

The Effects of Repeated Thermal Therapy for Patients with Chronic Pain

Akinori Masuda^b Yasuyuki Koga^a Masato Hattanmaru^c Shinichi Minagoe^d
Chuwa Tei^d

^aNishi Kyusyu University, Saga, ^bPsychosomatic Medicine, Respiratory and Stress Care Center, Kagoshima University Hospital, ^cHattanmaru Hospital, and ^dCardiovascular, Respiratory and Metabolic Medicine, Kagoshima University Graduate School of Medical and Dental Science, Kagoshima, Japan

Key Words

Chronic pain · Multidisciplinary treatment · Thermal therapy · Far-infrared ray dry sauna · Pain behavior · Pain-related anger

Abstract

Background: It has been reported that local thermal therapy with a hot pack or paraffin relieves pain. We hypothesized that systemic warming may decrease pain and improve the outcomes in patients with chronic pain. The purpose of this study was to clarify the effects of systemic thermal therapy in patients with chronic pain.

Methods: Group A (n = 24) patients with chronic pain were treated by a multidisciplinary treatment including cognitive behavioral therapy, rehabilitation, and exercise therapy, whereas group B (n = 22) patients were treated by a combination of multidisciplinary treatment and repeated thermal therapy. A far-infrared ray dry sauna therapy and post-sauna warming were performed once a day for 4 weeks during hospitalization. We investigated the improvements in subjective symptoms, the number of pain behavior after treatment and outcomes 2 years after discharge. **Results:** The visual analog pain score, number of pain behavior, self-rating depression scale, and anger score significantly decreased after treat-

ment in both groups. After treatment, the number of pain behavior was slightly smaller (p = 0.07) and anger score was significantly lower in group B than those in group A (p = 0.05). Two years after treatment, 17 patients (77%) in group B returned to work compared with 12 patients (50%) in group A (p < 0.05). **Conclusion:** These results suggest that a combination of multidisciplinary treatment and repeated thermal therapy may be a promising method for treatment of chronic pain.

Copyright © 2005 S. Karger AG, Basel

Introduction

Many patients with chronic pain consult health care clinics continually, and move from hospital to hospital without gaining pain relief. Opioids, lumbar surgery, spinal cord stimulators, and implantable drug delivery systems are used for treatment of chronic pain. However, it was reported that the effect of such therapeutic tactics was low [1]. On the other hand, behavioral therapy (BT), cognitive behavioral therapy (CBT), and pain rehabilitation are effective in reducing pain [2–4]. In some patients, prolonged refractory pain affects their daily life and social function despite BT-CBT and rehabilitation. Etiologically, they have psychosocial backgrounds such as chronic

Table 1. Patient profile

	Group A (n = 24)		Group B (n = 22)		p
	n	%	n	%	
Gender					n.s.
Male	12	50	11	50	
Female	12	50	11	50	
Marital status					n.s.
Married	17	71	16	73	
Single	7	29	6	27	
Divorced	5	21	4	18	
Age (mean \pm SD), years	47.5 \pm 8.5		43.5 \pm 10.6		n.s.
Duration of illness (mean \pm SD), months	44.0 \pm 14.2		46.0 \pm 12.8		n.s.
Number of hospitalizations (mean \pm SD)	12.4 \pm 0.6		12.5 \pm 0.2		n.s.

No statistically significant differences in the variables were found between the two groups.

stresses, problems in the family and between married couples, childhood abuse, or insufficient family affection [5–8]. They have pain-related anger and it is difficult to change their pain-related cognition and behavior. These social, emotional and environmental situations and incorrect pain-related cognition easily cause trouble for the therapist. In these cases, it is difficult to achieve therapeutic success with treatments such as BT-CBT and pain rehabilitation. Therefore, alternative effective treatments are needed.

It has been reported that thermal therapy reduces myotonia, improves circulation, and relieves pain by accelerating removal of pain-producing substances [9]. Local thermal therapy with a hot pack or paraffin has been used to treat pain [10]. We found that thermal therapy improved quality of life by improving sleep quality and general well-being in patients with chronic heart failure [11]. We hypothesized that systemic warming may decrease pain through the improvement of general well-being, and consequently, pain-related cognition may shift easily and pain behavior may decrease. The purpose of this study was to clarify the effects of thermal therapy for patients with chronic pain.

