SLEEP PATTERNS IN FIBROMYALGIA PATIENTS

By

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Introduction

Fibromyalgia, a chronic pain syndrome characterized by chronic widespread musculoskeletal pain, fatigue, sleep disturbance, and the presence of multiple reproducible *tender points*. This controversial chronic pain syndrome, previously known as fibrositis, has been studied since 1904 and has become a worldwide interest (Jacobsen, Danneskiold-Samsøe, & Lund, 1992). The term fibromyalgia was introduced by P. K. Hence in 1976 (fibro = fiber, myo = muscle, algos = pain, ia = condition) (Powers, 1993). While the term accurately reflects the condition, many patients go undiagnosed. This unfortunate circumstance occurs primarily because of lack of knowledge about signs and symptoms of this disorder. Symptoms of fibromyalgia are mistaken for other associated problems.

This study, which compared the reported sleep patterns of fibromyalgia patients with those of age and sex matched controls, was part of a larger study evaluating the prevalence of fibromyalgia in a family practice clinic setting. The study utilized the 1990 diagnostic criteria adopted from the American College of Rheumatology. The criteria included widespread musculoskeletal pain which is axial in location, and present for at least three months. On physical examination, 11 or more *tender points* (out of a possible selected 18) must be present (Figure 1) (Wolfe, Smythe, & Yunus, 1990). A multicenter study conducted in 1986 confirmed that in addition to the above criteria, most patients suffer from

overwhelming fatigue, sleep disturbance, and morning stiffness. Nonrestorative sleep has been described in fibromyalgia patients (Powers, 1993; Goldenberg, 1988; Moldofsky, 1982; Bennett, 1992). This study will *subjectively* describe the patterns of sleep experienced by fibromyalgia patients and those of controls.

Figure 1. Tender points.

Note: From "Rheumatic pain modulation syndrome: The interrelationships between sleep, central nervous system serotonin, and pain" by H. Moldofsky, 1982, *Adv. Neurol., 33*, p. 51.

Literature Review

History

Froreip, a German researcher, was among the first to recognize distinctive areas of muscle tenderness and coined the term *muskelschwiele*

or muscle callus in the nineteenth century (Powers, 1993; Boissevain & McCain, 1991). Gowers coined the term *fibrositis* in 1904 and defined it as a form of inflammation of the fibrous tissue of the muscles. The term *fibrositis* is misleading since the findings of inflammation have not been replicated by further research.

The first description of *tender points* was by M. Lange in 1931, who reported 32 paired locations where hardening occurred and palpation produced pain (Simons, 1975). It was in the 1930s that *trigger point* was differentiated from *tender points*. A trigger point produces pain at a site distant to palpation; *tender points* produce pain at the site of palpation. These reproducible tender points are necessary for diagnosis (see Figure 1). Moldofsky and Smythe (1977, 1978) described symptoms of the syndrome, including chronic musculoskeletal aching, nonrestorative sleep, morning stiffness and awakening feeling unrefreshed, and an EEG finding of alpha intrusion of non-REM sleep.

Fibromyalgia

The current clinical picture of fibromyalgia has evolved from studies done in the 1980s. A study by Yunus, Masi, Calabro, Miller, and Fiegenbaum (1981) proposed diagnostic criteria by comparing fibromyalgia patients with matched control volunteers. Of the 50 patients studied with fibromyalgia, 86 percent were women (mean age was 34), and all were Caucasian. Ninety-eight percent reported generalized aches and pains, 92

percent reported tiredness, and 56 percent reported sleep problems. Wolfe, Hawley, Cathey, Caro, and Russell (1985) studied 58 normal individuals, 136 rheumatic disease patients, and 155 fibromyalgia patients and found similar symptoms in fibromyalgia patients corroborating the findings of Yunus et al. (1981) (Wolfe et al., 1985). These symptoms included muscle and joint pain, nonrestorative sleep, morning stiffness and aching, and axial skeletal pain. The only significant difference found between the fibromyalgia patients and the rheumatic disease patients was that the tender point count was significantly higher for the fibromyalgia patients (Wolfe et al., 1985). This confirmed that the presence of tender points was necessary for the diagnosis of fibromyalgia.

The development of the diagnostic criteria for fibromyalgia is a very important turning point in understanding fibromyalgia syndrome. The American College of Rheumatology accepted the findings from a 1986 study that investigated fibromyalgia in 16 centers in the United States and Canada. The consensus at that time was to adopt the term fibromyalgia and use the following criteria for diagnosis: (a) history of widespread pain, (b) pain in 11 of 18 tender point sites on digital palpation (Wolfe, Smythe, & Yunus, 1990) (see Table 1).

Fibromyalgia involves primarily the muscles with pain being chronic and present for at least three months. The pain is axial in location and widespread, involving three out of four quadrants of the body. Patients

Table 1

The American College of Rheumatology 1990 Criteria for the Classification of Fibromyalgia

1. History of widespread pain.
   Definition. Pain is considered widespread when all of the following are present: pain in the left side of the body, pain in the right side of the body, pain above the waist, and pain below the waist. In addition, axial skeletal pain (cervical spine or anterior chest or thoracic spine or low back) must be present. In this definition, shoulder and buttock pain is considered as pain for each involved side. "Low back" pain is considered lower segment pain.

2. Pain in 11 of 18 tender point sites on digital palpation.
   Definition. Pain, on digital palpation, must be present in at least 11 of the following 18 tender point sites:

   Occiput: bilateral, at the suboccipital muscle insertions.
   Low cervical: bilateral, at the anterior aspects of the intertransverse spaces at C5–C7.
   Trapezius: bilateral, at the midpoint of the upper border.
   Supraspinatus: bilateral, at origins, above the scapula spine near the medial border.
   Second rib: bilateral, at the second costochondral junctions, just lateral to the junctions on upper surfaces.
   Lateral epicondyle: bilateral, 2 cm distal to the epicondyles.
   Gluteal: bilateral, in upper outer quadrants of buttocks in anterior fold of muscle.
   Greater trochanter: bilateral, posterior to the trochanteric prominence.
   Knee: bilateral, at the medial fat pad proximal to the joint line.

   Digital palpation should be performed with an approximate force of 4 kg. For a tender point to be considered "positive" the subject must state that the palpation was painful. "Tender" is not to be considered "painful."

From "The American College of Rheumatology 1990 criteria for the classification of fibromyalgia: Report of the multi-center criteria committee" by F. Wolfe, N. A. Smythe, and M. B. Yunus, 1990, *Arthritis and Rheumatism, 33*, p. 171.

often describe their pain as being constant, aching, radiating, steady, gnawing, and spreading (Leavitt, Katz, Golden, Glickman, & Layfer, 1986; Goldenberg, 1989). Modulating factors, or factors that make the pain worse, include cold, humidity, weather changes, poor sleep, overexertion, and physical or emotional stress (Wolfe, Smythe, & Yunus, 1990; Yunus et al., 1981; Campbell, Clark, Tindall, Forehand, & Bennett, 1983; Bennett, 1992).

There is supporting evidence to show that fibromyalgia patients have an enhanced perception of their pain due to the reduction in neuro-transmitters in their central nervous system. Although inconclusive due to methodological differences, data suggest that certain biogenic monoamines, such as serotonin and norepinephrine, are important to normal sleep physiology and influence pain (Moldofsky, 1982; Bennett, 1992; Russell, Vipraio, Morgan, & Bowden, 1986). It is known that a depletion of serotonin is associated with decreased non-REM sleep and a rise in somatic complaints (Boissevain & McCain, 1991). Central nervous system metabolism may play a role in the symptomatology of fibromyalgia syndrome, but specific mechanisms of action have not been proven.

Women are reported to be affected 10 to 20 times more often than men, with an age onset of symptoms from 20 to 40 years of age. Children have also been diagnosed with fibromyalgia. In a study by Yunus and Masi (1985), 33 children were found to have the syndrome with the youngest

being 9 years old (Yunus & Masi, 1985; Caro, 1989; Bennett, 1992; Goldenberg, 1989; Boissevain & McCain, 1991; Powers, 1993).

It is also evident that there are associated conditions in fibromyalgia syndrome. Raynaud's syndrome has been found in 30 percent of fibromyalgia patients. Irritable bowel syndrome has also been diagnosed in 50-80 percent of fibromyalgia patients. The presence of sicca symptoms (dry eyes and mouth) occurs frequently in fibromyalgia patients possibly related to increased sympathetic activity of the central nervous system. Headaches, cold sensitivity, restless legs, complaints of fatigue, and exercise intolerance are also commonly found.

