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Original Article

A Multidisciplinary Approach to the Management of Chronic Pain through a Self-managed Behavioral Exercise Program: A Pilot Study in Japan

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We conducted this study to determine the short-term treatment outcomes of multidisciplinary approaches to chronic pain management for outpatients in Japan. We evaluated pain reduction and improvement in quality of life (QOL) after treatment. We analyzed 32 patients who had experienced intractable chronic pain for >3 months. The patients received multidisciplinary therapeutic self-managed exercise instructions and then underwent evaluations 1 and 3 months after the treatment. We used the Pain Disability Short Form-36 (SF-36), Pain Catastrophizing Scale (PCS), and Pain Disability Assessment Scale (PDAS) to evaluate QOL. Although the pain levels were the same before and after the physical exercise program, the patients showed significant improvements in physical function on the SF-36 (48.5 vs. 54.5, 3 months vs. 1 month; $p=0.0124$), the magnification subscale on the PCS (6.8 vs. 5.9, 1 month vs. before; $p=0.0164$) and the PDAS (29.2 vs. 23.4, 3 months vs. before; $p=0.0055$). Chronic pain should be treated with a biopsychosocial approach, but time constraints and costs have limited the implementation of multidisciplinary and behavioral approaches to chronic pain management. Our findings demonstrate that clinical improvements are possible for patients with chronic pain, using multidisciplinary team resources widely available in Japanese clinical practice.

Key words: multidisciplinary treatment, pain management, quality of life, biopsychosocial approach, chronic pain

A challenging issue in developed countries is the clinical management of chronic pain [1,2], which affects an individual's quality of life (QOL) and has economic consequences in terms of employment and costs to health services. However, there is currently no standard definition of chronic pain [3,4]. For nonmalignant pain, chronic pain has been defined as persistent or recurrent pain over a period of >3 months [5,6]. The reported numbers of patients in developed countries suffering from chronic pain range from 12% to 30% of the population [1-3]. In Japan, 15% of the population is estimated to have experienced chronic musculoskeletal pain [1].

Chronic pain usually lowers a person's QOL and can cause harmful effects such as insomnia, anxiety, depression, and decreased physical activity [7,8]. High medical costs are incurred when individuals with chronic pain visit medical facilities and are prescribed

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several types of oral medicine [1,9]. In addition, many of these individuals must take a leave of absence from work or, in the worst case, stop working, which may lead to significant socioeconomic and personal consequences [3].

In addition to cognitive and behavioral therapy, a multidisciplinary approach to pain management that covers all patient factors, including the patient's socioeconomic background, is recommended [9-13]. However, because chronic pain is most often treated with a biopsychosocial approach, physicians have not yet established the optimal type of behavioral therapy for chronic pain. Since intensive behavioral therapy requires significant time and human resources, it has been implemented in very few facilities in Japan despite reports showing its effectiveness [14,15]. The low number of intensive behavioral therapies may be due to the Japanese medical system, which greatly differs from those in many Western countries. In Japan, it is difficult for medical professionals to assemble and conduct medical treatment in cooperation with one another, and there are few doctors and nursing staff compared to the patient population [16,17]. This situation also makes it difficult for doctors to attend meetings at fixed times each week.

Multidisciplinary programs for chronic pain patients range from an intensive 60-h program developed by Pietila *et al.* [18] to a light rehabilitative intervention (an individual rehabilitation plan) program trial developed by Merric *et al.* [19]. Both were shown to be effective multidisciplinary therapies. However, even the light intervention program required 2 days for evaluation as well as the participation of both the patient and his or her general practitioner (GP) physician in patient-doctor conferences. In Japan, GPs do not generally participate in such conferences.

We have therefore designed a simple multidisciplinary approach for chronic pain management that can be implemented using the current medical resources in Japan. The purpose of the present study was to assess the feasibility and effects of this approach, which we termed "outpatient pain liaison treatment."

