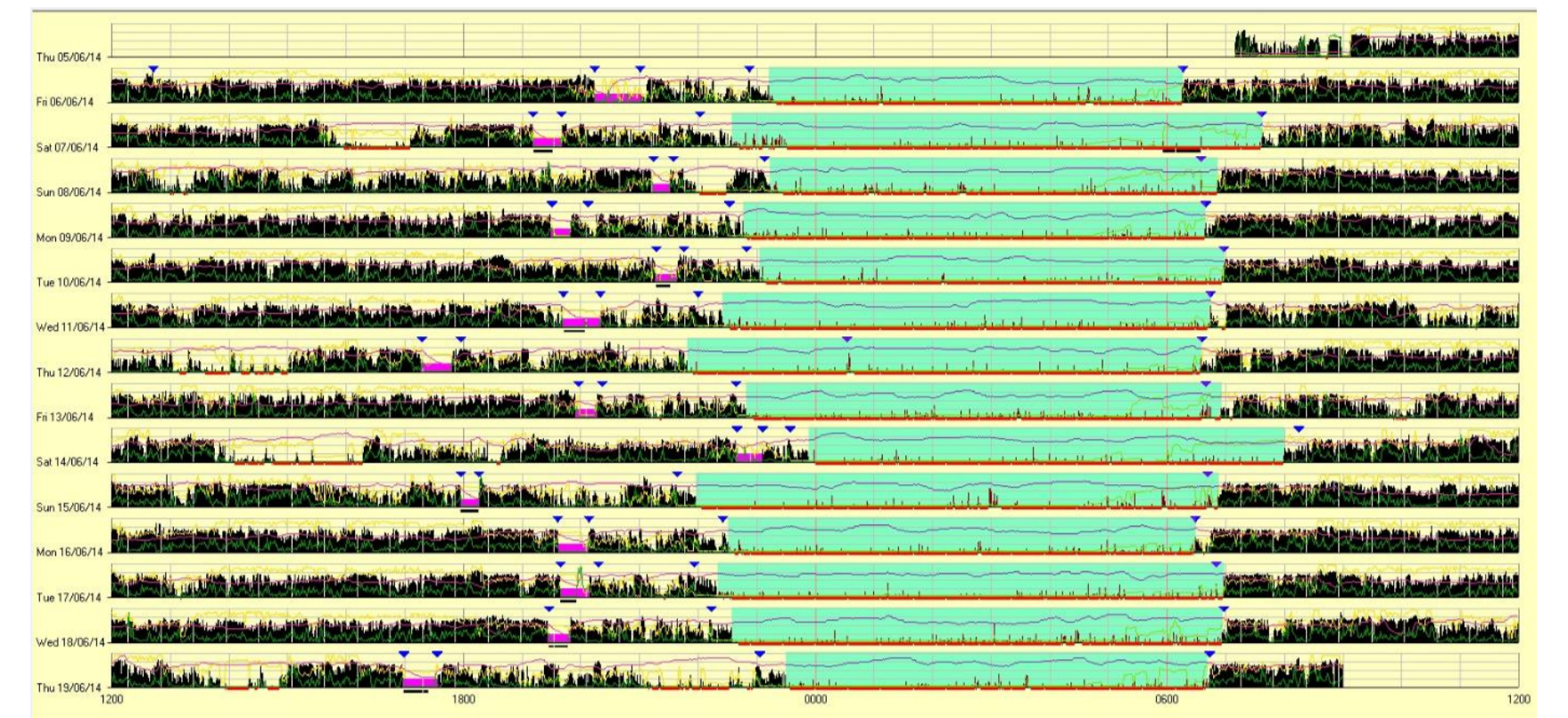

Figure 1. Actigraph's row data of 14 subjects

Figure 2. A sample of stable sleep-awake cycles
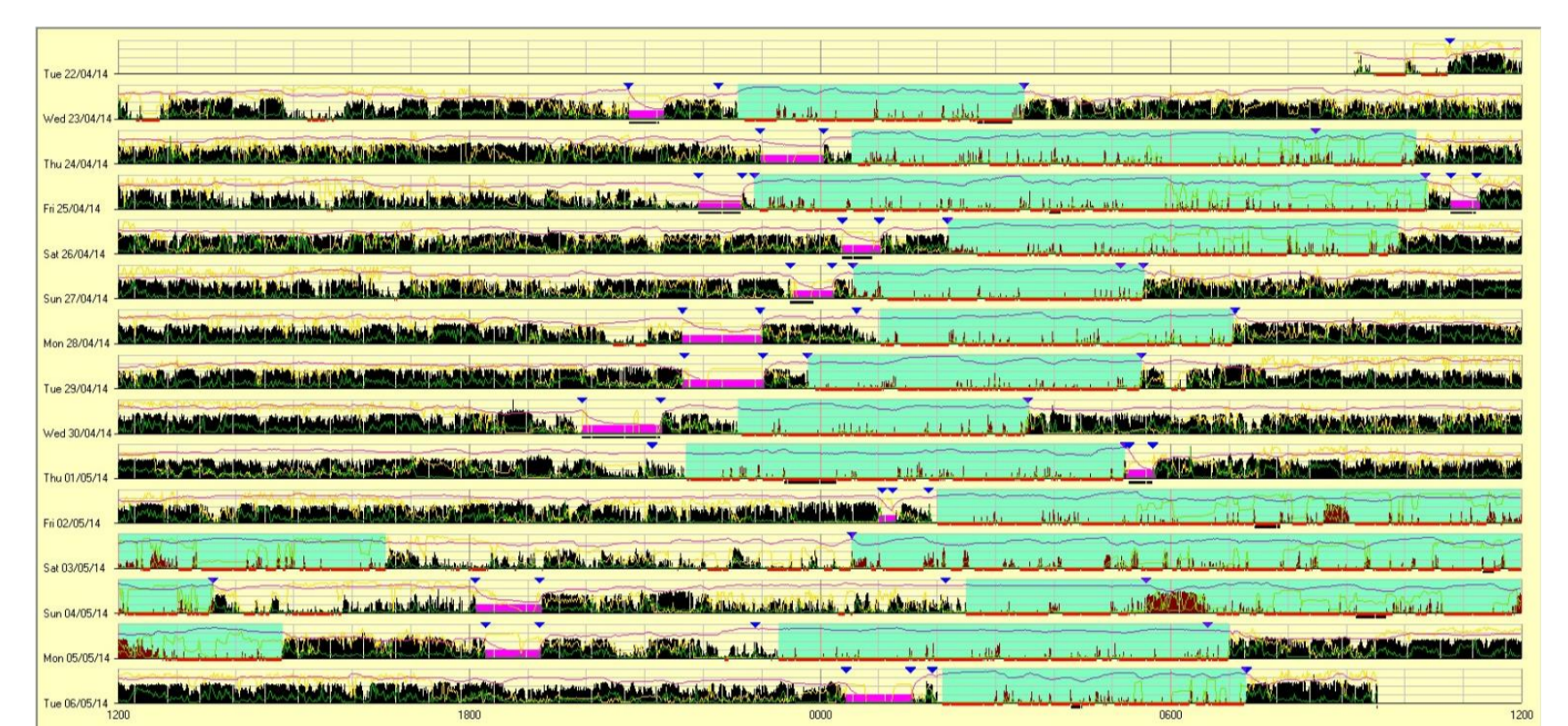
Figure 3. A sample of unstable sleep-awake cycles

Results from linear mixed effect model

Analysis 1
The linear mixed effect model revealed that among selected three covariates, "Subjective assessment of the quality of sleep during last night", and "The median number of the physical activity on the previous day" showed significant influences on jaw pain (Table 1).

Table 1. Analysis 1

	Dependent variables							
	The maximum jaw pain within 6 hours after awakening				The maximum jaw pain after more than 6 hours from awakening			
Covariates	Odds Ratio	P	95%CI		Odds Ratio	P	95%CI	
			min	max			min	max
Total sleep time during last night	.999	.218	.998	1.000	.999	.184	.998	1.000
Subject assessment of the quality of sleep during last night	.992	.000	.989	.996	.993	.000	.990	.997
The median number of the physical activity on the previous day	.997	.029	.995	.999	.997	.024	.995	.999

