Multidisciplinary Rehabilitation of Chronic Work-Related Upper Extremity Disorders

Long-Term Effects

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The prevalence of work-related upper extremity disorders has significantly increased in the past decade. Persistent pain, loss of function, and associated work disability in patients with work-related upper extremity disorders appears to be affected by multiple factors including physical capabilities in relation to work demands, ergonomic risk factors on the job, and psychological factors related to worker traits, psychological readiness to return to work, and ability to manage symptoms. The complex nature of these disorders suggests the utility of a multidisciplinary program targeted at these factors. The present study is an investigation of the long-term vocational outcome of a multicomponent rehabilitation program that includes physical conditioning, work conditioning, work-related pain and stress management, ergonomic consultation, and vocational counseling/placement. Two groups equivalent on measures of duration of work disability, pain severity, fear of reinjury, psychological distress, perceived work environment, age, and education level were exposed to either the comprehensive work rehabilitation intervention (n = 19) or usual care (n = 15). Return-to-work status was determined at an average of 17 months posttreatment (range, 3 to 35 months) for the treatment group and an average of 18 months postevaluation (range, 5 to 30 months) for the usual care group. Findings indicated that 74% of the treatment group returned to work or were involved in state-supported vocational training in contrast to 40% of the control group (P < .05). For those who returned to work, 91% of the treatment group were working full-time in contrast to 50%

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The increased reports of disorders associated with repeated trauma observed by the US Bureau of Labor Statistics[1] suggests that a higher percentage of cases with work disability associated with a chronic upper extremity disorder will eventually present to primary care, orthopedic and/or occupational health physicians.

Data from the National Ambulatory Medical Care Survey[2,3] on the utilization of medical services for new and chronic pain conditions provides data on the magnitude of pain related to the hand and wrist in general. A review of new pain visits for 1980 and 1981 indicates that 1.8% (1,264,662) related to pain of the hands and fingers, while 1% (703,740) pertained to wrist pain. Primary care visits for chronic pain (>3 months) for the same 2-year period revealed that hand and finger pain accounted for 1.6% of visits (1,157,984), while wrist pain was the stated reason for 0.6% of visits (434,244). Although not all of these cases are the result of occupational exposure, the total number of general practice medical visits for chronic pain of the hand, fingers, and wrists was approximately 800,000 per year for 1980 and 1981.

Although work-related upper extremity disorders typically do not result in total disability on a permanent basis, workers' compensation statistics from New York State suggest that these conditions engender a relatively high prevalence of permanent partial disability. In 1981, 28.6% of the total closed cases (31,756 out of 110,975 cases) were upper extremity disorders. Of these, 61.4% had a permanent par-

of the control group (P < .05). Although the treatment group demonstrated a higher return-to-work rate than controls, the work reentry rate was not as high as similar approaches with work-related low back pain (80% to 88% return-to-work rate). These findings suggest the need to modify treatment components to facilitate an increased return-to-work rate. Areas that may prove useful include a greater emphasis ergonomic modifications at the workplace to reduce the risks of repetitiveness, force, awkward posture, and insufficient work/rest cycles, as well as efforts to modify work style directly in order to reduce the impact of ergonomic stressors on the ability to perform essential job tasks. In combination with traditional work hardening efforts directed at improving strength and flexibility of the upper extremities and work-related pain and stress management training, these ergonomic and work-style modification efforts may contribute to increases in the percentage of work disabled cases who successfully return to competitive work.

tial disability, while 38.6% had a temporary disability. In 1981, the average cost per case was $1,880. By 1986, the prevalence of work-related upper extremity disorders in New York State had increased by 10.2% with an average cost per case of $2,612.[4,5] A more recent insurance company report estimates the average cost per upper extremity at $6,168.[6] In addition, workplace prevalence rates as high as 25% have been reported in some companies.[7]

Although large-scale epidemiologic data on chronic work-related upper extremity disorders are not currently available, clinical observation suggests a pattern of persistent pain, high perceived disability, loss of function, distress, and dysphoria not unlike that observed in the work disabled low back patient. Given the magnitude of the problem, coupled with the psychosocial and economic impact that persistent work-related upper extremity pain can exert on the injured worker, his or her family, and employer, comprehensive efforts at rehabilitation of these disorders have increased considerably over the past several years.