For many years, fibromyalgia was considered psychosomatic because no pathophysiological basis could be identified in connection with the syndrome. Research by Clark, Campbell, & Forehand (1985) found no significant difference between fibromyalgia patients and control patients on the Symptom Check List-90-Revised (SCL-90-R, a multidimensional psychologic symptom inventory), the Spielberger State and Trait Anxiety Inventory, and the Beck Depression Inventory. Ahles, Yunus, and Masi (1987), using the Zung Self-Rating Depression Scale found no difference in the presence of depression between fibromyalgia patients and rheumatoid arthritis patients. However, a study by Anch, Lue, MacLean, and Moldofsky (1991) revealed that fibromyalgia patients did have more evidence of "psychological distress" compared to controls (p. 181). Using

the SCL-90R, they found that fibromyalgia patients were significantly higher than controls on the subscales of somatization, obsessive-compulsive, depression, anxiety, and psychoticism.

Criticism of psychological studies done with fibromyalgia patients suggest that the specific instruments used in the studies were not meant for populations with chronic pain or somatic complaints. The current consensus is that even though psychological factors, such as depression or anxiety, may be present, there is no scientific evidence to support that these disorders cause fibromyalgia. Uveges, Parker, & Smaer (1990) found that fibromyalgia patients experienced more life stress and more sleep disturbance than rheumatoid arthritis patients. It is clear that psychological factors do affect fibromyalgia patients, but these factors may be manifestations of the chronic pain and sleep disturbance they experience (Goldenberg, 1987; Uveges, Parker, & Smaer, 1990; Clark, Campbell, & Forehand, 1985; Yunus, Ahles, Aldag, & Maxi, 1991; Powers, 1993; Bennett, 1992). The relationship between sleep and fibromyalgia is explored after a brief review of normal sleep.

Sleep and Fibromyalgia

Typically one-third of our lives is spent in sleep. Sleep is an active process composed of two major states: rapid eye movement (REM) and non-rapid eye movement (non-REM). Normally, the majority of sleep is spent in non-REM or slow-wave deep sleep, which is divided into four

stages. Stage 1 is a transition between wakefulness and *true* sleep. Stage 2 contains episodic bursts of rhythmic, 14 to 16 cycles per second waveforms, known as sleep spindles interspersed with occasional high amplitude slow waves. Stages 3 and 4 are defined by a lesser and greater occurrence, respectively, of high amplitude slow waveforms called delta waves. The cycle from Stage 1 to Stage 4 usually takes 70 to 90 minutes and is repeated as the night progresses, with less delta wave sleep and longer REM episodes (Institute of Medicine, Division of Health Sciences Policy, 1990). Alpha waves are those occurring when an individual is awake but nonattentive and relaxed, typically recorded during wakefulness or Stage 1. Stage 4, seen in the first part of the night, corresponds to the deepest sleep (most difficult time to arouse the subject).

In fibromyalgia patients, these normal sleep patterns are subtly altered. Harvey Moldofsky and Hugh Smythe described an electro-encephalogram (EEG) disturbance in Stage 4 sleep characterized by alpha-wave intrusion into normal delta sleep in fibromyalgia patients (Moldofsky, Scarisbrick, England, & Smythe, 1975). With this type of sleep disturbance, patients complain more frequently of musculoskeletal pain upon awakening. A similar finding was shown in rheumatoid arthritis patients when an alpha EEG anomaly occurred during normal delta slow wave sleep; this disturbance was associated with increased peripheral joint and musculoskeletal tenderness (Moldofsky, Lue, & Smythe, 1979).

In a similar study done by Moldofsky and Scarisbrick (1976), sleep deprivation was induced on 13 healthy male and female volunteers, ages 19-25. Six subjects took part in Stage 4 sleep deprivation and seven subjects took part in REM sleep deprivation. Of the 13 subjects, those deprived of Stage 4 sleep showed an increase in muscle tenderness, especially upon awakening. They also described overwhelming physical tiredness, heaviness or sluggishness, and aching or stiffness in the shoulders, lower limbs, neck, and upper back (Moldofsky & Scarisbrick, 1976). These results supported the theory that non-REM, slow wave deep sleep is essential for *restoration* of physical functioning.

Among patients with fibromyalgia, sleep disturbances are frequently reported, affecting 56 to 95 percent of patients. Most often they report morning aching and stiffness, feeling tired upon awakening, and fatigue during the day. This pattern of sleep disturbance has been named non-restorative sleep in relation to the persistence of fatigue and not feeling refreshed. Bennett (1992) proposed the hypothesis that there is a "neuroendocrine disturbance resulting from the non-restorative sleep anomaly." Bennett, Clark, Campbell, and Burckhardt (1992) measured Somatomedin-C, an anabolic hormone produced by the liver in response to the secretion of growth hormone, in 70 female patients with fibromyalgia for comparison with age-matched female controls. Decreased levels of Somatomedin-C were found in fibromyalgia patients, reflecting a possible

decrease in growth hormone. The growth hormone-Somatomedin-C axis which occurs during Stage 4 deep sleep is found to be important in muscle homeostasis and the repair of muscle microtrauma (which occurs universally in humans). Further work is needed to identify the mechanisms involved in the sleep disturbances associated with fibromyalgia.

The course of fibromyalgia is still unknown. The combination of symptoms occur in patients differently but are likely to persist over the course of a patient's life. These lifelong problems, involving increased medical visits, and chronic pain affect employment status and the ability to perform household tasks. There are definite physical and economic costs as shown in a study by Wolfe (1986). Fibromyalgia patients performed standardized work tasks at a level 40 percent below that of normal subjects, and over the course of 12 months, 30 percent of patients had to change jobs (Wolfe, 1986).

The treatment for fibromyalgia is multidimensional, with education being the foundation for any program. More research is needed to better understand fibromyalgia and to devise better treatments.

Methods and Procedures

The design of this cross-sectional study involved two groups: one group of 38 people with fibromyalgia and one group of 38 controls matched for age (±5 years) and gender. The purpose of the study was to describe and compare the patterns of sleep in fibromyalgia patients with a

group of matched controls. Two research questions were addressed: Do fibromyalgia patients report less effective sleep than age and gender matched patients? And, do fibromyalgia patients differ significantly in sleep scores on three subscales of the Verran Snyder-Halpern Sleep Scale when compared to age and gender matched control patients? The subjects were required to be English-speaking and at least 18 years of age. Pregnant women were included in the sample. The study was approved in advance by the Committee on Human Research of Oregon Health Sciences University. An informed consent was obtained from all subjects (Appendix A). The setting for the study was a university family practice clinic in the Pacific Northwest.

Instruments

The Verran Snyder-Halpern Sleep Scale (VSH), a visual analog scale developed by Joyce Verran, Ph.D., RN, and Rita Snyder-Halpern, Ph.D., RN, was used with permission of the authors to evaluate sleep (Appendix B). The VSH Sleep Scale is divided into three major categories: sleep disturbance, sleep effectiveness, and sleep supplementation. This scale was chosen for relevance in identifying sleep disturbances in adults and its ease of administration. The VSH Sleep Scale also provided a reliable and valid measure that has been used previously with healthy and hospitalized populations for comparison with this study (Snyder-Halpern & Verran, 1987).

Previous reported reliability for community living persons with insomnia was adequate for al subscales (sleep disturbance subscale, theta = .82; sleep effectiveness subscale, theta = .81; and sleep supplementation subscale, theta = .84). The scale has been tested in three other populations: healthy adults in their usual sleep environments, and hospitalized adults both in the U.S. and Taiwan. Although reliability estimates across these samples varied, the instrument was adequate across groups (Snyder-Halpern & Verran, 1987). Cronbach's alpha was calculated to estimate internal consistency of the VSH subscales for the present sample. The results indicate this instrument was reliable for this sample. Cronbach's alpha coefficient for the three subscales were .92 for sleep disturbance, .78 for sleep effectiveness, and .71 for sleep supplementation. Additional advantages of using the visual analog scale are that it permits an increased variability of response in contrast to the forced choice format of the more traditional Likert-type scale, and it provides interval-level data (Snyder-Halpern and Verran, 1987).

Seven questions were added to identify key areas that may also affect sleep practices. Those key areas included average hours of sleep at one time, working night shift, participation in a regularly scheduled exercise program, average number of mornings per month awakening feeling tired, and average number of mornings awakening feeling refreshed, and, subjects were asked if they were pregnant. The seventh question requested subjects

record the name and frequency of use for all medications they took, even if subjects thought the medications didn't affect their sleep (see Appendix B).

Research supports subjective measures of sleep to obtain the subject's perspective on the quality of sleep. A limitation of self-reported sleep instruments is the over-estimation of body movements and awakenings (Baekland & Hay, 1971). Other tools evaluated for use included the Moldofsky Sleep Diary, the Northwest Regional Sleep Center Questionnaire, and the Epworth Sleepiness Scale. These questionnaires included similar categories for sleep evaluation when compared to the VSH Sleep Scale but their format and length were not appropriate for study design. Polysomnography was used in previous research to demonstrate the sleep anomaly of fibromyalgia patients. However, there are no studies describing the quality of sleep among fibromyalgia patients based on self-appraisal. When practices that negatively affect the sleep of fibromyalgia patients are identified, then interventions to improve the quality of sleep may be developed specifically for fibromyalgia patients.