Methods

Design. This single-arm pilot study investigated the effects of our outpatient pain liaison treatment on QOL, anxiety, depression, and pain by prospectively evaluating consecutive patients who were examined at the Okayama University Hospital Pain Liaison Outpatient Treatment Center between September 2012 and August 2013. All patients provided written informed consent to participate.

The treatment team was comprised of many specialists, and the patients were asked to visit the clinic four times over a 6-month period (an initial visit followed by visits at 1 month, 3 months, and 6 months later). We did not include the patient assessment at 6 months in this pilot study, because our purpose was to assess the feasibility of this team approach at its early phase so that challenges could addressed before the approach was fully implemented.

Inclusion and exclusion criteria. The inclusion criteria were as follows: the presence of chronic pain for ≥3 months, the presence of pain requiring multidisciplinary treatment, the ability to understand the objectives and process of the outpatient pain liaison treatment, and willingness to participate in the study. The requirement for multidisciplinary treatment was determined by one of the authors (HN) during the initial screening visit and the subsequent conference. If the pain was strongly affected by psychosocial factors and low levels of physical activity, the patient was recommended for multidisciplinary treatment. The exclusion criteria were as follows: inability or refusal to complete the questionnaire, inability to regularly visit the hospital, the patients who were consulting other specialists (such as for schizophrenia, depression, and cancer), and rejection by the treatment team. A small number of patients who were unlikely to exercise by themselves were excluded from the study.

Recruitment. The patients were referred for examination at the Pain Liaison Outpatient Treatment Center by their local GP or primary doctor from another department. One of the authors (HN) screened the patients, arranged an appointment for an initial multidisciplinary therapy examination, and initiated treatment for the eligible candidates.

Procedure. The Okayama University Ethics Committee approved this study (#1,466). The procedure used is illustrated in Fig. 1. All patients completed medical questionnaires in advance. After the first consultation, the patients were treated by four specialists: an anesthesiologist, an orthopedic surgeon, a clinical psychologist or psychiatrist, and a physiotherapist. These specialists were all located on the same floor

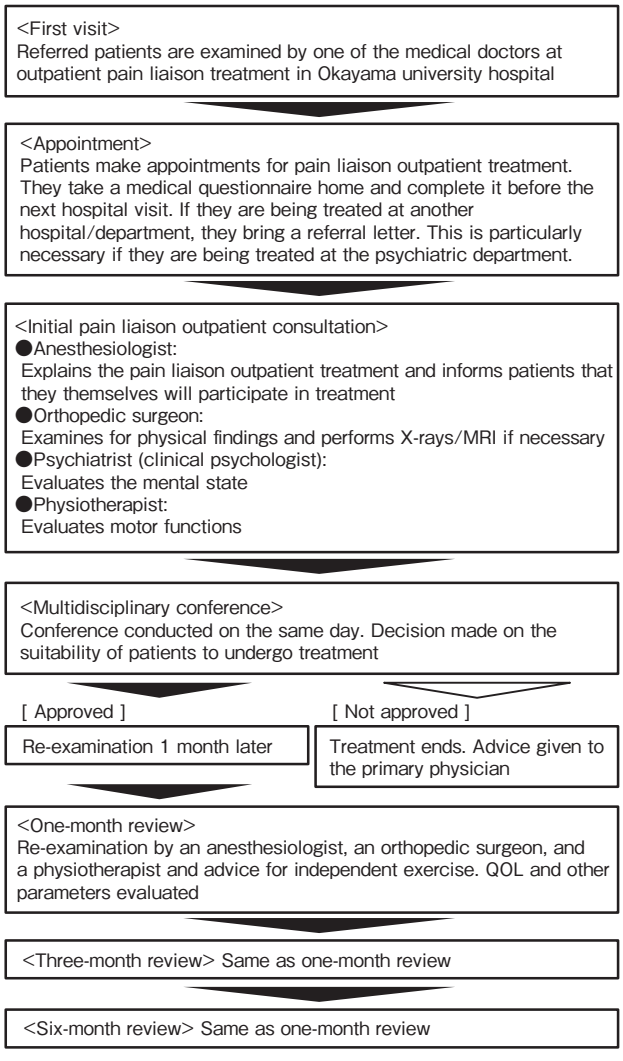

Fig. 1 Multidisciplinary self-pain management process.