Despite the widespread growth of programs and services that provide multidisciplinary rehabilitation of upper extremity related work disability, few outcome studies have been published. The majority of studies available have been directed at the chronic low back patient.[8,9] In addition, the outcome studies that do exist have been limited by a focus on hand function as the outcome of interest in contrast to return to work, or are characterized by multiple methodologic problems (eg, absence of comparison groups). In addition, these studies typically do not focus on the more complex chronic work-disabled employee receiving workers' compensation benefits because of a work-related upper extremity disorder.

Flinn-Wagner, Mladonicky and Goodman[10] have reported the vocational outcome among workers' compensation claimants disabled because of a chronic upper extremity disorder following a work hardening program. This uncontrolled group outcome study investigated vocational outcome in a group of 40 cases with diagnosed disorders of the hand, arm, or glenohumoral joints. A group of 62% had a diagnosis indicative of cumulative trauma in which 48% had previous surgical intervention. The remaining 38% had diagnoses related to fractures or other traumatic injury. Although the duration of work disability was not specified, the mean duration from injury to treatment was 14 months. The number of treatment sessions varied from three to 30 with a mean of 13, and treatment exposure ranged from 2 to 6 hours per day. The return-to-work outcome indicated that 82.5% of the group returned to regular duty competitive employment for a minimum of 3 months postprogram. The absence of a no-treatment control group matched on variables that can affect return to work (eg, length of time off work, education, job availability, psychological state), however, limits generalization of these findings. In addition, the components of the work hardening intervention are unclear, making it difficult to relate these findings to the outcome expected from a comprehensive multidisciplinary approach to work rehabilitation.

The present study was an investigation of the effects of a comprehensive work rehabilitation program on vocational outcome. The purpose of the study was to determine the long-term vocational outcome following a multidisciplinary work rehabilitation intervention that included physical conditioning, work conditioning/work simulation, work-related pain and stress management, ergonomic consultation, and vocational counseling in chronic work-disabled cases with a range of upper extremity disorders.

Methods

Patients

Thirty-four consecutive patients with chronic work-related musculoskeletal disorders of the upper extremities referred to the Center for Occupational Rehabilitation at the University of Rochester Medical Center for a Functional Capacity Evaluation and work rehabilitation were included in this study. All patients were work disabled for a minimum of 3 months and were receiving workers' compensation indemnity and medical benefits. Cases involved nerve entrapment and tendinitis-related upper extremity disorders presumed by patient report, physician evaluation, and medical records to be associated with repeated exposure to one or more suspected work-related risk factors for upper extremity musculoskeletal pain.[11] The percentage of cases with a history of previous surgery for the presenting problem was 52% and 53% for the treatment and usual care control group, respectively.

The control group (n = 15) consisted of cases who were not eligible for the comprehensive work rehabilitation program for the following reasons: referred to other programs (n = 5), denied by insurance carrier (n = 3), refused by participant (n = 3), inappropriate for program—high level of illness behavior/depression/pain (n = 2), denied by employer (n = 1), and denied by physician (n = 1).

Measures

Pretreatment Equivalence. Because of an inability to randomize cases into treatment and control groups, determination of whether the two groups were equivalent before treatment was of major importance. Measures of duration of work disability in months, expectation to return to work, average pain severity, fear of reinjury, perception of most recent work environment, and measures of anxiety, somatization, and dysthymia were collected during the pretreatment period.

The measure of duration of work disability was obtained from the patient's medical record. Patient ratings of return-to-work expectation[12] were measured using visual analog scales (0–10 ratings) completed as part of a Work ReEntry Questionnaire.[13] Pain severity and fear of reinjury were also measured using 10-cm visual analog scales (0–10 ratings).