The diagnosis of fibromyalgia was established with use of a screening questionnaire (Appendix C) and a tender point examination (Appendix D). A positive diagnosis was determined if the following were present: frequent musculoskeletal pain in three out of four quadrants described as axial in location; 11 out of 18 *tender points* compared with non-tender control points (established by the American College of

Rheumatology); and the presence of the following symptoms — excessive fatigue, waking unrefreshed, and tender skin and muscles. At each tender point, the amount of pain elicited was also recorded. The total pain score was calculated by adding the total points on the tender point exam, 0 being the lowest score and 54 the highest (see Appendix D). These core features are essential for the diagnosis and have been confirmed by other studies on fibromyalgia (Bennett et al., 1992; Moldofsky & Smythe, 1977-78; Yunus et al., 1981; Campbell et al., 1983). To reduce bias, the researchers completing clinical exams were blinded to the results of the screening questionnaire when performing the tender point examination. The examiners were health professionals who had been trained in the examination of tender points and control points by physicians specializing in rheumatology and conducting a series of studies on fibromyalgia. Examination proficiency was determined by independent examinations on selected patients prior to and during the data collection period.

Results

A total of 539 individuals attending a Family Practice Clinic were invited to be in the study. Of those 539, 171 refused and 45 agreed to participate but later withdrew from the study, leaving 323 total subjects screened. Subjects were then matched for age and gender, and scheduled for tender point examination. A total of 38 pairs (n = 76) completed the study. Other subjects were lost to follow-up because of moving, difficulty

Table 2

Characteristics of Sample Matched on Age and Gender

	Group	
	Fibromyalgia	Non-Fibromyalgia
Characteristic	n = 38	n = 38
Age		
Range	23-64	23-66
Mean	42.2	41.6
SD	10.2	10.7
Gender		
Percent female	95	95
Percent male	5	5
Tender points score (0-18)		
Mean	14.4	4.6
SD	2.9	3.3
Pain score (0-54)		
Mean	27.5	7.5
SD	2.1	6.4
Awaken tired (days/month 0-30)		
Mean	23.3	20.1
SD	6.7	9.2
Awaken refreshed (days/month 0-30)		
Mean	5.0	8.7
SD	4.7	9.2

Both groups were similar in the way they described their morning awakenings. On average, the fibromyalgia group awakened "refreshed" only 5/30 days, or 16.6% of the month, compared to 9/30 days or 30% of the month for the non-fibromyalgia group. Similar findings were described when subjects were asked: "On average, how many days do you awaken feeling tired?" The fibromyalgia group reported feeling tired 23/30 days or 76% of the month compared to the control group's report of feeling tired 20/30 days or 67% of the month. While the fibromyalgia group was frequently more tired on awakening, both groups described their sleep as being inadequate for their needs.

The mean subscale scores for sleep disturbance, sleep effectiveness, and sleep supplementation taken from the VSH Sleep Scale are reported in Table 3. Paired t-tests were then computed to analyze the differences in mean scores between the fibromyalgia subjects and controls. Table 3 represents the results of the paired t-tests done on the three subscales of the VSH Sleep Scale and four other major variables which include sleep medication usage, such as sleep inhibitors and sleep enhancers, total of all medications taken and average hours slept nightly. Both groups have scores reflecting sleep deprivation. Significant differences in sleep disturbance ($t = 3.84$, $p = .0005$) and sleep effectiveness ($t = -2.07$, $p = .0460$) between the fibromyalgia and non-fibromyalgia groups were demonstrated. As expected, the fibromyalgia group had higher mean

Table 3

Comparison of Sleep Characteristics and Factors Affecting Sleep Among Fibromyalgia and Non-Fibromyalgia Patients

	Fibromyalgia n = 38		Non-Fibromyalgia n = 38		Paired	
Variable	$\bar{x}$	SD	$\bar{x}$	SD	t	p
VSH Sleep Scale						
Disturbance[a]	458.2	148.9	310.6	200.8	3.84	.0005
Effectiveness[b]	229.4	75.9	272.6	113.5	-2.07	.0460
Supplementation[c]	97.4	93.9	118.1	101.0	-0.78	.4365
Medication Usage						
Sleep inhibitors	1.9	1.2	2.3	1.4	-1.23	.2277
Sleep enhancers	1.9	1.1	1.7	0.8	0.93	.3593
Total meds taken	5.5	3.3	4.9	2.3	0.89	.3775
Average hours slept nightly	4.4	2.2	6.2	2.3	-3.76	.0006

Reliability for VSH subscale was [a].92, [b].78, [c].71, respectively, using Cronbach's Alpha. Range for subscale scores on the Verran Snyder-Halpern Sleep Scale; Sleep Disturbance 0-700, Sleep Effectiveness 0-600, Sleep Supplementation 0-400, Snyder-Halpern, R., & Verran, J. A. (1987). Sleep inhibitors include tobacco, caffeine, alcohol, allergy medications, cough syrups, cold medications, water pills, and weight reduction pills. Sleep enhancers include anti-anxiety pills, anti-depressant medications, sleeping pills, high blood pressure pills, and pain medications.

scores for sleep disturbance (458.2) compared with the non-fibromyalgia group (310.6). The mean scores for sleep effectiveness among the fibromyalgia group averaged 229.4 compared to 272.6 among the non-fibromyalgia group. These findings indicate greater impairment for fibromyalgia patients but decreased sleep quality and sleep length among both groups.

The fibromyalgia group also reported significantly fewer hours slept at night. On average, fibromyalgia subjects reported 1.8 fewer hours of sleep at night (4.4 hours compared to 6.2 hours). Both groups, however, averaged fewer hours of sleep at night than the national norm for this age group. Mean scores between the two groups did not differ significantly on the sleep supplementation subscale but the non-fibromyalgia group reported the ability to supplement their sleep in contrast to the fibromyalgia group.

Information about the use of medications was divided into two categories: those who used sleep inhibiting medications and those who did not. From these, frequency counts and percentages were compared between diagnostic groups for specific categories. When Diagnostic groups were compared by medications, specifically *sleep inhibiting* and *sleep enhancing*, no statistical differences were found (see Table 3). But as Table 4 shows, the non-fibromyalgia group had higher percentages of use in two sleep inhibiting subcategories: tobacco (45% compared to 18%) and

Table 4

Comparison of Selected Medications Affecting Sleep by Group

	Group			
	Fibromyalgia n = 38		Non-fibromyalgia n = 38	
Medication Usage	Frequency	Percent of Subgroup	Frequency	Percent of Subgroup
Sleep Inhibitors				
Tobacco	7	18	17	45
Caffeine	31	82	29	76
Alcohol	6	16	26	42
Allergy medications	13	35	9	24
Sleep Enhancers				
Antianxiety medications	6	16	3	8
Antidepressants	19	50	9	24
Sleep pills	3	9	4	11
Pain medications including OTCs	31	82	35	95

Percent = number using medications in subgroup over total in subgroup. Use includes daily, weekly, or monthly. Other medication categories assessed but not listed here because too few were listed by subjects include cough syrup, cold medications, water pills, weight reduction pills, and high blood pressure medications.

alcohol (42% compared to 16%). In the category of *sleep enhancing* medications, the fibromyalgia group scored higher percentages of use with antidepressants (50% compared to 24%) and antianxiety medications (16% compared to 8%). Surprisingly, both groups had high percentages of pain medication usage: 82% for the fibromyalgia group and 95% for the non-fibromyalgia group. Furthermore, non-fibromyalgia subjects reported using more pain medications than the fibromyalgia subjects possibly indicating that more subjects with joint or muscle pain volunteered for the study. Pain medications included over-the-counter medications such as Tylenol and Motrin, as well as narcotic analgesics.

Because pain medications may alter sleep patterns, it is possible that some of the sleep disturbance may be related to unrelieved pain or misuse of this category of medications. It would be of interest to know the subject's medical history, especially in terms of chronic conditions, in order to best understand how the pain medication influenced the subject's sleep pattern. Clearly, unrelieved pain may negatively affect the sleep pattern.

Curiously, 50% of the fibromyalgia subjects reported use of antidepressant medications. Depression is commonly found in fibromyalgia patients and use of low dose antidepressants is consistent with treatment for the sleep disturbance they experience. Very few fibromyalgia subjects reported being on sleeping pills (9%). Self-report of medication

use is limited due to lack of accurate recall of medication and frequency of use.

While the fibromyalgia group used slightly more medications overall, the non-fibromyalgia group was found on average to use more sleep inhibiting medications than the fibromyalgia group. Interestingly, both groups were using approximately the same amount of sleep enhancing drugs.