Methods

Subjects

Among 57 patients with a 6-month or longer history of somatoform pain disorder based on DSM-IV who consulted the outpatient clinic of our hospital between the year 2000 and 2001, written in-

formed consent was obtained from 48 patients after explanation of the treatment program. After hospitalization, these patients were assigned to a multidisciplinary treatment group including CBT, rehabilitation and exercise therapy (n = 24, group A) or a combination of multidisciplinary treatment and thermal therapy group (n = 24, group B) by the systematic random sampling method. However, since 2 patients in group B were excluded from the treatment program due to acute bronchitis and claustrophobia in the sauna room during the treatment, group B finally included 22 patients. There were no significant differences in age, gender, history of marriage or divorce, duration of illness, or the number of previous admissions due to chronic pain between the two groups (table 1). The Ethics Committee of the Faculty of Medicine at Kagoshima University approved the experimental protocol.

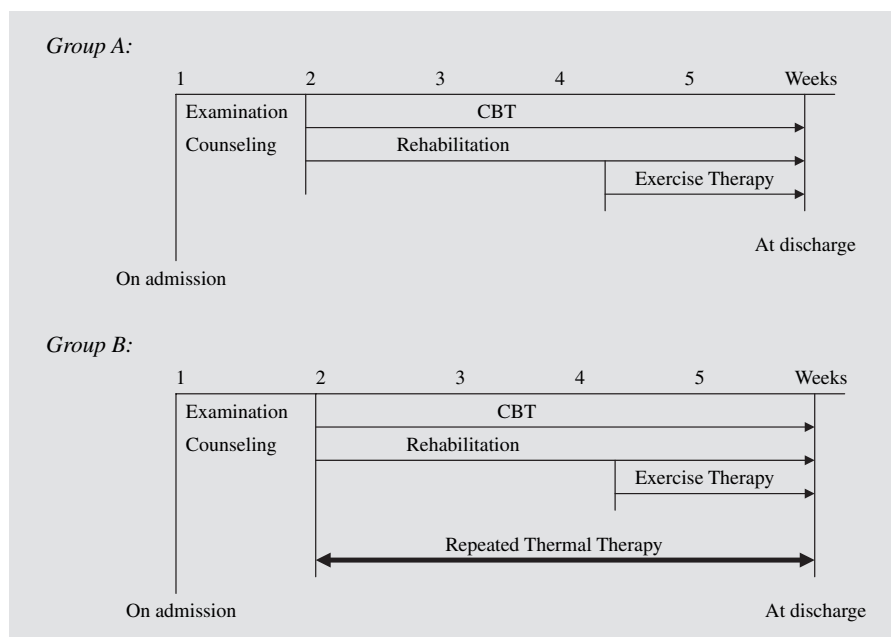
Treatment Program

All patients were admitted to our hospital for 5 weeks. One week after admission, behavioral counseling was given by a clinical psychologist to motivate the patients to participate in our treatment program. In group A, CBT and rehabilitation were started 2 weeks after admission, and exercise therapy was started 4 weeks after admission. In group B, thermal therapy was started 2 weeks after admission in addition to CBT and rehabilitation, and exercise therapy was started 4 weeks after admission (fig. 1).

Multidisciplinary Treatment

After explaining that psychosocial factors, incorrect pain-related cognition and behavior, and pain-related beliefs were etiologically involved in chronic pain, the patients were motivated to undergo CBT and rehabilitation. After CBT was started, the main target of treatment was to decrease the number of pain behavior according to shifts in pain-related cognition and behavior. Interviews, telephone calls, letter writing, and leaving the hospital were prohibited to enable the patients to confront their pain and to avoid incorrect operant from family and other people. Furthermore, the therapist attended to the pain-related complaints in a neutral man-

Fig. 1. Treatment program group A (n = 24) patients were treated by multidisciplinary treatment including CBT, rehabilitation, and exercise therapy. Group B patients (n = 22) were treated by a combination of multidisciplinary treatment and repeated thermal therapy.



ner, and minimized the drugs, injection, cataplasm, and massage that were provided only upon request by patients. The behavioral restrictions were gradually removed as the number of pain behavior decreased. The family was instructed to be neutral to the patient's pain-related complaints and to avoid providing excessive attention or help to the patient. All patients in both groups took medicines such as analgesic agents, or minor tranquilizer, antidepressant or sleep-promoting drugs. The medications were not changed during our treatment program.