The higher the subjective assessment of the quality of sleep during last night, the lower the maximum jaw pain became and vice versa (Figure 4).
The higher the median number of the physical activity on the previous day, the lower the maximum jaw pain (Figure 5).
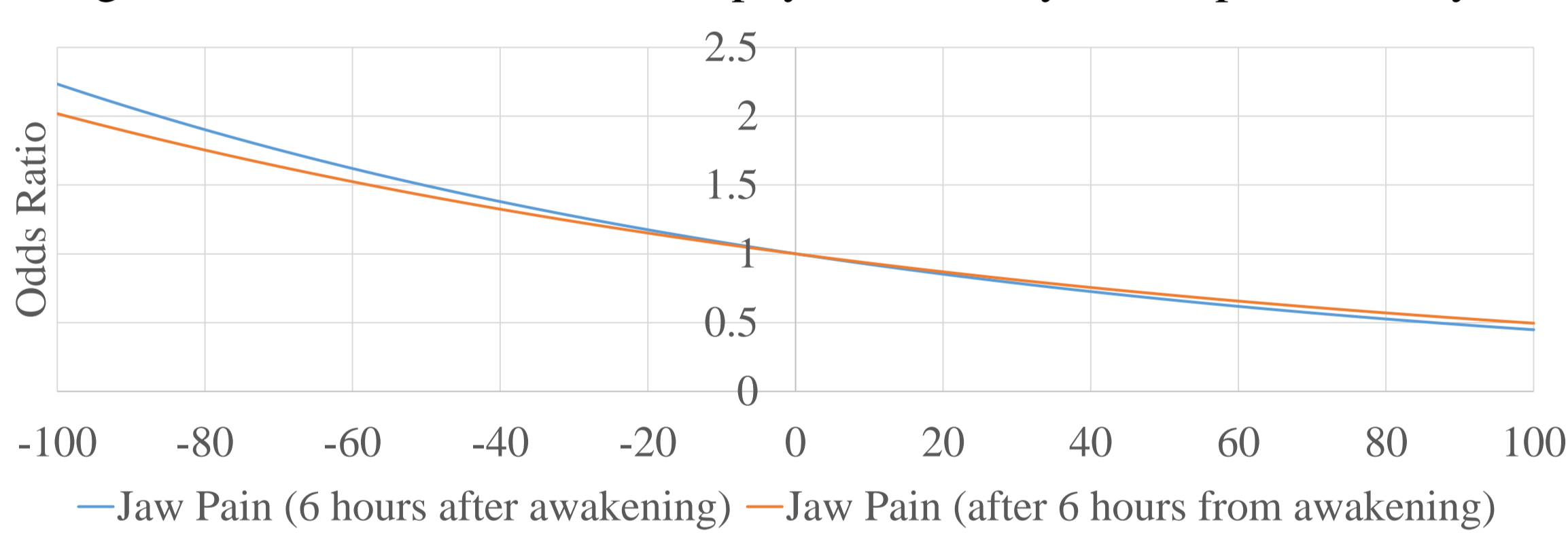

Figure 4. Odds ratio for pain according to changes in the subjective assessment of the quality of sleep during last night.
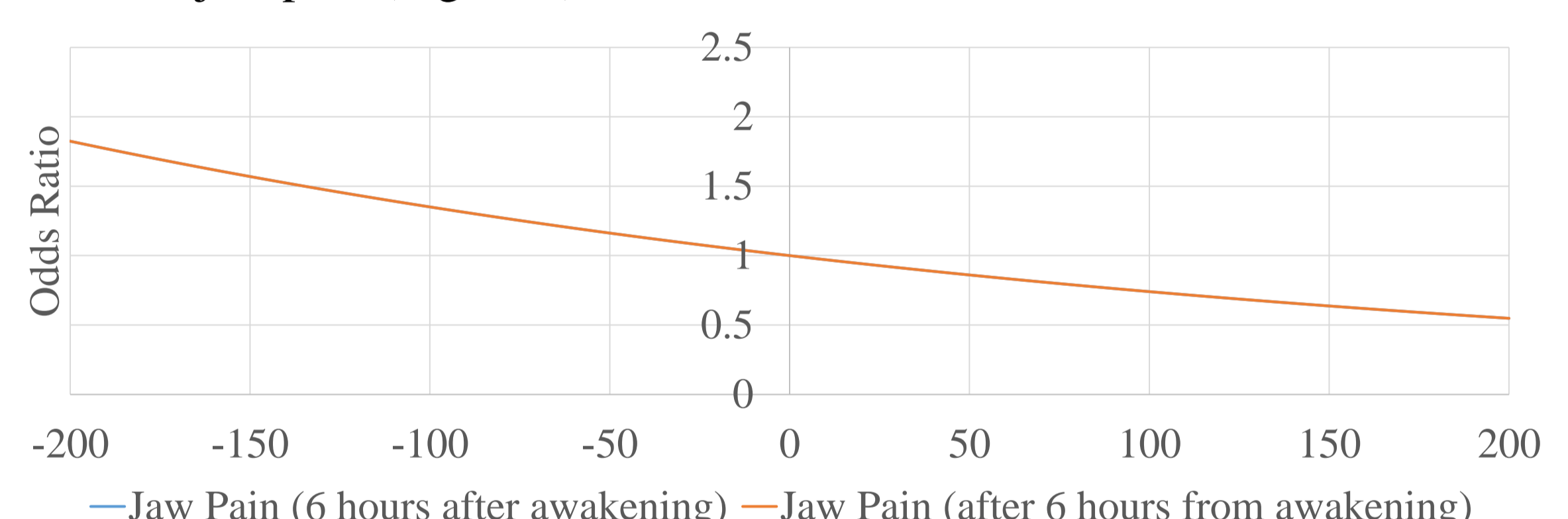