Mean scores were also compared on individual items of each sleep subscale to further explore differences in sleep between the two groups (see Tables 5, 6, and 7). Means were not tested for individual characteristics of each subscale because standard deviations were large, indicating wide variability between groups. This made it difficult to detect statistically significant between these two groups. The fibromyalgia group averaged higher scores on each characteristic of the sleep disturbance subscale indicating greater dysfunction. The largest differences were seen in (a) the characteristic of *soundness of sleep* or perception of sleep depth, and (b) *mid-sleep awakening* or perception of the number of awakenings during the sleep period. The least difference was noted in the characteristic of *sleep latency* or perception of amount of time from settling down to sleep until falling asleep reflecting the sleep deprivation that both groups reported.

Table 5

Mean Scores on Sleep Disturbance Subscale by Group

	Group			
	Fibromyalgia n = 38		Non-fibromyalgia n = 38	
Sleep Characteristic	$\bar{x}$	SD	$\bar{x}$	SD
Mid-sleep awakening	71.1	26.6	50.8	35.0
Wake after sleep onset	53.0	27.4	40.4	32.0
Movement during sleep	70.9	25.4	52.6	33.6
Soundness of sleep	72.8	27.5	47.5	38.1
Quality of disturbance	63.8	29.2	43.7	35.1
Sleep latency	51.7	30.1	41.0	33.2
Quality of latency	62.0	33.2	46.9	39.8

Range for subscale scores 0 - 100.

Table 6

Mean Scores on Sleep Effectiveness Subscale by Group

	Group			
	Fibromyalgia n = 38		Non-fibromyalgia n = 38	
Sleep Characteristic	$\bar{x}$	SD	$\bar{x}$	SD
Rest upon awakening	24.4	24.8	40.4	34.9
Quality of sleep	29.1	26.0	43.7	37.7
Sleep sufficiency	36.4	29.7	31.0	36.0
Total sleep time	46.6	24.4	54.1	23.3
Total time attempting to sleep	99.5	21.7	94.4	27.8

Possible range for subscale scores 0 - 100 on VSH sleep scale.

Table 7

Mean Scores on Sleep Supplementation Subscale by Group

	Group			
	Fibromyalgia n = 38		Non-fibromyalgia n = 38	
Sleep Characteristic	$\bar{x}$	SD	$\bar{x}$	SD
Daytime sleep	12.3	17.7	19.6	25.7
Morning sleep	24.1	35.9	28.0	32.3
Afternoon sleep	27.5	35.0	31.5	35.3
Wake after final arousal	31.0	36.4	38.8	40.8

Possible range for subscale scores 0 - 100 on VSH sleep scale.

Comparison of diagnostic groups on individual characteristics of the sleep effectiveness subscale was also performed. *Subjective quality of sleep* or the perception of sleep adequacy in terms of overall quality showed the largest difference in mean scores between the two groups. *Total sleep period* reflected the smallest difference between groups, being defined as the perception of the total time spent in bed attempting to sleep. Even though there was no statistical difference in scores between the two groups on the sleep supplementation subscale, average scores were higher for the non-fibromyalgia group in all these characteristics. Thus, when given an opportunity to nap, the non-fibromyalgia subjects were able to supplement their sleep while the fibromyalgia group could not. As Table 6 shows, the non-fibromyalgia group reported augmenting their bulk sleep period with additional sleep time, the most being between initial morning arousal and final awakening.

Interestingly, the two groups did not differ in their description of their morning awakenings. Both groups reported a high number of days awakening tired and a few days awakening refreshed. Identifying key items in the subscale about sleep in fibromyalgia patients can help the primary care provider ask questions that are unique to fibromyalgia syndrome.

Discussion

Despite efforts to include a wide range of subjects in age and gender, the sample was characteristic of previous samples with

fibromyalgia. Almost all subjects were female and in the middle age range, which is classic for the syndrome. The findings from this study are consistent with and build upon findings from other studies demonstrating sleep disturbances in fibromyalgia patients. Fibromyalgia patients in this study differ significantly from control patients in two main categories of sleep: sleep disturbance and sleep effectiveness. Both sleep disturbance and lack of sleep effectiveness reflect the nonrestorative sleep pattern previously found in fibromyalgia patients. Although previous studies had shown a sleep disturbance, none had *subjectively* measured the characteristics and demonstrated statistically significant differences in sleep patterns between fibromyalgia subjects and patient controls living in the community. Based on the findings from this study, the use of the items from the VSH Sleep Scale may be appropriate for use in the clinic setting to elicit sleep characteristics affected by fibromyalgia, such as asking about quality of sleep, soundness of sleep, or number of awakening during sleep period. Self-report is much less expensive compared to polysomnography. Together, the tender point exam, the history of three symptoms, and items from the VSH Sleep Scale may assist primary care providers in diagnosing patients who otherwise undergo unnecessary and expensive testing.

Implications

Fibromyalgia is a complex syndrome to understand and to treat. Many conditions mimic the syndrome. Of the 76 subjects examined, 38

were found to meet the criteria for diagnosis. Few of the subjects reported having been diagnosed with fibromyalgia prior to this study. Clinical recognition and treatment of this syndrome characterized by widespread aching, reproducible tender points, and sleep disturbance is long overdue.

Basic evaluation of sleep patterns and an understanding of the sleep disturbance found in fibromyalgia patients may help the primary care provider in appropriate treatment and referral of these patients. Providing tools for sleep evaluation that are practical for a primary care setting may be a step in the right direction.

Further research is underway to better understand the stage-4 sleep anomaly typically seen in fibromyalgia patients and its affect on muscle. Research is needed on many aspects of fibromyalgia. It is hoped that this study will assist health care providers in understanding more about fibromyalgia as well as the sleep disturbance found among fibromyalgia patients.

References

Ahles, T. A., Yunus, M. B., & Masi, A. T. (1987). Is chronic pain a variant of depressive disease? The case of primary fibromyalgia syndrome. *Pain, 29*, 105-111.

Anch, A.M., Lue, F. A., MacLean, A. W., & Moldofsky, H. (1991). Sleep physiology and psychological aspects of the fibrositis (fibromyalgia) syndrome. *Canadian Journal of Psychology, 45*(2), 179-184.

Baekland, F., & Hay, P. (1971). Reported vs. recorded sleep characteristics. *Arch. Gen. Psychiat., 24*, 548-551.

Bennett, R. M. (1992). Myopain '92: Consensus document on fibromyalgia. *The Copenhagen Declaration*, 3-19.

Bennett, R. M., Clark, S. R., Campbell, S. M., & Burckhardt, C. S. (1992). Low levels of somatomedin C in patients with the fibromyalgia syndrome. *Arthritis and Rheumatism*, 35, 1113-1116.

Boissevain, M., & McCain, G. (1991). Toward an integrated understanding of fibromyalgia syndrome I: Medical and pathophysiological aspects. *Pain, 45*, 227-238.

Campbell, S. M., Clark, S., Tindall, E. A., Forehand, M. E., & Bennett, R. M. (1983). Clinical characteristics of fibrositis: In a "blinded," controlled study of symptoms and tender points. *Arthritis and Rheumatism, 26*, 817-824.

Caro, X. J. (1989). New concepts in primary fibrositis syndrome. *Comprehensive Therapy, 15*(5), 14-22.

Clark, S., Campbell, S. M., & Forehand, M. E. (1985). Clinical characteristics of fibrositis II: A "blinded", controlled study using standard psychological tests. *Arthritis and Rheumatism, 28*, 132-137.

Goldenberg, D. L. (1987). Fibromyalgia syndrome: An emerging but controversial condition. *Journal of the American Medical Association, 257*, 2782-2787.

Goldenberg, D. (1988). Research in Fibromyalgia: Past, present and future. *The Journal of Rheumatology, 15*(6), 992-996.

Goldenberg, D. L. (1989, September 30). Diagnostic and therapeutic challenges of fibromyalgia. *Hospital Practice*, 39-52.

Institute of Medicine, Division of Health Sciences Policy. (1990). *Research briefing: Basic sleep research*. Washington, DC: National Academy Press.

Jacobsen, S., Danneskiold-Samsøe, B., & Lund, B. (1992). *Musculoskeletal pain, myofascial pain syndrome, and the fibromyalgia syndrome*. New York: Haworth Medical Press.

Leavitt, F., Katz, R. S., Golden, H. E., Glickman, P. B., & Layfer, L. F. (1986). Comparison of pain properties in fibromyalgia patients and rheumatoid arthritis patients. *Arthritis and Rheumatism, 29*, 775-781.

Moldofsky, H. (1982). Rheumatic pain modulation syndrome: The interrelationships between sleep, central nervous system serotonin, and pain. *Advanced Neurology, 33*, 51-57.