Thermal Therapy

A far-infrared ray dry sauna system (Olympia Co., Miyazaki, Japan) was used for thermal therapy [11, 12]. The patients were placed in a supine position on a bed in a 60°C sauna room for 15 min, and, after being transferred to a room kept at 28°C, they were made to rest on a bed and covered with a blanket to keep them warm for an additional 30 min. Patients were weighed before and after thermal therapy, and oral hydration with water was used to compensate for lost weight. The therapy was performed once a day and 5 days a week from Monday through Friday for 4 weeks.

Measurements

Pain was evaluated by the visual analog scale (VAS pain), using a marked 10-cm line extending from 'no pain' to 'worst ever pain'. Pain behavior was assessed based on the following 11 items: (a) request for an analgesic agent, (b) request for a compress or massage, (c) complain of stubborn pain, (d) change in expression or posture due to pain, (e) complain that they cannot take care of themselves because of pain, (f) request for help in eating, bathing, and excretion, (g) complain of sleeplessness due to pain, (h) complain of pain to family by telephone or calling them to hospital, (i) reject rehabilitation because of pain, (j) complain of dissatisfaction and blame the neutral attitude of the therapist, and (k) overreact to pain by gait disturbance, crying, hysterical reaction. The

number of pain behavior per day was counted by the doctor, nurse, clinical psychologist, and other hospital staff.

Depressive mood was evaluated by the Zung Self-Rating Depression Scale (SDS) [13]. Anger score (0–9) was evaluated using the mental complaints in the Cornell Medical Index [14]. To evaluate the sleep quality, the sleep score (0–10) was checked using 5 questions that we prepared (Appendix) [15]. The patients answered 'yes', 'sometimes', or 'no' to each question, and these were scored as 2, 1, and 0 points, respectively.

The VAS pain and the number of pain behavior were checked during 1 week after admission and 1 week before discharge, and the mean values were recorded. The sleep score, SDS and anger scores were checked on admission and at discharge.

Degree of Satisfaction with Treatment

The degree of satisfaction with the treatment was evaluated at discharge using a 5-grade scale of 'very satisfactory', 'satisfactory', 'not sure', 'disappointing', and 'very disappointing'.

Outcomes 2 Years after Discharge

The outcomes 2 years after discharge were evaluated as 'good' in patients who were able to return to work, and 'poor' in patients who had not returned to work and/or with remaining hindrance in daily life.

Statistical Analysis

All data were expressed as means \pm SD. The comparisons between before and after treatment within the group were made with the Wilcoxon matched pairs signed ranks test. The comparisons between the two groups were compared using the Mann-Whitney U test. The VAS pain and the number of pain behavior at discharge were compared according to the outcomes after discharge using the Mann-Whitney U test. The outcomes in group A and group B were compared using the χ^2 test. $p < 0.05$ was regarded as significant.

Table 2. Changes in parameters before and after treatment

	Group A (n = 24)		Group B (n = 22)		p ¹
	before	after	before	after	
VAS pain score (0–10)	6.1 ± 1.4	4.0 ± 2.3**	6.0 ± 2.0	3.2 ± 2.1***	0.26
Number of pain behavior	12.0 ± 3.1	3.3 ± 2.2***	11.9 ± 2.7	2.1 ± 1.5***	0.07
Sleep score (0–10)	4.8 ± 2.9	4.0 ± 1.5	5.4 ± 3.0	3.5 ± 2.4**	0.34
SDS score	52 ± 12	45 ± 14***	50 ± 16	42 ± 9 **	0.66
Anger score (0–9)	4.3 ± 1.2	3.2 ± 1.9*	4.5 ± 1.1	2.2 ± 1.6***	0.05

Figures are means ± SD. * p < 0.05; ** p < 0.01; *** p < 0.001 compared with before treatment.

¹ Comparisons of values after treatment between the two groups. After treatment, the number of pain behavior was slightly smaller (p = 0.07) and anger score was significantly lower in group B than that in group A (p = 0.05).

Table 3. Outcomes 2 years after treatment

Outcomes	Group A (n = 24)		Group B (n = 22)	
	n	%	n	%
Good	12	50	17	77
Poor	12	50	5	23

Twelve patients (50%) in group A and 17 patients (77%) in group B showed good outcomes 2 years after discharge ($\chi^2 = 3.7$, p < 0.05).

