ACUTE POST-OPERATIVE PAIN AFTER ORTHOGNATHIC SURGERY COULD BE PREDICTED BY CONDITIONED PAIN MODULATION (CPM) AND PAIN CATASTROPHIZING SCALE (PCS)-MAGNIFICATION

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Introduction and objectives

Previous study suggested that severity of chronic post-operative pain could be predicted by conditioned pain modulation (CPM) examined before surgeries[1)].The aim of the study was to investigate the relationship between pre-operative CPM, pain catastrophizing scale (PCS), and the severity of acute post-operative pain.

Methods

Forty-two patients scheduled for orthognathic surgery (age range: 18-52 years) participated and had the CPM and PCS assessed prior to the surgery (Figs. 1-5). Pressure pain threshold was measured as test stimulus at dominant forearm (Fig. 1). Tonic cold-heat pulse stimulation (pulse duration of 40 seconds, -10 to 47 degree Celsius) was applied to the contralateral forearm with pain intensity of 70 at visual analogue scale (VAS 0-100) as conditioning stimulus (CS) (Fig. 2).The period of consumption for post-operative analgesics (AP) and pain area under the VAS curve (VASAUC) were measured for one month after surgery (Figs. 6,7).The relationships between CPM effect and AP, VASAUC, PCS were analyzed with Pearson correlation coefficient and multiple regression analysis.

Results

The patient background, operation type, CS temperature are shown in Tables 1,2,3. Positive CPM effect (15.8 [8.3 - 26.0] %) was detected in 35 patients (Table 4). In the patients with positive CPM effect, a significant negative correlation was detected between CPM effect and AP (R=-0.38, p=0.023) and between CPM effect and VASAUC (R=-0.38, p=0.022) (Figs. 8,9).
A significant positive correlation was detected between PCS-magnification and AP (R=0.41, p=0.015) (Fig. 10).
Multiple regression analysis showed; AP = -0.10xCPM effect + 0.34xPCS-magnification + 7.25 (R=0.48, p=0.005, CPM effect; p=0.034, PCS-magnification; p=0.023) (Table 7).

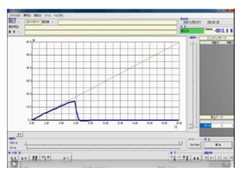
Conclusions

Acute post-operative pain after orthognathic surgery could be predicted by CPM and PCS-magnification.

Fig. 1 Test stimulus
pressure pain threshold： PPT

Electronic pressure algometer (AIKOH Engineering, Japan)

PPT measuring device



PPT Measurement display

Fig. 2 Conditioning stimulus
cold-heat pulse stimulation :CHPS

Thermal stimulator (VICS, Japan)

CHPS display

Fig. 3 CPM evaluation

CS was applied by thermal stimulator with a Peltier element probe (16 cm^2) for 5 min.
PPT was measured by the electronic pressure algometer (AIKOH Engineering, Japan) before and during CS.

$$\text{CPM effect (\%)} = \left[\frac{\text{(PPT during the CS)}}{\text{(PPT at baseline)}} - 1 \right] \times 100$$

Fig. 4 Protocol (Preoperative day)
Stimulation temperature setting and CPM measurement