Moldofsky, H., Lue, F., & Smythe, H. (1979). Alpha EEG sleep and pain in rheumatoid arthritis. *Sleep Research, 8*, 236.

Moldofsky, H., & Scarisbrick, P. (1976). Induction of neurasthenic deprivation. *Psychosomatic Medicine, 38*, 35-44.

Moldofsky, H., Scarisbrick, P., England, R., & Smythe, H. (1975). Musculoskeletal symptoms and non-REM sleep disturbance in patients with "fibrositis syndrome" and health subjects. *Psychosomatic medicine, 37*(4), 341-351.

Moldofsky, H., & Smythe, H. A. (1977-78). Two contributions to understanding of the "fibrositis" syndrome. *Bulletin of Rheumatic Disease, 28*, 928-931.

Powers, R. (1993). Fibromyalgia: An age-old malady begging for respect. *Journal of General Internal Medicine, 8*, 93-105.

Russell, I. J., Vipraio, G. A., Morgan. W. M., & Bowden, C. L. (1986). Is there a metabolic basis for the fibrositis syndrome? *American Journal of Medicine, 82*, Supplement 3A, 50-54.

Simons, D. G. (1975). Muscle pain syndromes - part I. *American Journal of Physical Medicine, 54*, 289-311.

Snyder-Halpern, R., & Verran, J. A. (1987). Instrumentation to describe subjective sleep characteristics in healthy subjects. *Research in Nursing and Health, 10*, 155-163.

Uveges, J. M., Parker, J. C., & Smaer, K. L. (1990). Psychological symptoms in primary fibromyalgia syndrome: Relationship to pain, life stress, and sleep disturbance. *Arthritis and Rheumatism, 33*, 1279-1283.

Wolfe, F. (1986). The clinical syndrome of fibrositis. *American Journal of Medicine, 81*, 7-14.

Wolfe, F., Hawley, D. J., Cathey, M. A., Caro, X., & Russell, I. J. (1985). Fibrositis: Symptom frequency and criteria for diagnosis: An evaluation of 291 rheumatic disease patients and 58 normal individuals. *Journal of Rheumatology, 12*, 1159-1163.

Wolfe, F., Smythe, H. A., & Yunus, M. B. (1990). The American College of Rheumatology 1990 criteria for the classification of fibromyalgia: Report of the multi-center criteria committee. *Arthritis and Rheumatism, 33*, 160-172.

Yunus, M. B., Ahles, T. A., Aldag, J. C., & Masi, A. T. (1991). Relationship of clinical features with psychological status in primary fibromyalgia. *Arthritis and Rheumatism, 34*, 15-21.

Yunus, M. B., & Masi, A. T. (1985). Juvenile primary fibromyalgia syndrome. *Arthritis and Rheumatism, 28*, 138-145.

Yunus, M., Masi, A. T., Calabro, J. J., Miller, K. A., & Fiegenbaum, S. L. (1981). Primary fibromyalgia (fibrositis): Clinical study of 50 patients with matched normal controls. *Seminar in Arthritis and Rheumatology, 11*, 151-171.

APPENDIX A

Consent Form

ORS# 3214-EXP 12/4/92

Ted Conklin, MD, Dept. of Family Medicine, Robert Bennett, MD, Chief of Div. of Arthritis & Rheumatology, Steve Campbell, MD, Sharon Clark, PhD, ANP, Carol Burckhardt, PhD, RN, and Katherine Crabtree, DNSc., RN.

Consent Form

Title: Prevalence of Rheumatism in Family Practice Clinic Patients

Purpose: I am being asked to volunteer to participate in a research study to determine how common rheumatism is in Family Practice Clinic patients. This study involves completing four questionnaires and a brief examination of my muscles and joints to determine if I have rheumatism.

Procedures: Today I am asked to check off those symptoms that describe me and to shade on a drawing of the body where I have aches or pain. Completion of the questionnaire will take about 5 minutes today. I will then be scheduled for a 30 minute appointment at a later time for a brief physical examination of my muscles and joints. The examination will include thumb pressure on areas of my neck, torso, arms and legs and will take about 10 minutes. At that time, I will also be asked to fill out two other questionnaires describing the onset of symptoms (if any), their effect on my daily activity and comfort. I may also be asked to fill out a questionnaire describing my sleep patterns. These questionnaires will take about 10 minutes each to complete.

The examination will be done by a physician or nurse trained to assess my muscles and joints for rheumatism. The examination will be scheduled at a mutually convenient time in the out-patient Rheumatology Clinic at OHSU.

Potential adverse reactions: A self-limited increase in pain from thumb pressure during the brief physical examination may last up to 12 hours in patients with rheumatism. No adverse effects are expected in normal, healthy individuals.

Liability: The Oregon Health Sciences University, as an agency of the State, is covered by the State Liability Fund. If I suffer any injury from the research project, compensation will be available to me only if I establish the injury occurred through the fault of the University, its officers or its employees. If I have further questions, I understand I may call Dr. Michael Baird at 503-494-8014.

Benefits: There are no benefits to me for participating in this study.

Costs: The only cost to me for participating in this study is the cost of transportation to the 4th floor out-patient Rheumatology Clinic at OHSU for the exam.

Confidentiality: Signing this consent form will not affect the confidentiality of my medical records. Neither my name nor my identity will be used for

publication or publicity purposes. The results of the study will be shared with my physician in the Family Practice Clinic.

I may refuse to participate, or I may withdraw from this study at any time without affecting my relationship with, or treatment at, the Oregon Health Sciences University.

Dr. Ted Conklin and Dr. Robert Bennett and their colleagues have agreed to answer any questions I have regarding this study. Dr. Conklin's telephone number is 503-494-5271 in the Family Practice Clinic and Dr. Robert Bennett's telephone number is 503-494-8963 in the Rheumatology Clinic.

I will receive a copy of this consent form.

My signature below indicates that I have read the foregoing and agree to participate in this study.

_____ _____
Signature of patient Date

_____ _____
Signature of person obtaining consent Date

_____
(Print) First name (Middle Initial) and Last name

_____
Address

_____
City Zip code

( )_____
Day phone

( )_____
Evening phone

APPENDIX B

VSH Sleep Scale/Sleep Questionnaire

VERRAN AND SNYDER-HALPERN SLEEP SCALE

Scale # _____ (34)

Directions: Answer each question by placing a vertical mark across the answer line at a point which BEST REFLECTS YOUR OPINION.

Example: Happy _____|_____ Sad

Answer all of the following questions about your last night's sleep. Consider the night's sleep to begin from the time you first tried to go to sleep to the time you were finally "up" in the morning.

1. Did not awaken	_____	Was awake ten hours	___ ___ ___ (35-37)
2. Had no sleep	_____	Excluding time awake, had ten hours of sleep	___ ___ ___ (38-40)
3. Did not sleep during the day yesterday	_____	Slept ten hours during the day	___ ___ ___ (41-43)
4. Did not sleep yesterday morning	_____	Slept off and on yesterday morning	___ ___ ___ (44 - 46)
5. Did not sleep yesterday evening	_____	Slept off and on yesterday evening	___ ___ ___ (47 - 49)
6. Fell asleep immediately	_____	Did not fall asleep	___ ___ ___ (50 - 52)
7. Slept lightly	_____	Slept deeply	___ ___ ___ (53-55)
8. Had no trouble with disrupted sleep	_____	Had a lot of trouble with disrupted sleep	___ ___ ___ (56 - 58)
9. Didn't wake at all	_____	Was awake off and on all night	___ ___ ___ (59 - 61)
10. Had no trouble falling asleep	_____	Had a lot of trouble falling sleep	___ ___ ___ (62 - 64)
11. Didn't move	_____	Tossed all night	___ ___ ___ (65 - 67)
12. Awoke exhausted	_____	Awoke refreshed	___ ___ ___ (68 - 70)
13. After morning awakening, stayed awake	_____	After morning awakening, dozed off and on	___ ___ ___ (71 - 73)
14. Had a bad night's sleep	_____	Had a good night's sleep	___ ___ ___ (74 - 76)
15. Had enough sleep	_____	Did not have enough sleep	___ ___ ___ (77 - 79)

3/84 (Revised 2/85) (Revised 6/86)

ID: _____
DATE: _____

SLEEP QUESTIONNAIRE

Many things influence the amount and quality of your sleep. Please answer the following questions by filling in the information or circling the answer that best describes you.

1. On average, how many hours do you sleep at one time?_____

2. Have you worked a night shift with daytime sleeping in the past month? Yes No Unknown

3. On average, how many mornings in a month do you wake up feeling tired?_____

4. On average, how many mornings in a month do you wake up feeling refreshed?____

5. Do you participate in a regularly scheduled exercise program? Yes No Unknown

6. Are you pregnant? Yes No Not applicable

   If Yes, how many weeks pregnant are you? _____weeks

On the next page, we would like you to describe any medications you use regularly. Many drugs affect sleep patterns. Some drugs promote sleep and some interfere with sleep. Please record all medications you take even if you think they don't affect your sleep. Please fill in the information requested as best you can.