Figure 5. Odds ratio for pain according to changes in the physical activity on the previous day.

Analysis 2
The linear mixed effect model revealed that among selected two covariates, "The maximum jaw pain within 6 hours after awakening" showed significant influences on the quality of sleep (Table 2).

Table 2. Analysis 2

	Dependent variables							
	Total sleep time				Quality of sleep			
Covariates	Odds Ratio	P	95%CI		Odds Ratio	P	95%CI	
			min	max			min	max
The maximum jaw pain within 6 hours after awakening	1.000	.859	.997	1.002	.993	.049	.987	.999
The maximum jaw pain after more than 6 hours from awakening	.999	.428	.997	1.001	.995	.130	.990	1.001

The higher the maximum jaw pain within 6 hours after awakening, the lower the quality of sleep became and vice versa (Figure 6).
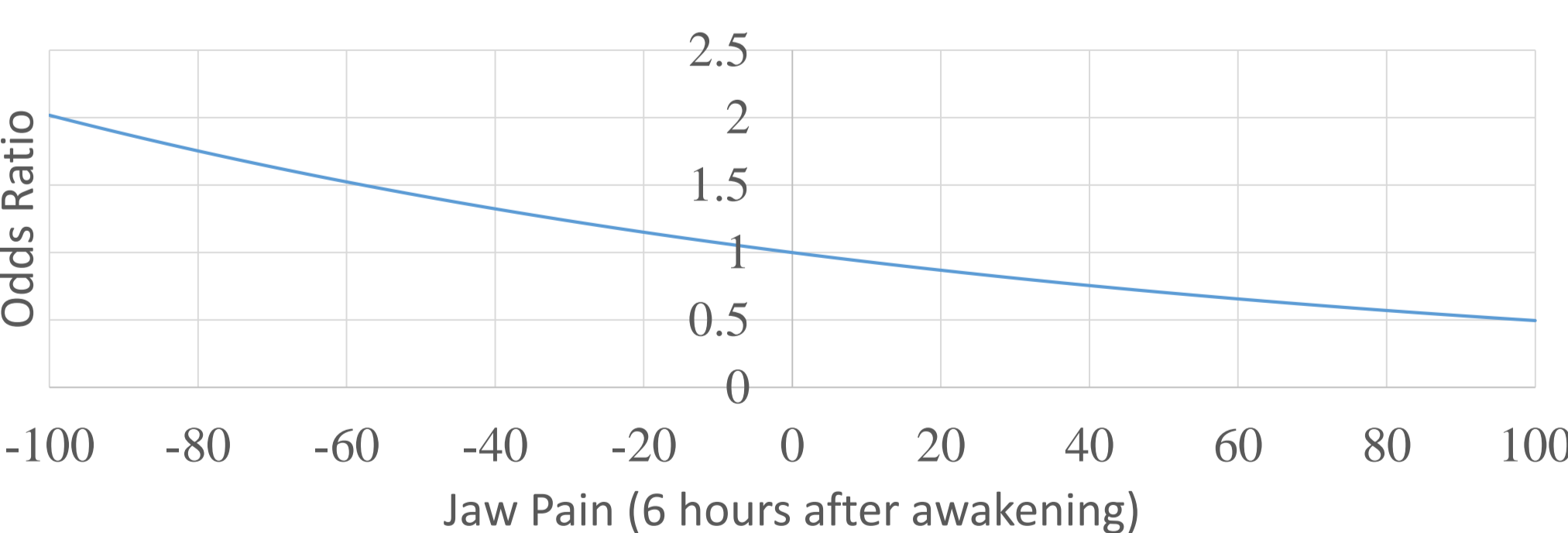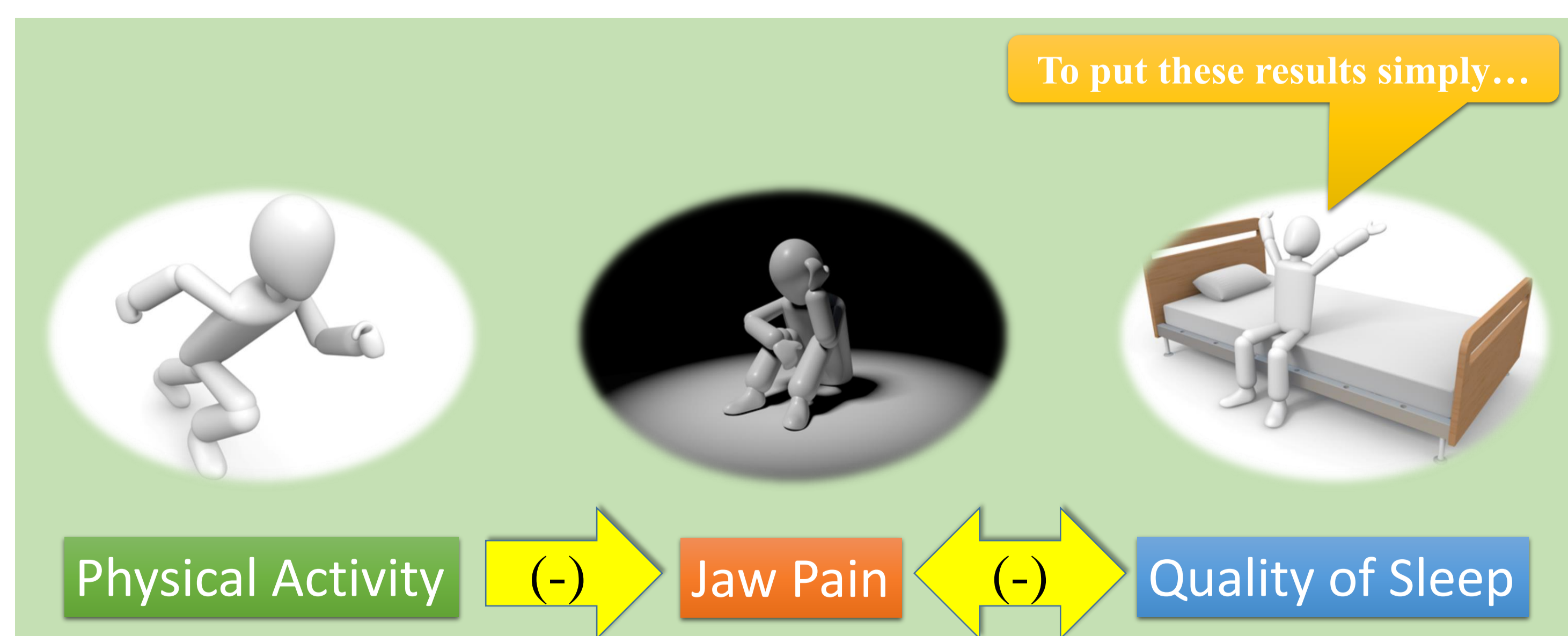

Figure 6. Odds ratio for the quality of sleep according to changes in the jaw pain on the previous day.

To put these results simply…

Physical Activity (-) → Jaw Pain (-) → Quality of Sleep

Discussion & Conclusion

The results suggest that jaw pain was reduced by the increase of the subjective assessment of the sleep quality during last night and the physical activity during the previous day. Since the subjective assessment of the sleep quality during last night was associated with jaw pain on the following day, it was suggested that sleep with good quality has a suppressive role on chronic pain. In addition, as physical activity were associated with jaw pain, improvement of sleep and living could offer an effective treatment method.

These results suggest that sleep quality and physical activities affect chronic myalgia and that the chronic myalgia and sleep status could form the vicious cycle. Further investigation is needed with more samples to evaluate the effects of various parameters associated with sleep.