Results

VAS Pain, Number of Pain Behavior, Sleep Score, SDS, and Anger Score before and after Treatment

On admission, there were no significant differences in VAS pain, number of pain behavior, sleep score, SDS, and anger score between the two groups. In both groups, VAS pain, number of pain behavior, SDS, and anger score significantly decreased after treatment (table 2). The sleep score significantly decreased after treatment in group B but not in group A. After treatment, the number of pain behavior was slightly smaller (p = 0.07) and anger score was significantly lower in group B than in group A (p = 0.05). Furthermore, the differences in number of pain behavior and anger score before and after treatment were larger in group B than in group A (8.7 ± 1.9 vs. 9.9 ± 1.8 , p < 0.05; 1.1 ± 2.0 vs. 2.3 ± 1.6 , p < 0.05, respectively). The difference in the sleep score before and after treatment was slightly greater in group B than in group A (0.8 ± 2.0 vs. 1.3 ± 1.9 , p = 0.06).

Outcomes 2 Years after Discharge

Twelve patients (50%) in group A and 17 patients (77%) in group B showed good outcomes 2 years after discharge (table 3). On the other hand, 12 patients (50%) in group A and 5 patients (23%) in group B showed poor outcomes ($\chi^2 = 3.7$, p < 0.05).

The Relationships between Outcomes and the Number of Pain Behavior and VAS Pain at Discharge

In patients with good outcomes after discharge, the mean number of pain behavior at discharge was 2/day or less in both groups (table 4). No differences were observed in the number of pain behavior or the VAS pain at discharge between the two groups according to the outcomes. In both groups, the number of pain behavior at discharge was significantly smaller in good outcomes than that in poor outcomes, but no significant relationship was noted between the VAS pain at discharge and the outcomes.

Degree of Satisfaction with Treatment

The treatment was rated as 'satisfactory' or 'very satisfactory' by 13 patients (55%) in group A and 18 (82%) in group B (table 5). It was rated as 'disappointing' by 6 patients (24%) in group A but none in group B ($\chi^2 = 14.9$, p < 0.01).

Discussion

The VAS pain, number of pain behavior, SDS, and anger score in patients with chronic pain significantly decreased after treatment in both groups. After treatment, the number of pain behavior was slightly smaller and an-

Table 4. Outcomes 2 years after discharge and the number of pain behavior and VAS pain score at discharge

Outcomes	Number of pain behavior			VAS pain score		
	total (n = 46)	group A (n = 24)	group B (n = 22)	total	group A	group B
Good	1.6 ± 1.3 (n = 29)	1.7 ± 1.4 (n = 12)	1.5 ± 1.2 (n = 17)	3.4 ± 2.4	3.5 ± 2.6	3.4 ± 2.2
Poor	4.6 ± 1.5 (n = 17)	4.8 ± 1.6 (n = 12)	4.0 ± 1.0 (n = 5)	3.9 ± 2.0	4.4 ± 1.8	2.6 ± 1.8
p value	<0.0001	0.0003	0.003	0.52	0.15	0.50

Figures are means ± SD. In both groups, the number of pain behavior at discharge was significantly smaller in good outcomes than that in poor outcomes, but no significant relationship was noted between the VAS pain score at discharge and the outcomes.

Table 5. Evaluation of treatment

Evaluation of treatment	Group A (n = 24)		Group B (n = 22)	
	n	%	n	%
Very satisfactory	4	17	14	64
Satisfactory	9	38	4	18
Not sure	5	21	4	18
Disappointing	6	24	0	0
Very disappointing	0	0	0	0

The treatment was rated as 'satisfactory' or 'very satisfactory' by 13 patients (55%) in group A and 18 (82%) in group B ($\chi^2 = 14.0$, $p < 0.01$).

ger score was significantly lower in the combined therapy group than those in the multidisciplinary treatment group. Furthermore, the differences in the number of pain behavior and anger score before and after treatment were significantly larger in the combined therapy group than those in the multidisciplinary treatment group. Although all patients were not working at the beginning of treatment, 50% of patients in the multidisciplinary treatment group and 77% of those in the combined therapy group returned to work 2 years after discharge.

Cutler et al. [16] conducted a meta-analysis of multidisciplinary treatment for chronic pain. They analyzed 37 studies that met their inclusion criteria. The mean proportion of patients who returned to work was 41%. The mean follow-up interval was 14 months. The outcomes of our treatment were better even though the follow-up interval of 2 years was longer. The following 2 issues may be considered as reasons for the favorable outcomes in the combined therapy group. First, the number

of pain behavior and anger score after treatment decreased in the combined therapy group in comparison with the multidisciplinary treatment group. Second, the degree of satisfaction with treatment was higher in the combined therapy group than in the multidisciplinary treatment group.