ID: _____
DATE: _____

USE			FREQUENCY OF USE		
DRUG	No	Yes	Daily (5-7days/wk)	Weekly (1-4days/wk)	Monthly (1-3days/mth)
Tobacco (chew, smoke)					
Caffeine (coffee, tea, chocolate, cocoa, cola)					
Alcohol (beer, wine)					
Allergy (medications)					
Cough syrups					
Cold medicines					
Water pills					
Weight reduction pills					
Anti-anxiety pills					
Anti-depressant medications					
Sleeping pills					
High blood pressure pills					
Pain meds (aspirin,tylenol, ibuprofen, etc.)					

List below all other medications taken regularly and indicate frequency of use (as above)

NAME OF DRUG	Daily	Weekly	Monthly

APPENDIX C

Screening Questionnaire

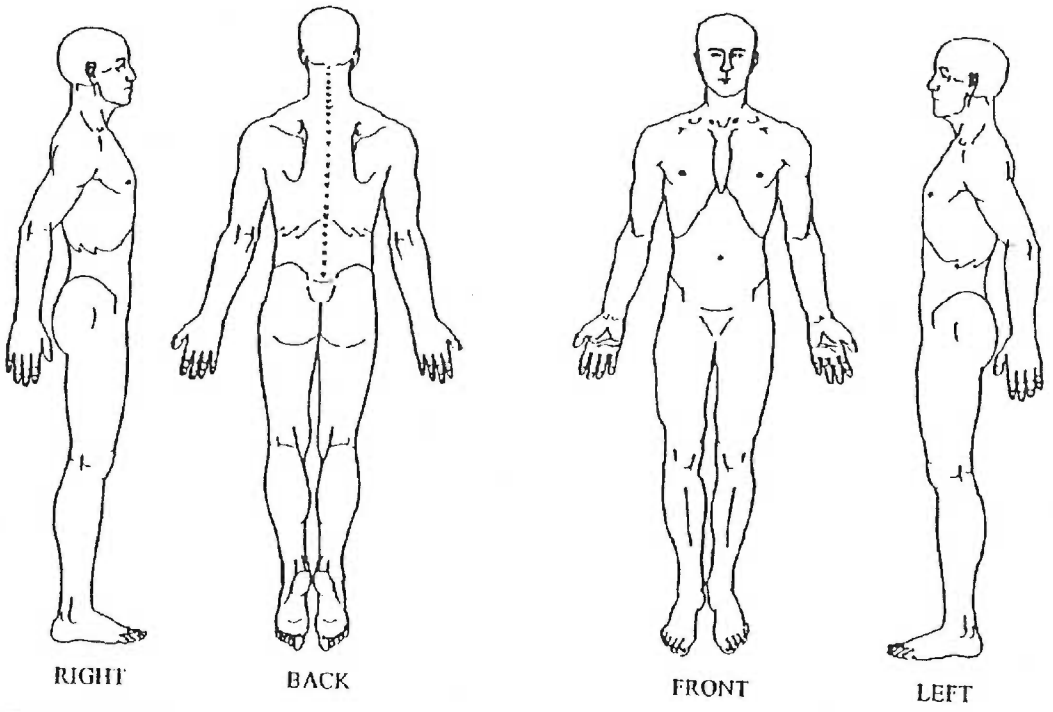
I.D.: _____

Date: _____

SCREENING QUESTIONNAIRE

Age: Sex: M F

1. Do you often have pain in your muscles or joints? Yes No *(please circle)*
If you answered Yes please shade involved areas and answer the questions.



2. Do you have any of the following problems? *(check items that apply to you)*

- Joint pain
- Joint swelling
- Stiffness
- Pain after exertion
- Back pain
- Muscle pain
- Numbness or tingling
- Depressed Moods
- Excessive anxiety
- Panic attacks
- Constipation
- Fever
- Dry or itchy eyes
- Loss of memory
- Tenderness of skin or muscles
- Poor sleep
- Awaken feeling tired
- Pain that keeps you awake rarely
- Restless legs
- Hands change color in cold
- Excessive fatigue
- Abdominal cramping
- Headaches
- Premenstrual tension (PMS)
- Frequent loose stools
- Frequent and urgent urination
- Loss of logical reasoning

APPENDIX D

Tender Point Exam Sheet

ID _____
Date _____
Examiner ____

** 0 = no pain
1 = mild pain
2 = verbal exclamation of pain
3 = withdrawal or flinching

ACR FIBROMYALGIA TENDER POINTS

LOCATION	RIGHT	LEFT	COMMENTS
1.Elbow	0 1 2 3	0 1 2 3	
2.Occiput	0 1 2 3	0 1 2 3	
3.Lateral neck	0 1 2 3	0 1 2 3	
4.Upper Trapezius	0 1 2 3	0 1 2 3	
5.Supraspinatus	0 1 2 3	0 1 2 3	
6.Anterior Chest	0 1 2 3	0 1 2 3	
7.Upper Gluteal	0 1 2 3	0 1 2 3	
8.Trochanteric	0 1 2 3	0 1 2 3	
9.Medial Knee	0 1 2 3	0 1 2 3	

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APPENDIX E

Article Submitted for Publication

Sleep Patterns in Fibromyalgia Patients

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Key words: FIBROMYALGIA, SLEEP, PRIMARY CARE, SCREENING

Abstract

In a cross-sectional study, sleep patterns of 38 persons with fibromyalgia were compared with 38 age and gender matched patient controls drawn from a family practice clinic. Based on clinical examination of tender points and completed questionnaires, fibromyalgia patients had significantly higher tender point and pain scores. Fibromyalgia patients reported more sleep dysfunction on the sleep disturbance ($t = 3.84$, $p = .0005$) and sleep effectiveness $t = -2.07$, $p = .0460$) subscales of the Verran Snyder-Halpern (VSH) Sleep Scale and slept fewer hours ($t = 3.76$, $p = .0006$) than the patient controls. Clinicians can use selected items from the VSH Sleep Scale to elicit sleep disturbances typically found in fibromyalgia patients.

Sleep Patterns in Fibromyalgia Patients

Fibromyalgia, previously known as fibrositis, is a chronic pain syndrome characterized by chronic widespread pain, fatigue, sleep disturbance, and the presence of multiple reproducible tender points. It occurs in the outpatient setting with a prevalence ranging from 6-15% (Powers, 1993). This chronic pain syndrome has been identified since 1904, and has achieved worldwide interest (Jacobsen, Danneskiold-Samsøe, & Lund, 1992).

The current clinical picture of fibromyalgia has developed from studies done in the 1980s. Yunus, Masi, Calabro, Miller, and Fiegenbaum (1981) proposed diagnostic criteria after comparing fibromyalgia patients with matched control volunteers. Of the 50 patients studied with fibromyalgia, 86% were Caucasian and female, with a mean age of 34. Ninety-eight percent reported generalized aches and pains, 92% reported tiredness, and 56% reported sleep problems. In a corroborating study of 58 normal individuals, 136 rheumatic disease patients, and 155 fibromyalgia patients, Wolfe, Hawley, Cathey, Caro, and Russell (1985) found similar symptoms in fibromyalgia patients. These symptoms included muscle and joint pain, nonrestorative sleep, morning stiffness and aching, and axial skeletal pain. The only significant difference found between the fibromyalgia patients and the rheumatic disease patients was that the tender point count was significantly higher for the fibromyalgia patients (Wolfe et al., 1985). Based on these studies, the presence of tender points is now recognized as essential for the diagnosis of fibromyalgia (see Figure 1).

Figure 1 about here

The recognition of tender points as diagnostic criteria for fibromyalgia was a turning point in understanding the syndrome. The American College of Rheumatology (ACR) set criteria based on the findings from a 1986 confirming study that investigated fibromyalgia in 16 centers in the United States and Canada. The term fibromyalgia was adopted and the following criteria for diagnosis were established: (a) history of widespread pain, and (b) pain in 11 out of 18 tender point sites on digital palpitation (Wolfe, Smythe, & Yunus, 1990). In addition to the above criteria, hallmark features of fibromyalgia include morning aching and stiffness, sleep disturbance, and overwhelming fatigue during the day.

1. History of widespread pain. *Definition*. Pain is considered widespread when all of the following are present: pain in the left side of the body, pain in the right side of the body, pain above the waist, and pain below the waist. In addition, axial skeletal pain (cervical spine or anterior chest or thoracic spine or low back) must be present. In this definition, shoulder and buttock pain is considered as pain for each involved side. "Low back" pain is considered lower segment pain.