of our pain center. The anesthesiologist had the role of pain specialist, explaining to the patient that (1) the outpatient pain liaison treatment included the setting of objectives and the performance of therapeutic exercises with guidance from medical staff from multiple disciplines and (2) the patient him- or herself would be involved in the treatment process. The anesthesiologist understood the biopsychosocial aspects of each patient's background and the contents of medication and treatment. He or she also directed the multidisciplinary conference. In the role of anesthesiologist, he/she provided his/her conclusions regarding the necessity of interventional treatment.

The orthopedic surgeon examined each patient for musculoskeletal problems, and the clinical psychologist or psychiatrist examined the patient's psychological status. The physiotherapist evaluated the physical functions and performed the timed up and go (TUG), finger floor distance (FFD), and one-leg-stand tests. He or she also measured the range of motion (ROM) that indicates joint function and muscle strength. If the patient's ROM was improved compared to the values either before treatment by the physiotherapist or as observed on previous visits, we considered the pain as treatable and instructed the patient regarding how to engage in active exercise of the joint. If the patient's muscles were judged to be weak, the weakness was considered to be related to the cause of pain, and we developed appropriate muscle strengthening exercises.

Next, the physiotherapist demonstrated three types of exercises that the patients could perform by themselves. The types of exercise were different for each patient. One set was defined as a single exercise type to be performed 10 times. The physiotherapist asked the patient to perform 2-3 sets of exercises a day. This guidance visit lasted for approx. 2 h.

A conference was then held with various staff members that included nurses, dental anesthesiologists, and occupational therapists. The aim of this conference was to determine the suitability of patients for outpatient pain liaison treatment and therapeutic exercise. If a patient was found to have mental or physical disorders that required treatment on a priority basis, he/she was excluded from the analysis and treated accordingly.

The patients approved for multidisciplinary treatment visited the hospital 1 month later and received instructions regarding therapeutic exercises. The exercises were performed depending on the patient's condition. The physiotherapist provided the same treatment as on the first visit. During this visit, a nurse also interviewed the patient and identified the therapeutic objectives of the patient for the next 2 months. All patients performed therapeutic exercises independently for 2 months at home. A clinical psychologist screened the patients regarding the presence of psychiatric disorders, and the psychologist advised the patients about whether to see a psychiatrist.

Three months after the initial consultation, the patients returned to the hospital to be examined by an anesthesiologist, an orthopedic surgeon, a physiotherapist, and a clinical psychologist. All patients maintained an activity diary, in which they recorded their

ability to perform rehabilitative exercises, work, and/or housework. They also recorded their outdoor visits, pain intensity, intake of pain medications, meals, and sleep history.

Outcome measures. All patients completed the requested medical questionnaires before the initial consultation and at the end of the 1- and 3-month periods. The patients were asked to evaluate their pain intensity and any interference of activity on the Brief Pain Inventory (BPI), any anxiety and depression on the Hospital Anxiety and Depression Scale (HADS), pain catastrophizing on the Pain Catastrophizing Scale (PCS), and their QOL by completing the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36) (RAND, Santa Monica, CA, USA) and the Pain Disability Assessment Scale (PDAS).

The basic demographic data assessed in this study were sex, age, height, weight, academic background, and employment. Each patient's satisfaction with previous medical treatment, oral medication history, and sleep cycle were also assessed. The multidisciplinary team assessed the above data at each visit. The physiotherapist prescribed additional exercises if the patient was able to complete the exercise regimen prescribed at the previous visit. Finally, the nurse helped the patient set future goals, and the clinical psychologist provided appropriate counseling.

The brief pain inventory (BPI). The BPI [20] evaluates pain intensity on an 11-point scale where 0 is no pain and 10 is maximum pain. All patients recorded their current pain ratings and their highest, lowest, and average pain ratings over each 24-h period. These four ratings were averaged. The BPI also evaluates pain-induced alterations in mood and behavior in 7 domains where 10 indicates the maximum (worst) score. The patient's scores for these 7 domains were also averaged.