Perception of the most recent work environment was measured using the Work Environment Scale.[14] This scale has been used in previous studies with chronic pain and is related to pain severity[15] and tendency to continue to work with pain.[16] The scale has 10 subscales that measure dimensions of the work climate including: involvement with work, peer cohesion, supervisor support, autonomy, task orientation, work pressure, task clarity, control, innovation, and physical comfort.

The Millon Clinical Multiaxial Inventory-II was used to measure psychological state and personality style.[17] The three subscales of interest in the present study were *somatoform*, or tendency to focus on bodily concerns and ill health; *dysthymia*, or tendency toward feelings of discouragement, lack of initiative, and low self-esteem; and *anxiety*, or pattern of tension, restlessness, apprehensiveness, hyperalertness, and inability to relax expressed physically and/or interpersonally.

Vocational Outcome. Determination of vocational outcome was obtained through a structured interview by a trained research assistant. Vocational outcome was classified as: employed full time, employed part time, actively enrolled in state-supported vocational training/retraining program, or currently unemployed. Employment status was confirmed by providing the interviewer with the name and phone number of the employer and the name of the direct supervisor.

Treatment

Multidisciplinary Work ReEntry Rehabilitation Program. The multidisciplinary work rehabilitation program was specifically designed for the patient with a prolonged work disability (work disabled > 3 months) to facilitate an optimal transition from disability to productive work. The emphasis of the program was on attitude and health behavior change in conjunction with physical conditioning, and safe work practice instruction and rehearsal. The program was based upon a conceptual model (Rochester Model) of work disability[18] and the functional restoration approach developed for chronic low back pain.[9] The Rochester Model proposes that work disability is a function of a complex interaction among medical status, physical capabilities, and work tolerances in relation to work demands (biomechanical, metabolic, psychologic) in addition to psychosocial factors such as worker traits/work style, psychological readiness to return to work, and ability to manage pain or symptoms.[18] This conceptual framework proposes that the injured worker's perceptions of functional capabilities and the environment in which he or she worked can significantly affect return-to-work outcome.

The program consisted of the following components: 1) warm-up period (30 minutes), 2) physical conditioning (55 minutes), 3) work conditioning/simulation (55 minutes), 4) job-related pain and stress management (45 minutes), and 5) ergonomic consultation. Treatment occurred daily over a 4- to 6-week period.

Warm-up Period. Subjects received instruction in basic exercises to serve as a warm-up for all major muscle groups. This group was led by an exercise physiologist or physical therapist.

Physical Conditioning. A daily exercise regimen was designed based upon pretreatment levels of strength, flexibility, and aerobic capacity in relation to the physical demands of the previous or anticipated new job. The patient was exposed to an individualized exercise prescription including aerobic conditioning, isotonic weight training, isokinetic strengthening, and instruction in flexibility exercises.

This component emphasized the development and maintenance of a level of upper and lower body muscular strength, endurance, flexibility, and overall cardiovascular capacity to reduce the likelihood that the injured worker would be working at maximum physical capacity over prolonged periods when returning to work.[19] It was assumed that this improved level of fitness, if achieved, would reduce the likelihood of fatigue, thus potentially contributing to the ability to return to work and maintain a competitive level of work. Emphasis was placed on specific exercises for the involved upper extremity. Forceful grasp was avoided and the use of cuff weights was encouraged. The patient was instructed in lower body and uninvolved limb exercises to allow for improved stabilization and to provide an alternative rest period during the session. Interim evaluations provided feedback and permitted the exercise physiologist and physical therapist to adjust the exercise prescription based on performance. A home exercise program to be continued as a maintenance routine on a daily basis was also provided. Given the potential importance of developing and maintaining this state of fitness and the difficulty many individuals experience with maintaining a personal exercise/fitness program, efforts were directed at facilitating exercise adoption and maintenance of exercise behavior through the use of specific cognitive-behavioral procedures such as shaping, reinforcement, self-control, and relapse prevention.[20]

Work Conditioning/Simulation. A daily work conditioning regimen was designed for the individual needs of the patient by a physical therapist and work conditioning technician. Job-related tasks were simulated to increase work tolerances associated with specific job tasks. Instruction, monitoring, and rehearsal of safe work practices and individual work methods to reduce exposure to ergonomic risk factors associated with work-related upper extremity disorders was also provided. Gradual exposure to increasingly more demanding tasks within a tolerable work envelope was implemented in an effort to desensitize fear of reinjury.