2. Pain in 11 of 18 tender point sites on digital palpation. *Definition*. Pain, on digital palpation, must be present in at least 11 of the following 18 tender point sites: *Occiput*: Bilateral, at the anterior aspects of the intertransverse spaces at C5-C7. *Trapezius*: Bilateral, at the midpoint of the upper border. *Supraspinatus*: bilateral, at origins, above the scapula spine near the medial border. *Second rib*: bilateral, at the

second costochondral junctions, just lateral to the junctions on upper surfaces. *Lateral epicondyle*: Bilateral, 2 cm distal to the epicondyles. *Gluteal*: bilateral, in upper outer quadrants of buttocks in anterior fold of muscle. *Greater trochanter*: Bilateral, posterior to the trochanteric prominence. *Knee*: bilateral, at the medial fat pad proximal to the joint line.

Digital palpation should be performed with an approximate force of 4 kg. For a tender point to be considered "positive" the subject must state that the palpation was painful. "Tender" is not to be considered "painful" (Wolfe, Smythe, & Yunus, 1990, p. 171).

Sleep and Fibromyalgia

This study describes and compares the reported sleep patterns of fibromyalgia patients with those of age and gender matched controls, as part of a larger prevalence study. In fibromyalgia patients, normal sleep patterns are subtly altered. Moldofsky and Smythe described an electroencephalogram (EEG) disturbance in Stage 4 sleep characterized by alpha wave intrusion into normal delta sleep in fibromyalgia patients (Moldofsky, Scarisbrick, England, & Smythe, 1975). With this type of sleep disturbance, patients complain more frequently of musculoskeletal pain upon awakening.

In a similar study done by Moldofsky and Scarisbrick (1976), sleep deprivation was induced on 13 healthy male and female volunteers, ages 19-25. Six subjects took part in Stage 4 sleep deprivation and 7 subjects took part in REM sleep deprivation. Of the 13 subjects, those deprived of Stage 4 sleep

showed an increase in muscle tenderness, especially upon awakening. They also described overwhelming physical tiredness, heaviness or sluggishness, and aching or stiffness in the shoulders, lower limbs, neck, and upper back (Moldofsky & Scarisbrick, 1976).

Among patients with fibromyalgia, sleep disturbances are frequently reported, affecting 56 to 95 percent. They most often report morning aching and stiffness, feeling tired upon awakening, and fatigue during the day. This pattern of sleep disturbance has been named nonrestorative, in relation to the persistence of fatigue and not feeling refreshed. Further insight into the physiological changes associated with fibromyalgia was demonstrated when Bennett, Clark, Campbell, and Burckhardt (1992) measured Somatomedin-C, an anabolic hormone produced by the liver in response to the secretion of growth hormone. Decreased levels of Somatomedin-C were found in 70 female fibromyalgia patients, reflecting a possible decrease in growth hormone when compared with age-matched female controls. The growth hormone-Somatomedin-C secretion pattern, which occurs during Stage 4 deep sleep, is important in muscle homeostasis and the repair of muscle microtrauma. Additional research is needed to further define the mechanisms involved in the sleep disturbances associated with fibromyalgia.

Methods and Procedures

This cross-sectional study involved 76 subjects equally divided into two groups. A group of 38 patients with fibromyalgia was matched for age (±5 years) and gender with a group of 38 patient controls. Subjects were required to be

English speaking and at least 18 years of age. Informed consent was obtained from all subjects.

Two research questions were addressed: Do fibromyalgia patients report less effective sleep than age and gender matched patients? And, do fibromyalgia patients differ significantly in sleep scores on three subscales of the VSH Sleep Scale when compared to age and gender matched control patients? The setting for the study was a university family practice clinic in the Pacific Northwest.

The diagnosis of fibromyalgia was established with use of a screening questionnaire and tender point examination. A positive diagnosis was established if the subject met ACR criteria and had the presence of the following symptoms on the screening questionnaire: excessive fatigue, waking unrefreshed, and tender skin and muscles. The examiners were health professionals (MDs, nurses, NPs) who had been trained in the examination of tender points and control points by rheumatologists. Independently a trainer and trainee examined the same patient to verify clinical findings. The team is an on-going group conducting a series of studies on fibromyalgia. To reduce bias, the researchers completing clinical exams were blinded to the results of the screening questionnaire when performing the tender point examination.

Instruments

The VSH, a visual analog scale developed by Joyce Verran, Ph.D., RN, and Rita Snyder-Halpern, Ph.D., RN, was used with permission of the authors to evaluate sleep. The VSH Sleep Scale is divided into three subscales measuring sleep disturbance, sleep effectiveness, and sleep supplementation. The VSH Sleep

Scale provided a reliable and valid measure that has been used previously with healthy and hospitalized populations (Snyder-Halpern & Verran, 1987). Previous reported reliability for persons with insomnia in their usual sleep environment was adequate for all subscales (sleep disturbance subscale, theta = .82; sleep effectiveness subscale, theta = .81; and sleep supplementation subscale, theta = .84). The scale has been tested in three other populations: healthy adults in their usual sleep environments, and hospitalized adults both in the U.S. and Taiwan (Snyder-Halpern & Verran, 1987). Construct validity was supported by scores on the VSH subscales found in the predicted direction when tested with known sample of insomniacs and healthy adults.

Seven questions were added to the VSH sleep scale to describe key areas that may also affect sleep practices. These factors included: the average hours of sleep at one time, working night shift, participation in a regularly scheduled exercise program, average number of mornings per month awakening feeling tired, and average number of mornings per month awakening feeling refreshed, and number of weeks pregnant, if applicable. The seventh question requested subjects record the name and frequency of use for all medications taken. These questions were added to explore whether differences in sleep patterns found between the two groups were associated with the diagnosis of fibromyalgia or the other factors.

Results

A total of 323 subjects were screened but due to constraints of matching, scheduling, and patient transportation, a total of 38 pairs (N = 76) completed the study. The matched pairs represented two diagnostic groups based on presence or

absence of fibromyalgia according to ACR criteria and consisted of 36 females and 2 males. Age ranged from 23-64 years for the fibromyalgia group, and 23-66 for the non-fibromyalgia group. Because too few subjects were pregnant, worked night shift, or exercised, statistical differences could not be detected. These factors were evenly distributed between the fibromyalgia and patient control groups.

As expected, the two diagnostic groups differed on clinical examination findings. A mean tender point score of 14.4 was calculated for the fibromyalgia group compared to the score of 4.6 for the non-fibromyalgia group. The mean total pain score obtained during evaluation of tender points was also 20 points higher in the fibromyalgia group (27.5 compared to 7.5).

Sleep disturbances were reported more frequently by fibromyalgia patients. The fibromyalgia group reported feeling tired 23/30 days, or 76% of the month, compared to the control group's report of feeling tired 20/30 days, or 67% of the month. While the fibromyalgia group was frequently more tired on awakening, both groups reported their sleep as being inadequate for their needs. On average, the fibromyalgia group reported awakening *refreshed* on 5/30 days, or 16.6% of the month, compared to 9/30 days, or 30% of the month for the non-fibromyalgia group.

The mean subscale scores for sleep disturbance, sleep effectiveness, and sleep supplementation taken from the VSH Sleep Scale are reported in Table 1. Table 1 also presents the results of the paired t-tests comparing diagnostic groups

on medication usage divided into categories of sleep inhibitors and sleep enhancers, total of all medications taken, and average hours slept nightly.

Table 1 about here

Interestingly, both groups have scores reflecting sleep deprivation. Unlike the previously tested normal population, these patient controls' response to both subscales indicated sleep disturbance. Significant differences in sleep disturbance ($t = 3.84$, $p = .0005$) and sleep effectiveness ($t = -2.07$, $p = .0460$) between the fibromyalgia and non-fibromyalgia groups were demonstrated. As expected, the fibromyalgia group had higher mean scores for sleep disturbance (458.2) compared with the non-fibromyalgia group (310.6). The mean scores for sleep effectiveness among the fibromyalgia group averaged 229.4 compared to 272.6 among the non-fibromyalgia group. This finding indicates greater impairment for fibromyalgia patients but decreased sleep quality and length among both groups.

The fibromyalgia group also reported significantly fewer hours slept at night, averaging 1.8 fewer hours of sleep at night (4.4 compared to 6.2 hours). Both groups, however, averaged fewer hours of sleep at night than the national norm for this age group. Mean scores on the sleep supplementation subscale did not differ significantly. The patient control group reported the ability to supplement their sleep, unlike the fibromyalgia group.