The SF-36. The SF-36 measures health-related QOL and has been noted for its reliability [24]. It is divided into eight subscales: physical functioning (PF), role functioning (physical; RP), bodily pain (BP), general health (GH), vitality (VA), social functioning (SF), role functioning (emotional; RE), and mental health (MH).

The hospital anxiety and depression scale (HADS). The HADS [21] is a medical questionnaire that evaluates anxiety and depression and comprises 14 questions: 7 evaluate anxiety, and the other seven evaluate depression. Each question has 4 possible answers, and the scores range from 0 to 21 points (a higher score indicates worse symptoms). Anxiety and/or depression are suspected with scores of 8-10 and strongly suspected with scores of ≥ 11.

The pain catastrophizing scale (PCS). The PCS was developed by Sullivan in 1995 [22] and evaluates pain catastrophizing using 13 questions. Pain catastrophizing has been broadly defined as an exaggerated negative orientation toward the nociceptive stimulus and an experience of pain [21, 23]. The PCS comprises three subscales: rumination, helplessness, and magnification. Rumination is defined as giving too much attention to pain; helplessness is defined as a feeling that nothing can be done to decrease the pain, and magnification is defined as an overestimation of the extent of pain.

The pain disability assessment scale (PDAS). The PDAS is a medical questionnaire that evaluates the extent of impairment in the activities of daily living (ADLs) and comprises 20 items related to ADLs such as household chores, vacuuming, gardening, and jogging [26]. Each activity is evaluated from grade 0 to 3, with a maximum possible score of 60.

Statistical analysis. We evaluated each patient's mean scores for all scales before, 1 month after, and 3 months after the intervention by performing a repeated-measures analysis of variance (ANOVA) with a significance level of $p < 0.05$, followed by a post hoc t-test to assess individual time points. Bonferroni correction was used to compensate for the multiple tests; the corrected significance level was $p < 0.017$. JMP ver. 11 software (SAS, Cary, NC, USA) and the G*Power3 program [26] were used for all statistical analyses.

Results

Table 1 summarizes the patients' attributes. There were more females than males, and their diagnoses varied. A total of 40 patients were examined; however, since 8 patients dropped out over the 3-month study period, the remaining 32 patients were used in the analysis. The reasons for dropout included the refusal to continue (n = 2), refusal to complete a questionnaire (n = 1), being deemed unsuitable for treatment at the conference (n = 2), having a diagnosis of a concurrent psychiatric disorder (n = 2), and inability to understand the study protocol (n = 1).

There were no significant differences in pain inten-

Table 1 Background characteristics of the participants

Characteristics		
Sex (male, %)	10	31
Sex (female, %)	22	69
Age (mean, SD)	56.9	15.8
Age (n, %)		
20–29	1	3
30–39	4	13
40–49	6	19
50–59	5	16
60–69	7	22
70–79	8	25
80–89	1	3
BMI (mean, SD)	23.2	4.2
Level of education (n, %)		
≤12 years	23	71
>12 years	8	25
Unknown	1	3
Bodily Part of Pain (n, %)		
Trunk	13	41
Whole body	7	22
Upper limb	5	16
Head and neck	4	13
Lower limb	3	9
Diagnosis Diagnosis (n, %)		
Chronic postsurgical pain or trauma	9	28
Fibromyalgia	6	19
Postherpetic neuralgia	3	9
Cervical hernia	3	9
Cervical syndrome	2	6
Low back pain	2	6
Myofascial pain	2	6
Cervical spondylosis	1	3
Facial pain	1	3
Thoracic outlet syndrome	1	3
Osteitis	1	3
Lumbar canal stenosis	1	3
Satisfaction with medical care (n, %)		
Very satisfied	0	0
Moderately satisfied	5	16
Neither	12	38
A little unsatisfied	7	22
Very unsatisfied	8	25
Medication (n, %)		
Opioids	4	13
Antidepressants	15	47
Sleep (n, %)		
Good	6	19
Sometimes sleepless	11	34
Cannot sleep	15	47
Work status		
Employed	4	13
Absent from work	1	3
Homemaker	8	25
Employed as a disabled worker	1	3
Unemployed	18	36