Work-Related Pain and Stress Management. Patients received daily group instruction by a clinical psychologist in cognitive-behavioral approaches designed to improve ability to manage work-related pain and stress. The psychological treatments were as follows: 1) training in relaxation skills, including biofeedback-assisted relaxation with select cases, with an emphasis on enhancing abilities to use these skills in stressful job-related situations; 2) training in enhancing cognitive coping skills to manage stress, pain, and negative emotions (eg, anger, frustration, fear, perceived disability); 3) training in sensory alteration approaches (ie, self-hypnosis) to assist in reducing pain sensations during times of peak pain; 4) instruction in increasing effective communication among supervisors, co-workers and family members (eg, assertiveness training); and 5) training in problem-solving techniques that can be used on the job and at home. The overall focus of this treatment component was to facilitate a greater sense of control over pain and disability by providing patients with a set of coping skills to better manage pain, perceived disability, and job-related psychological stressors.

Ergonomic Consultation. When implemented, this component of the intervention involved on-site ergonomic job analysis to identify potential risk factors for upper extremity musculoskeletal disorders. When feasible, problematic workplace risk factors were identified using a standard ergonomic job analysis protocol including videotaping of the job to which the patient was to return.[21] The job was analyzed for: 1) repeated or sustained exertions, 2) forceful exertions, 3) localized mechanical stressors, and 4) postural stressors.[11] Based upon this analysis, suggestions were made to the patient and his or her supervisor regarding low-cost workplace modifications to facilitate a safe return to work and ideally to reduce the likelihood of relapse. This information also was used in the work conditioning/simulation component of the program to instruct the patient in strategies to reduce risk in order to facilitate a self-management approach to risk reduction (personal ergonomics).

Vocational Counseling/Placement. A New York State-supported vocational counselor with expertise in rehabilitation of individuals with occupational musculoskeletal disorders provided counseling and/or coordinated placement services for patients who were unable to return to their former job because of lack of availability or the decision that such work was not feasible given the severity of the disorder and the extent of ergonomic risk associated with the former job. This latter decision was ideally made by the rehabilitation team in collaboration with the patient's referring physician, occupational health physician, and employer (health, safety, and human resource personnel).

Usual Care

This group did not receive the multidisciplinary rehabilitation offered to the treatment group. Patients in this group were managed by their primary care physician, and where available, a rehabilitation nurse affiliated with the workers' compensation carrier. The typical care for these cases in the community included the use of physical therapy modalities, therapeutic exercise, hand therapy, chiropractic treatment, rehabilitation counseling and/or pain treatment. The work rehabilitation protocol offered to the treatment group was not available to this group.

Procedures

Consecutive referrals completed a 4-hour Functional Capacity Evaluation that included a medical examination by a physician board certified in physical and occupational medicine, orthopedic physical therapy evaluation, psychological evaluation by a clinical psychologist, assessment of extremity strength and flexibility, and determination of generic work tolerances and work tolerances in relation to expected work demands. When feasible, in those cases with jobs to which to return, an ergonomic job analysis to assess work demands and ergonomic risk factors was also completed.[21,22]

Following the evaluation, approval was sought for a comprehensive work rehabilitation program by the workers' compensation carrier. Cases approved for program entered the Work ReEntry program designed to facilitate a safe return to work. Cases not approved for program for reasons specified above entered the usual care control group.

Cases in the treatment group were contacted at an average of 17 months (3 to 35 months) after treatment, while controls were contacted at an average of 18 months after evaluation (5 to 30 months). Employment confirmation was obtained by collecting information on the name and phone number of the employer and name of the most direct supervisor.