Fordyce et al. [17] distinguished chronic pain as a subjective sensation from pain behavior to express the presence of pain to other persons. Maruta et al. [18] mainly attempted to decrease pain behavior using a pain management program, and reported that improvement was achieved in 70% of patients at discharge and that 47% of them showed a good course 3 years after their program. In this study, the number of pain behavior at discharge was significantly smaller in patients with good outcomes compared to those with poor outcomes. However, no significant relationship was noted between the VAS pain at discharge and the outcomes. These results suggest that the treatment to reduce pain behavior can effectively improve the outcomes.

Thermal therapy is useful for relieving pain in patients with rheumatic disease [19], and mild warming exhibits sedative effects via the sensory nerve endings [20]. Furthermore, thermal therapy using far-infrared rays have a sleep-enhancing effect [21] and relaxation effect of mind and body [22]. In the combined therapy group, these effects of thermal therapy may be related to the improvement of pain and sleep quality, and these may have resulted in the higher degree of satisfaction with the treatment. When satisfaction was obtained, the patients could smoothly accept the therapist's behavioral counseling and neutral management to decrease pain behavior. In addition, a cognitive shift from negative emotional responses against pain to acceptance of pain was acquired. They also noted that it is important to live with pain rather than avoid it [23]. As a result, it is considered that

the number of pain behavior and pain-related anger decreased after repeated thermal therapy.

Twelve patients (50%) in the multidisciplinary treatment group showed poor outcomes compared with 5 patients (23%) in the combined therapy group. In patients with refractory chronic pain, pain-related anger may be readily converted to pain exceeding organic findings [24]. There is a positive relationship between chronic pain intensity and the trait anger [25]. We reported that patients with poor outcomes had chronic stress and they exhibited anger and aggressiveness that they did not know how to express or relieve [26]. In this study, 8 patients in the multidisciplinary treatment group and 6 patients in the combined therapy group had chronic stress that they could not resolve by themselves. When physicians were neutral to their pain behavior, and the treatments that were desired by patients were minimized by behavioral restrictions, the 8 patients in the multidisciplinary treatment group and 2 of the 6 patients in the combined therapy group caused trouble as they exhibited anger and aggressiveness against the therapist. The remaining 4 in the combined therapy group had chronic stress but were highly satisfied with the thermal therapy and did not show anger or aggressiveness. The patients who were continuously angry at the treatment and therapists could not shift their pain-related cognition and behavior and they resisted the disappearance of pain behavior during hospitalization.

We acknowledge that this study has several limitations that should be borne in mind in interpreting our results. First, nonvalidated instruments such as pain behavior and sleep score were used. Second, the severity of stress

felt by the subjects was not evaluated objectively. Third, the changes in pain-related cognition and behavior in the two groups were not concretely evaluated. Fourth, this study did not include a control group that solely reflected the natural course of chronic pain, so the time effects could not be evaluated.

In conclusion, a combination of multidisciplinary treatment and repeated thermal therapy decreased the number of pain behavior and anger score, and led to a better clinical course and outcomes in patients with chronic pain. Therefore, this combination therapy may be a promising method for treatment of chronic pain.

Acknowledgement

We thank the nursing and administrative staff of Hattanmaru Hospital for their contribution in carrying out the protocol.

Appendix

To evaluate sleep quality, we constructed the following 5 questions.

- 1 Do you have difficulty in falling asleep?
(yes, sometimes, no)
- 2 Do you have difficulty in staying asleep?
(yes, sometimes, no)
- 3 Do you wake up frequently?
(yes, sometimes, no)
- 4 Do you wake up early?
(yes, sometimes, no)
- 5 Do you feel weary on awakening?
(yes, sometimes, no)