SD, standard deviation; BMI, body mass index. ($n = 32$)

sity (as measured by the BPI) before and at 1 month after or 3 months after the intervention (Table 2, Fig. 2). The patients' results on the PF subscale of the SF-36 improved significantly. Overall, the PCS total scores improved, but there were no significant differences. Two elements from the PCS subscale, *i.e.*, "helplessness" and "magnification," showed significant improvement. The patients' PDAS scores were also significantly improved post-intervention.

We conducted post hoc tests by paired *t*-test, and significant improvements were observed for the PF subscale of the SF-36 (3 months vs. 1 month), magnification in the PCS (1 month vs. before), and the PDAS (3 months vs. before). The effect sizes of the PF subscale of the SF-36, magnification in the PCS, and the PDAS between scores recorded before and 3 months after the intervention were 0.436, 0.340 and 0.527, respectively (Table 3).

Discussion

To our knowledge, this study is the first to verify the short-term effects of a multidisciplinary treatment (simple outpatient pain liaison treatment) on patients with chronic pain in Japan. No changes in pain intensity were observed after the intervention, but the PDAS-evaluated QOL, the physical QOL assessed by the SF-36, and "magnification" assessed by the PCS improved. In particular, the PDAS and SF-36 demonstrated improvements in ADLs and PF, respectively, suggesting that although the patients' pain intensity remained unchanged, their motor function improved. It is thus apparent that the QOL of individuals with intractable chronic pain can be improved by defining therapeutic objectives and conducting therapeutic exercise sessions involving the patient. Instead of using instruments for exercise therapy or setting a standard for goal setting, we encouraged the patients to exercise and decide the goals by themselves.

Although the patients' total PCS scores improved, the changes were not significant, which may be due to the small sample size. If there were a greater number of patients, the catastrophizing thoughts regarding pain may have decreased. Our results indicate that the outpatient pain liaison treatment was moderately effective for intractable chronic pain. The key aspect of this treatment program is its simplicity, requiring only three 2-h sessions, three 1-h conferences, and the

Table 2 Significance of changes in outcomes before, 1 month after, and 3 months after intervention

Variable (measure)	Before (B) Mean (SD)	1 month Mean (SD)	3 months Mean (SD)	*P*-value	B/1 month *P*-value	B/3 months *P*-value	1 month/3 months *P*-value
SF-36 (QOL)							
Physical functioning (PF)	48.5 (24.2)	48.3 (23.6)	54.5 (21.3)	*0.0214*	0.9324	0.0194	*0.0124*
Role: physical (RP)	36.1 (26.6)	40.8 (26.7)	39.9 (26.0)	0.5243	0.2629	0.4367	0.8166
Bodily pain (BP)	25.2 (15.9)	27.9 (15.6)	26.8 (15.7)	0.5512	0.2475	0.5648	0.6474
General health (GH)	34.6 (16.7)	38.4 (16.9)	37.7 (20.0)	0.1174	0.0367	0.1561	0.7044
Vitality (VA)	32.4 (22.3)	33.1 (21.7)	32.3 (20.4)	0.7762	0.5981	0.8850	0.4828
Social functioning (SF)	41.4 (30.2)	47.2 (28.9)	41.4 (26.8)	0.3636	0.1839	1.0000	0.2371
Role: emotional (RM)	49.5 (34.5)	46.6 (32.1)	46.1 (30.3)	0.7517	0.5740	0.5038	0.9061
Mental health (MH)	50.8 (23.3)	54.8 (21.6)	49.8 (25.6)	0.1628	0.0951	0.7769	0.0562
Pain intensity (0–10) (mean, SD)	6.1 (2.0)	6.0 (1.9)	6.2 (1.9)	0.4691	0.4907	0.6203	0.1301
Pain interference (0–10) (mean, SD)	6.0 (2.4)	5.6 (2.0)	5.5 (2.2)	0.2719	0.1586	0.1887	0.7441
HADS							
Anxiety (mean, SD)	9.0 (5.3)	8.0 (5.2)	8.3 (5.8)	0.1240	0.0589	0.1923	0.5213
Depression (mean, SD)	9.9 (4.8)	9.5 (4.8)	9.2 (4.3)	0.4379	0.4454	0.2607	0.5332
Pain Catastrophizing Scale							
Total (mean, SD)	33.1 (11.1)	31.2 (11.3)	29.9 (11.7)	0.0603	0.0966	0.0590	0.2719
Rumination (mean, SD)	15.2 (4.2)	14.4 (4.9)	14.6 (4.5)	0.3551	0.1391	0.3653	0.6811
Helplessness (mean, SD)	11.2 (4.6)	10.8 (4.7)	9.8 (5.2)	*0.0488*	0.5216	0.0780	0.0567
Magnification (mean, SD)	6.8 (3.4)	5.8 (3.0)	5.9 (3.2)	*0.0303*	*0.0106*	0.0365	1.0000
PDAS (mean, SD)	29.2 (12.9)	25.6 (11.6)	23.4 (11.5)	*0.0063*	0.1492	*0.0095*	0.0461