Results

Pretreatment Equivalence

Subject Characteristics, Return-to-Work Expectation, Pain, and Fear of Reinjury. No significant differences were found between the two groups on pretreatment measures of age, duration of work disability, expectation to return to work, average pain severity, and fear of reinjury (Student's *t*-tests). A χ^2 test revealed the lack of differences on gender between the two groups (refer to Table 1).

Diagnoses. A χ^2 test on ICD-9-cm diagnoses at time of entry into the study indicated no differences between groups. Table 2 presents the distribution of upper extremity-related diagnoses for the treatment and control groups.

Psychological Status. Analysis of group differences using Student's t-tests indicated the two groups did not differ on any of the subscales of the Millon Clinical Multiaxial Inventory-II. Table 3 summarizes the findings for the three scales of primary interest in the present study: anxiety, dysthymia, and somatization.

Perception of Former Work Environment. The Student's t-tests computed on measures of job involvement, peer cohesion, supervisor support, autonomy, task orientation, work pressure, task clarity, control, innovation, and physical comfort indicated the groups did not differ at pretreatment on the perception of their most recent work environment (refer to Table 4).

Job Availability. Sixty eight percent of the treatment group and 60% of the usual care group reported that a job was available to return to at the time of referral. A χ^2 test revealed no differences between groups in reported job availability.

These findings as a whole indicate the treatment and usual care groups were equivalent on demographics, length of work disability, pain severity, diagnoses, psychological status, perception of the former work environment, and job availability at pretreatment.

Vocational Outcome

Differential return-to-work rates between the treatment and usual care control group were determined using

TABLE 1
Age, Gender, Work Disability Duration, Expectation to Return to Work, Pain Severity, and Fear of Reinjury in Treatment and Control Groups

	Treatment (n = 19)	Usual Care (n = 15)
Age	37.9 (8.0)	37.9 (9.7)
Gender		
Male	26.3%	53.3%
Female	73.7%	46.7%
Duration of work disability (months)	7.1 (5.6)	11.3 (8.2)
Expectation to return to work (VAS, 0–10)	8.4 (2.5)	7.0 (3.0)
Average pain severity (VAS, 0–10)	6.6 (2.1)	6.4 (2.6)
Fear of reinjury (VAS, 0–10)	6.6 (4.0)	5.7 (3.8)

Note.—No significant differences between groups; VAS = visual analog scale. Values expressed as means except for gender. Standard deviations in parentheses.

TABLE 2
Upper Extremity Diagnoses in Treatment and Control Groups

	Treatment (n = 19)	Usual Care (n = 15)
Hand/wrist/forearm/elbow		
Carpal tunnel syndrome (354.00)	5	3
Lateral epicondylitis (726.32)	4	1
Medial epicondylitis (726.31)	2	0
Mononeuritis, unspecified (354.90)	1	0
Edema, forearm (782.30)	1	0
Enthesopathy (elbow region) (726.30)	1	0
Enthesopathy of elbow, other (726.39)	0	1
Reflex sympathetic dystrophy (337.9)	0	1
Causalgia, upper limb (354.40)	0	1
deQuervain's disease (727.04)	0	1
Tenosynovitis (hand/wrist) (727.05)	0	1
Upper arm/shoulder		
Sprain and strain, rotator cuff (840.4)	3	3
Unspecified enthesopathies (726.90)	1	0
Osteoarthritis (715.90)	1	1
Rotator cuff syndrome (726.10)	0	1
Rupture of long head tendon of bicep (727.62)	0	1

Note.—Values represent number of cases. Numbers in parentheses are ICD-9-cm diagnostic codes.

TABLE 3
Psychological Distress and Somatic Focus

	Treatment (n = 19) M (SD)	Usual Care (n = 15) M (SD)
Anxiety	49.0 (32.5)	45.6 (19.9)
Dysthymia	40.0 (24.8)	37.7 (13.5)
Somatization	61.6 (14.4)	64.3 (11.1)

Note.—No significant differences between groups. M = means; SD = standard deviations.