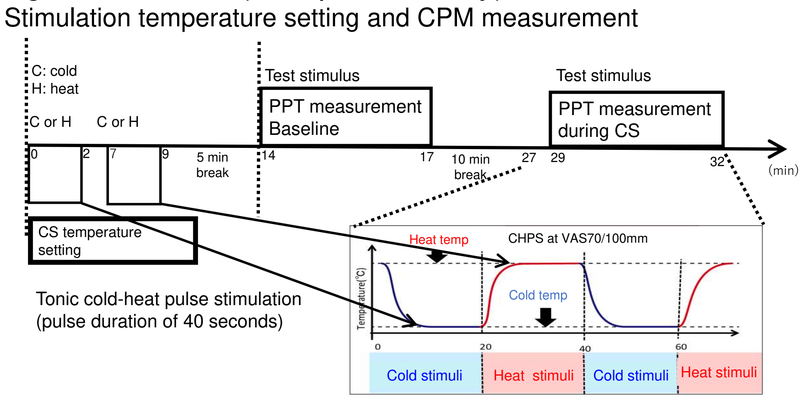


Fig. 5 PCS assessments （Japanese version）

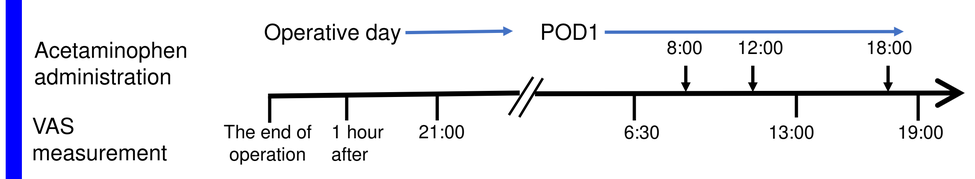
1＊	I worry all the time about whether the pain will end.
2	I feel I can't go on.
3	It's terrible and I think it's never going to get any better
4	It's awful and I feel that it overwhelms me.
5	I feel I can't stand it anymore.
6	**I become afraid that the pain will get worse.**
7	**I keep thinking of other painful events.**
8	I anxiously want the pain to go away
9	I can't seem to keep it out of my mind
10	I keep thinking about how much it hurts.
11	I keep thinking about how badly I want the pain to stop.
12	There's nothing I can do to reduce the intensity of the pain.
13	**I wonder whether something serious may happen.**

0 - not at all
1 - to a slight degree
2 – to a moderate degree
3 - to a great degree
4 - all the time

PCS total scoer:52
rumination:1 8 9 10 11
Max score:20
helplessness:2 3 4 5 12
Max score:20
magnification:6 7 13
Max score:12

＊: 1 is classified as helplessness in English version

Fig. 6 Post-operative pain management



- Acetaminophen administration
  - ✓ During operation: administration of 1000 to 2000 mg
  - ✓ After operation: administration of 3000 mg / day (3 times / day) from the evening of the operative day
- Rescue administration (Loxoprofen sodium, Acetaminophen)
- Pain assessment by VAS scale (0 - 100 mm)

Fig. 7 VASAUC (example)

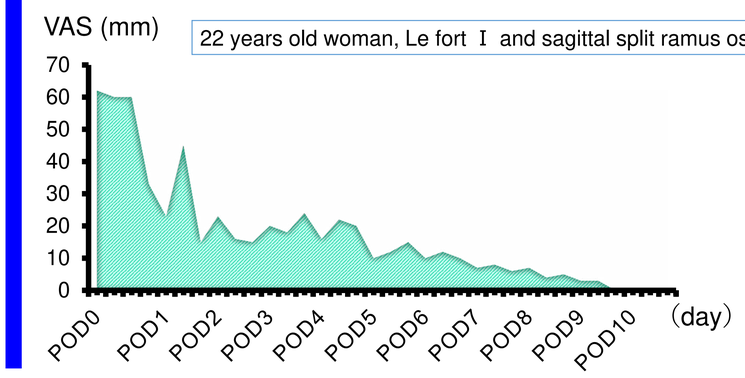


Table 1 Patient background

Sex (M/F)	12/30	
Age (years)	27	[21 - 37]
Height (cm)	163.0	[156.8 - 167.7]
Body weight (kg)	57.0	[52.0 - 65.0]

(Median [interquartile range])

Table 2 Operation type

Le fort Ⅰ and sagittal split ramus osteotomy（SSRO）	n=18
SSRO	15
SSRO,and Chin angioplsty	4
Wassmund	3
Surgically assisted rapid palatal expansion(SARPE)	1
Chin angioplasty	1

Table 3 CS Temp

Cold (degree Celsius)	-1.0 [-10.0 - 4.0]
Heat (degree Celsius)	47.0 [47.0 - 47.0]

(Median [interquartile range])