Mean scores were also compared on individual items of each sleep subscale to further explore differences in sleep between the two groups. The fibromyalgia group averaged higher scores on each characteristic of the sleep

disturbance subscale, indicating greater dysfunction. The largest differences were seen in the characteristics of *soundness of sleep* and *mid-sleep awakening*. From the sleep effectiveness subscale, subjective *quality of sleep* and *rest upon awakening* showed the greatest difference in mean scores between the two groups. The fibromyalgia group scores were lower, as predicted. Even though there was no statistical difference in mean scores on the sleep supplementation subscale, average scores were higher for the non-fibromyalgia group in all of these characteristics. Thus, when given an opportunity to nap, the non-fibromyalgia subjects reported being able to supplement their sleep while the fibromyalgia group did not. Sleep disturbance as measured on all three subscales was consistently greater among fibromyalgia patients.

Medication Question Results

Whether diagnostic groups were compared by total medication use and sleep inhibiting or sleep enhancing medication use, no statistically significant differences were found (see Table 1). The non-fibromyalgia group had higher percentages of use in two sleep inhibiting subcategories: tobacco (45% compared to 18%) and alcohol (42% compared to 16%). In the category of sleep enhancing medications, the fibromyalgia group scored higher percentages of use with antidepressants (50% compared to 24%) and antianxiety medications (16% compared to 8%). Surprisingly, both groups had high percentages of pain medication usage: 82% for the fibromyalgia group and even higher, 95%, for the non-fibromyalgia group. Furthermore, non-fibromyalgia subjects reported using more pain medications (OTCs, NSAIDS, narcotics) than the fibromyalgia subjects.

This finding may possibly indicate that more subjects with joint or muscle pain volunteered for the study.

In this study, 50% of the fibromyalgia subjects reported use of antidepressant medications. Depression is commonly found in 30% of fibromyalgia patients and use of low dose antidepressants is consistent with treatment for the sleep disturbance they experience. Few fibromyalgia subjects (9%) reported being on sleeping pills. Whether treated with sleeping pills or low dose antidepressants whose side effect is sleepiness, there was under-treatment of the sleep disturbance in this sample.

Discussion and Implications

The findings from this study are consistent with and build upon findings from other studies demonstrating sleep disturbances in fibromyalgia patients. In this study, fibromyalgia patients differ significantly from control patients in greater sleep disturbance, less sleep effectiveness, and less sleep supplementation. Although previous studies had shown a sleep disturbance, none had *subjectively* measured the characteristics and demonstrated statistically significant differences between fibromyalgia subjects and patient controls.

Basic evaluation of sleep patterns and an understanding of the sleep disturbances found in fibromyalgia patients may help the primary care provider in appropriate treatment and referral of these patients. Based on the findings from this study, the use of selected items from the VSH Sleep Scale may be appropriate for use in the clinic setting to elicit sleep characteristics affected by fibromyalgia. Together, the history of fatigue, waking unrefreshed, and tender skin and muscles,

combined with a positive tender point exam should lead clinicians to consider the diagnosis of fibromyalgia. Knowing sleep characteristics are altered by fibromyalgia, clinicians should elicit a sleep history when fibromyalgia is suspected. Asking patients about mid-sleep awakenings, soundness of sleep, overall quality of sleep, and the absence of sleep supplementation may assist primary providers in diagnosing patients who otherwise undergo unnecessary and expensive testing such as polysomnography.

Fibromyalgia is a complex syndrome to diagnose and to treat. Clinical recognition and treatment of this syndrome characterized by widespread aching, reproducible tender points, and sleep disturbance is long overdue. Providing tools for sleep evaluation that are practical for a primary care setting may be a step in the right direction. It is hoped that this study will guide health care providers in assessment of the sleep disturbance found among fibromyalgia patients.

References

Bennett, R. M. (1992). Myopain '92: Consensus document on fibromyalgia. *The Copenhagen Declaration*, 3-19.

Jacobsen, S., Danneskiold-Samsøe, B., & Lund, B. (1992). *Musculoskeletal pain, myofascial pain syndrome, and the fibromyalgia syndrome*. New York: Haworth Medical Press.

Moldofsky, H., & Scarisbrick, P. (1976). Induction of neurasthenic deprivation. *Psychosomatic Medicine, 38*, 35-44.

Moldofsky, H., Scarisbrick, P., England, R., & Smythe, H. (1975). Musculoskeletal symptoms and non-REM sleep disturbance in patients with "fibrositis syndrome" and health subjects. *Psychosomatic medicine, 37*(4), 341-351.

Snyder-Halpern, R., & Verran, J. A. (1987). Instrumentation to describe subjective sleep characteristics in healthy subjects. *Research in Nursing and Health, 10*, 155-163.

Wolfe, F., Hawley, D. J., Cathey, M. A., Caro, X., & Russell, I. J. (1985). Fibrositis: Symptom frequency and criteria for diagnosis: An evaluation of 291 rheumatic disease patients and 58 normal individuals. *Journal of Rheumatology, 12*, 1159-1163.

Wolfe, F., Smythe, H. A., & Yunus, M. B. (1990). The American College of Rheumatology 1990 criteria for the classification of fibromyalgia: Report of the multi-center criteria committee. *Arthritis and Rheumatism, 33*, 160-172.

Yunus, M., Masi, A. T., Calabro, J. J., Miller, K. A., & Fiegenbaum, S. L. (1981). Primary fibromyalgia (fibrositis): Clinical study of 50 patients with matched normal controls. *Seminar in Arthritis and Rheumatology, 11*, 151-171.

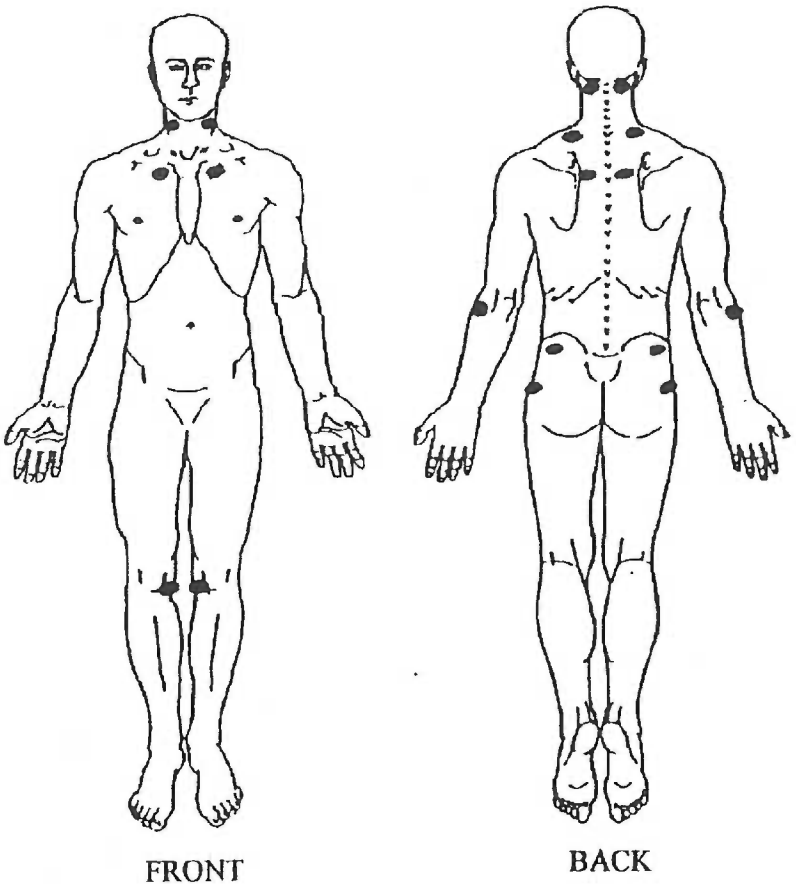

Figure 1. Tender points.

Table 1

Comparison of Sleep Characteristics and Factors Affecting Sleep Among Fibromyalgia and Non-Fibromyalgia Patients

	Fibromyalgia n = 38		Non-Fibromyalgia n = 38		Paired	
Variable	x̄	SD	x̄	SD	t	p
VSH Sleep Scale						
Disturbance[a]	458.2	148.9	310.6	200.8	3.84	.0005
Effectiveness[b]	229.4	75.9	272.6	113.5	-2.07	.0460
Supplementation[c]	97.4	93.9	118.1	101.0	-0.78	.4365
Medication Usage						
Sleep inhibitors	1.9	1.2	2.3	1.4	-1.23	.2277
Sleep enhancers	1.9	1.1	1.7	0.8	0.93	.3593
Total meds taken	5.5	3.3	4.9	2.3	0.89	.3775
Average hours slept nightly	4.4	2.2	6.2	2.3	-3.76	.0006

Range of scores and reliability, respectively, for Sleep Disturbance [a](0-700; .92), Sleep Effectiveness [b](0-600; .78), and Sleep Supplementation [c] (0-400; .71). Sleep inhibitors included tobacco, caffeine, alcohol, allergy medications, cough syrups, cold medications, water pills, and weight reduction pills. Sleep enhancers included anti-anxiety pills, anti-depressant medications, sleeping pills, high blood pressure pills, and pain medications.