TABLE 4
Perception of Most Recent Work Environment

	Treatment (n = 19) M (SD)	Usual Care (n = 15) M (SD)
Involvement	43.4 (17.4)	45.5 (18.5)
Peer cohesion	39.9 (15.6)	44.7 (20.4)
Supervisor support	36.0 (19.2)	37.8 (19.2)
Autonomy	43.3 (15.1)	43.1 (19.3)
Task orientation	48.8 (16.5)	52.1 (19.6)
Work pressure	65.0 (13.0)	71.0 (10.8)
Task clarity	50.0 (17.5)	49.9 (20.6)
Control	58.1 (17.9)	61.2 (19.1)
Innovation	46.3 (17.8)	41.3 (12.7)
Physical comfort	37.6 (24.1)	37.7 (15.4)

Note.—No significant differences between groups. M = means; SD = standard deviations.

a χ^2 test. The χ^2 test comparing cases who returned to work or were officially enrolled in a state-supported vocational retraining program at follow-up revealed a significant difference between the two groups (χ^2 [df = 1] = 3.93, $P < .05$). A significantly higher percentage of cases in the treatment group returned to work (73.7%) in contrast to the usual care control group (40.0%). Figure 1 illustrates these group differences.

A χ^2 test of the type of employment (full-time, part-time, self-employed) in those cases who returned to work revealed that a significantly higher percentage of cases from the treatment group returned to full-time employment (91% vs 50%) (χ^2 [df = 2] = 6.9, $P < .05$). These findings are presented in Figure 2.

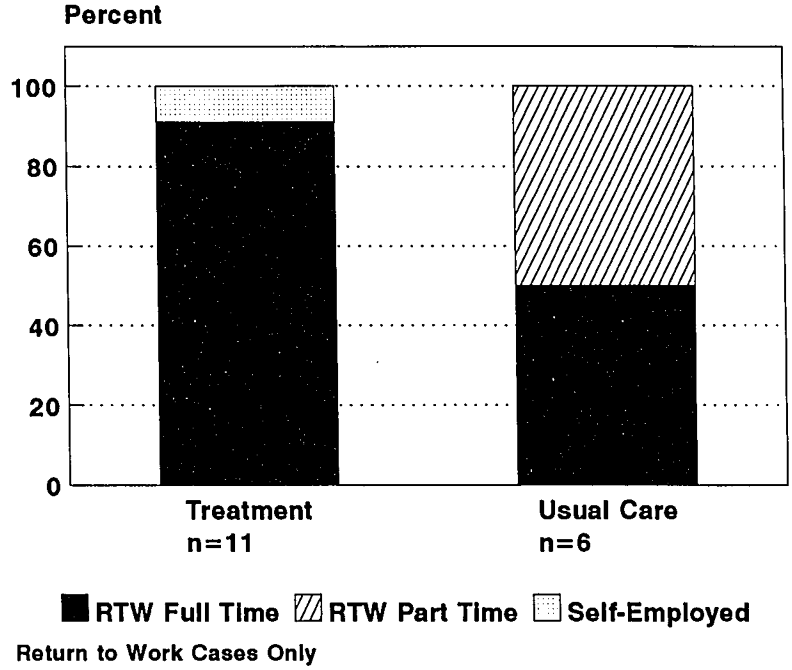

Fig. 2. Type of employment status for cases who returned to work in the treatment and usual care groups.

Program Length and Cost. The average program for the treatment group was 25.4 half-days (SD = 11.7) and 3.1 full-days (SD = 4.4). The average program cost was $5,089 (SD = $1,813) which included the initial Functional Capacity Evaluation at a fee of $500. The cost of the program was based on half-day and daily rates using a set of procedure codes from the New York State Workers' Compensation Fee Schedule that equate with each program component. This approach was developed by the authors and is described in Goldberg.[23]