SD, standard deviation; QOL, quality of life; SF-36, Medical Outcomes Study 36-Item Short Form Health Survey; HADS, Hospital Anxiety and Depression Scale; PDAS, Pain Disability Assessment Scale. ($n = 32$)

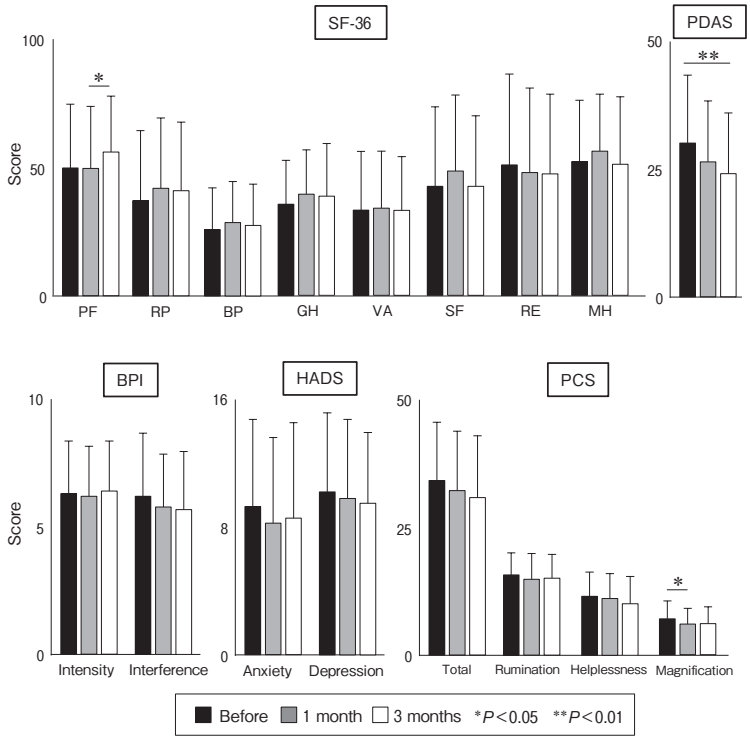

Fig. 2 Significance of changes in outcomes before, 1 month after, and 3 months after the intervention (n = 32). The *p*-values were calculated by paired *t*-test with Bonferroni correction. $p < 0.05$ (the corrected $p < 0.017$) was defined as significant. PF, physical functioning; RP, role functioning (physical); BP, bodily pain; GH, general health; VA, vitality; SF, social functioning; RE, role functioning (emotional); MH, mental health.