Table 4 CPM effect

	CPM≧0	CPM＜0
n	35	7

	All patients (n=42)	Patients positive CPM effect (n=35)
CPM effect (%)	12.8 [4.4 - 23.0]	15.8 [8.3 - 26.0]

(Median [interquartile range])

Table 5 PCS score

rumination	12.5	[9.8 - 16.0]
helplessness	6.0	[2.0 - 10.0]
magnification	4.0	[1.0 - 6.3]
total	21.5	[14.5 - 32.3]

(Median [interquartile range])

Table 6 Analgesic consumption period and VASAUC

	All patients (n=42)	Patients with positive CPM effect (n=35)
Analgesic consumption period (day)	7.3 [5.8 - 9.3]	7.1 [5.8 - 8.3]
VASAUC for postoperative pain (day × mm)	188.5 [93.4 - 286.7]	185.0 [96.6 - 289.8]

Fig. 8 CPM vs AP (analgesics period)

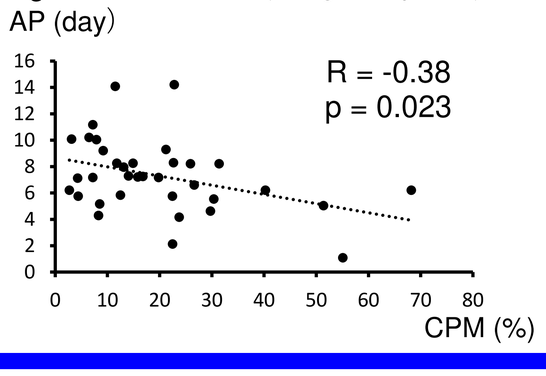


Fig. 9 CPM vs VASAUC

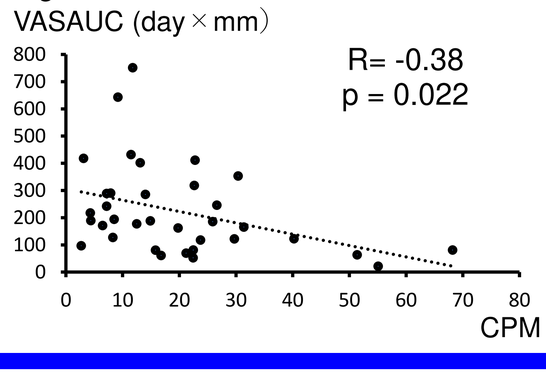


Fig. 10 PCS-Magnification vs AP

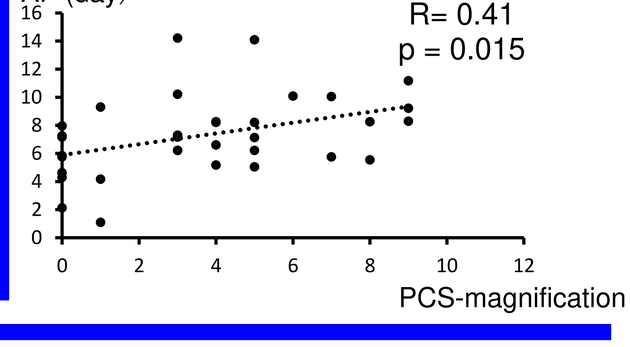


Table 7 Multiple regression analysis
Objective variable: AP

Dependent variable	coef	std. Err	t-value	p -value	β-value
CPM effect	-0.10	0.03	- 2.21	0.034＊	-0.34
PCS-magnification	0.34	0.14	2.40	0.023＊	0.36
constant	7.25	0.90	8.02	0.037×10^{-7}	

Adj-R-squared：0.23　N：35　＊p< .05

AP = -0.10xCPM effect + 0.34xPCS-magnification + 7.25,
(R=0.48, p=0.005, CPM effect; p=0.034, PCS-magnification; p=0.023)

REFERENCES
1) Yarnitsky D, Crispel Y, Eisenberg E, et al. Prediction of chronic post-operative pain: pre-operative DNIC testing identifies patients at risk. Pain 2008; 138: 22-8.