References

- 1 McCracken LM, Turk DC: Behavioral and cognitive-behavioral treatment for chronic pain. *Spine* 2002;27:2564–2573.
- 2 Jensen IB, Bergstrom G, Ljungquist T, Bodin L, Nygren AL: A randomized controlled component analysis of a behavioral medicine rehabilitation program for chronic spinal pain: Are the effects dependent on gender? *Pain* 2001;91:65–78.
- 3 Kroenke K, Swindle R: Cognitive-behavioral therapy for somatization and symptom syndromes: A critical review of controlled clinical trials. *Psychother Psychosom* 2000;69:205–215.
- 4 Turk DC: Clinical effectiveness and cost-effectiveness of treatments for patients with chronic pain. *Clin J Pain* 2002;18:355–365.
- 5 Harkapaa K, Jarvikoski A, Mellin G, Hurri H, Luoma J: Health locus of control beliefs and psychological distress as predictors for treatment outcome in low back pain patients: Results of a 3-month follow-up of a controlled intervention study. *Pain* 1991;46:35–41.
- 6 Schwartz L, Slater MA, Birchler GR: The role of pain behaviors in the modulation of marital conflict in chronic pain couples. *Pain* 1996;65:227–233.
- 7 McMahon MJ, Gatchel RJ, Polatin PB, Mayer TG: Early childhood abuse in chronic spinal disorder patients: A major barrier to treatment success. *Spine* 1997;22:2408–2415.
- 8 Payne B, Norfleet MA: Chronic pain and the family: A review. *Pain* 1986;26:1–22.
- 9 Michlovitis SL: *Thermal Agents in Rehabilitation*. Philadelphia, FA Davis Company, 1986, pp 99–118.
- 10 Greenberg RG: The effects of hot packs and exercise on local blood flow. *Phys Ther* 1972;52:273–276.
- 11 Tei C, Horikiri Y, Park JC, Jeong JW, Chang KS, Toyama Y, Tanaka N: Acute hemodynamic improvement by thermal vasodilation in congestive heart failure. *Circulation* 1995;91:2582–2590.
- 12 Kihara T, Biro S, Imamura M, Yoshifuku S, Takasaki K, Ikeda Y, Otsuji Y, Minagoe S, Toyama Y, Tei C: Repeated sauna treatment improves vascular endothelial and cardiac function in patients with chronic heart failure. *J Am Coll Cardiol* 2002;39:754–759.

- 13 Zung WWK: A self-rating depression scale. *Arch Gen Psychiatry* 1965;12:63–70.
- 14 Brodman K, Erdmann AJ, Lorge I, Gershenson CP, Wolf HG, Caples B: The Cornell Medical Index-Health questionnaire. 3. The evaluation of emotional disturbances. *J Clin Psychol* 1952;8:119–124.
- 15 Masuda A, Nozoe S, Matsuyama T, Tanaka H: Psychobehavioral and immunological characteristics of adult people with chronic fatigue and patients with chronic fatigue syndrome. *Psychosom Med* 1994;56:512–518.
- 16 Cutler RB, Fishbain DA, Rosomoff HL, Abdel-Moty E, Khalil TM, Rosomoff RS: Does nonsurgical pain center treatment of chronic pain return patients to work? A review and meta-analysis of the literature. *Spine* 1994;19:643–652.
- 17 Fordyce WE, Fowler RS Jr, Lehmann JF, DeLateur BJ, Sand PL, Trieschmann RB: Operant conditioning in the treatment of chronic pain. *Arch Phys Med Rehabil* 1973;54:399–408.
- 18 Maruta T, Swanson DW, McHardy MJ: Three year follow-up of patients with chronic pain who were treated in a multidisciplinary pain management center. *Pain* 1990;41:47–53.
- 19 Nurmikko T, Hietaharju A: Effect of exposure to sauna heat on neuropathic and rheumatoid pain. *Pain* 1992;49:43–51.
- 20 Lehman JF, Brunner GD, McMillan JA, Silverman DR, Johnson VC: Modification of heating patterns produced by microwaves at the frequencies of 2,456 and 900 mc by physiologic factors in the human. *Arch Phys Med Rehabil* 1964;45:555–563.
- 21 Honda K, Inoue S: Sleep-enhancing effects of far-infrared radiation in rats. *Int J Biometeorol* 1988;32:92–94.
- 22 Masuda A, Kihara T, Fukudome T, Shinsato T, Minagoe S, Tei C: The effects of repeated thermal therapy for two patients with chronic fatigue syndrome. *J Psychosom Res*, in press.
- 23 McCracken LM: Learning to live with the pain: Acceptance of pain predicts adjustment in persons with chronic pain. *Pain* 1998;74:21–27.
- 24 Engel GL: 'Psychogenic' pain and the pain prone patient. *Am J Med* 1959;26:899–918.
- 25 Bruehl S, Burns JW, Chung OY, Ward P, Johnson B: Anger and pain sensitivity in chronic low back pain patients and pain-free controls: The role of endogenous opioids. *Pain* 2002;99:223–233.
- 26 Hattanmaru K, Masuda A, Nakayama T, Kuroki N, Tei C, Hattanmaru M: Multidisciplinary treatment and the outcome in patients with chronic pain (in Japanese). *Jpn J Psychosom Med* 2004;44:193–200.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.