Table 3 Effect size and post hoc power analysis for changes in outcome measures before and after intervention

Variable (measure)	Effect size	Post hoc power	Required sample
SF-36 (QOL)			
Physical Function	0.436	0.666	44
Role/physical	0.139	0.119	407
Bodily pain	0.103	0.087	743
General health	0.257	0.291	121
Vitality	0.013	0.051	48,178
Social functioning	0.000	0.050	NA
Role/emotional	0.120	0.101	551
Mental health	0.051	0.059	3,077
HADS			
Anxiety	0.236	0.253	144
Depression	0.203	0.199	194
Pain Catastrophizing Scale			
Total	0.347	0.478	68
Rumination	0.162	0.145	300
Helplessness	0.338	0.457	71
Magnification	0.340	0.461	70
PDAS	0.527	0.811	31

QOL, quality of life; SF-36, Medical Outcomes Study 36-Item Short Form Health Survey; HADS, Hospital Anxiety and Depression Scale; PDAS, Pain Disability Assessment Scale; NA, not applicable. ($n = 32$)

self-management of chronic pain by the patients performing exercises at their own homes [27].

The patients' scores on the magnification subscale of the PCS improved between the initial visit and the 1-month review, indicating a possible improvement in the outcome. We believe that discussions with medical staff can improve a patient's psychosocial aspects. Regarding the PF subscale of the SF-36 and the PDAS, significant improvements were observed, suggesting that exercising toward the patient's self-identified goal is important.

Thus the biopsychosocial approach is a key aspect of chronic pain treatment, and this approach addresses the difficulty that a single physician encounters when treating chronic pain patients. This is why we formed a pain liaison team. As a team, we considered all of the psychological and social aspects of each patient's background. We also aided the patients' goal setting and maintained their motivation to exercise by themselves. During the outpatient pain liaison treatment, we explained that the treatment requires the patient's active participation. These aspects of our program explain why this treatment was effective. Because of its simplicity, a team like ours could be formed in an acute hospital with many patients. This is an important point in Japan.

Many reports from Western countries have shown the effectiveness of multidisciplinary treatment for chronic pain. However, few reports have evaluated multidisciplinary management (with an anesthesiologist, an orthopedic surgeon, a psychology specialist, and a physiotherapist) of chronic pain in Japan. Inoue *et al.* reported a type of multidisciplinary treatment for patients with chronic pain in 2014 [13]. However, that team therapy was mainly conducted by a physiotherapist.

In Japan, palliative care for cancer patients has undergone remarkable development. The first Japanese hospice appeared in 1981 [28]. Since then, there have been continuous efforts to spread palliative care in Japan. The Japanese government approved the subsidization of palliative care for patients with cancer in 2002 [29]. After that point, thanks to the Cancer Control Act approved by the Japanese government, palliative care teams were started in hospitals all over Japan. We must make further efforts in order to spread multidisciplinary pain treatment for non-cancer patients, so that the Japanese government approves a law regarding chronic pain patients as it has for cancer patients.

Limitations. This study has several limitations. The small number of subjects and the lack of a control group make it difficult to extrapolate our findings. However, a medium effect size was achieved for the SF-36 scale and the PDAS, suggesting improved QOL. If these were simply placebo effects, the pain scores should also have improved because the numeric pain rating scale (NRS) is prone to subjectivity. These results justify continued research into multidisciplinary chronic pain management in Japan. We plan to conduct a multicenter trial with carefully selected patients and interventions.

Patients with chronic pain often take many medications and may require one or more leaves of absence from work; this decreases their QOL and results in significant socioeconomic losses. In the future, a randomized controlled trial (RCT) that considers the medical economics of outpatient pain liaison treatment should be conducted. If the number of medical examinations and the volume of medications administered can be decreased, there will be an overall decrease in medical costs despite the added costs of multidisci-

plinary teams. In conclusion, multidisciplinary behavioral self-management of intractable chronic pain may be useful for improving the QOL of individuals with chronic pain. We plan to continue this work and conduct an RCT that investigates the economic effects of this treatment process.

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