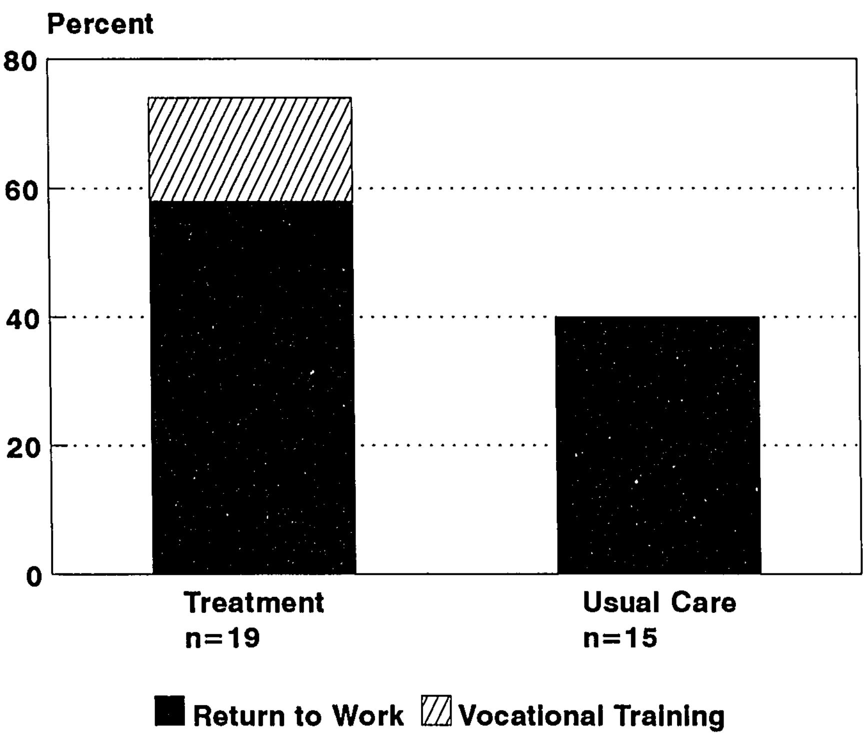

Fig. 1. Vocational outcome following a multidisciplinary work rehabilitation program (treatment) and usual care (control) groups.

Discussion

The results from this study indicate that a multidisciplinary work rehabilitation program is associated with return-to-work rates greater than usual care. It is important to emphasize that these findings are based upon an average follow-up period of 17 to 18 months. Thus, long-term follow-up not only indicates that the work rehabilitation program is associated with a higher percentage of cases returning and remaining at work, but also a greater number of cases employed full-time. These findings as a whole support the utility of the treatment approach used in the present study.

The finding indicating a greater number of patients employed full-time in the treatment group may be the consequence of the comprehensive nature of the rehabilitation program. That is, the approach used was not only directed at improving physical capacities, but also placed a strong emphasis on learning work-related pain and stress management skills and a problem-solving approach to symptom management at the workplace. Specific skills to reduce heightened levels of musculoskeletal activity and autonomic reactivity through the use of relaxation training, with adjunctive skin conductance biofeedback in select cases, were provided. The generalization of these skills in a simulated work environment also represented an important component of the program. Additional aspects of the pain and stress management component of the program included training in assertiveness skills with particular emphasis on learning to communicate more effectively with supervisors and co-workers. The use of cognitive-behavioral interventions directed at helping patients modify heightened levels of anger, frustration, and helplessness characteristic of many patients with pain-related work disability involved in the Workers' Compensation System[24] was also emphasized. These psychological interventions directed at attitude and health behavior change, coupled with physical conditioning and training in safe work behaviors, may have contributed to a greater sense of control over pain and distress which in turn resulted in an increased ability to return to work and to manage a full-time position. Although the specific contribution of the behavioral component of the program requires further investigation, the role of cognitive, psychosocial, and behavioral factors in work disability has become more evident over the past decade[18,25] and interventions that identify and modify these factors represent an area of significant potential in efforts to more effectively manage work disability. Future research that measures specific attitude and health behavior change following intervention would be of interest to better determine the mechanisms of change contributing to the observed outcome.

Although the return-to-work outcome was greater in the treatment group, the percentage was lower than that reported by Flinn-Wagner et al.[10] The difference in outcome between the two studies may be the consequence of patient sample/diagnoses, duration of work disability, and the length of follow-up. The present study only included work-related upper extremity musculoskeletal disorders. In contrast, these disorders comprised only 62.5% of the Flinn-Wagner sample. Chronic work-related upper extremity disorders appear to present a greater rehabilitation challenge in relation to return to work than other disorders of the extremities such as traumatic hand injuries. In addition, although the cases in the Flinn-Wagner sample reported a mean duration from "injury" to treatment of 14 months (2 months to 14.9 years), the mean duration of work disability was not reported. It is possible that the cases in the present study had a longer period of work disability. In other work-related musculoskeletal disorders such as low back pain, it is well documented that the longer the worker is off work, the poorer the return-to-work outcome.[26] Lastly, while the range of follow-up varied in the present study, the mean follow-up was 17 and 18 months for the treatment and usual care groups, respectively. This follow-up was considerably longer than the 3-month duration in the Flinn-Wagner et al study. It is possible, and quite likely, that over this longer time period relapses occurred that may account for the lower "currently working" figure observed at follow-up in the present study. Future outcome research should track vocational status at fixed intervals following treatment in order to quantify relapse rates associated with multidisciplinary work rehabilitation interventions.

It is interesting to note that the return-to-work outcome in the present study is less than that observed with low back pain cases.[9,27] The protocol for the chronic upper extremity cases was based in part on experience with work-disabled low back pain cases.[27] Whereas modifications, including an increased emphasis on reducing exposure to suspected ergonomic risk factors for upper extremity disorders, were initiated to adapt the program to painful upper extremities; the overall focus of the physical and work conditioning components was targeted at increasing strength, flexibility, and endurance. Given the nature of work-related upper extremity disorders and the problem of activity-related inflammation and pain, the emphasis on an active functional restoration approach over a relatively short duration may not be as useful with upper extremity disorders. Perhaps a more gradual exposure to functional restoration over a longer period of time may prove useful. In addition, it may be more effective to place greater emphasis on instruction in modifying work style or work method in conjunction with more consistent and aggressive efforts at modifying the workstation in those cases for whom jobs are available and medical status suggests they can reasonably return to such a previous job.[29] It has also become apparent that, perhaps even more so than with low back pain cases, clear determination of vocational options prior to work rehabilitation or early in the rehabilitation program should be emphasized. Such an assessment can potentially facilitate the return-to-work process by establishing clear and realistic return-to-work options.

The use of the usual care control represents an advantage over previous studies.[10] However, this group was made up of cases that were considered inappropriate for the program primarily because of insurance carrier denial or participant refusal. The selection criteria for such a group as a control group may have contributed to poorer outcome in this group in contrast to the treatment group. That is, such an approach may have biased the outcome since it could be argued that the cases in the usual care group may have been less motivated to return to work than the group who was offered and accepted the comprehensive work rehabilitation program. However, data on pretreatment levels of such factors as length of work disability; pain severity; fear of reinjury; psychological distress, including anxiety and dysthymia as well as somatization; and perception of the former work environment revealed the absence of differences on each of these measures. Given the effect that these variables can have on outcome,[15,16,18] the observation that the groups were equivalent on these measures prior to treatment mitigates against a potential selection bias.

While return to work is often the outcome measure of interest, there were several other potential outcome measures that could be used when evaluating interventions for chronic work-related upper extremity disorders. For example, determination of changes in levels of pain severity, mood, functional capacity in the extremities, and quality of work life would be of interest. Data on modification of work style or work methods, ergonomic risk at the workplace and supervisor perceptions of the worker also represent outcome measures of potential interest. Future research should incorporate a variety of outcome measures in order to begin to identify the differential effects of various interventions on outcome, as well as utilize large scale randomized clinical trial methodology.

The present study illustrates the potential utility of a multidisciplinary approach that focuses efforts on the physical, ergonomic, and psychological factors that may contribute to prolonged work disability. However, the problem of safe work reentry in employees with a range of recurrent or chronic upper extremity musculoskeletal pain disorders remains an enigma. As such, continuous efforts to systematically evaluate the clinical application of interventions that consider the multifaceted nature of these problems are essential to improve the management of these complex cases in the workplace and the clinic.

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