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Workplace Changes in Successful Rehabilitation

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There is a lack of rehabilitation programs that also involve the workplace as a significant variable. Epidemiologic studies have pointed out aspects of the work environment that are risk factors for developing musculoskeletal disorders, delaying return to work, and for promoting relapse. An understanding of risk factors and the ability to identify and alter them is the basis for effective rehabilitation and prevention programs. Workplace changes should comprise organizational and psychosocial aspects, as well as the physical work conditions. Positive attitudes of managers and supervisors toward early return to work need to be emphasized. Several studies stress the importance of new or changed work tasks for a positive prognosis. Opportunities for the individuals to influence their own rehabilitation process may improve the outcome. A promising approach, based on a problem-based rehabilitation strategy, is presented as an attempt to integrate present knowledge from etiologic studies and from rehabilitation studies, respectively.

KEY WORDS: musculoskeletal disorders; work; prevention; rehabilitation; problem-based.

INTRODUCTION

Work-related musculoskeletal disorders, in particular in the back, the neck, and shoulders, represent a major source of work disability in many countries. Rehabilitation of these disorders has for many years focused on treatment of symptoms. There are a number of treatment methods available, but in general it appears not possible to determine if one treatment is significantly superior to the others in terms of return to work, sick leave, pain, or symptoms (1–6). In spite of the extensive resources spent on rehabilitation the prevalence rate of cases with musculoskeletal complaints has increased in many countries.

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The complexity of the symptoms would suggest that one method of treatment for all symptoms is unlikely to be successful, and possibly that identified subgroups may gain from specific treatments. According to Linton (7), cognitive-behavioral programs produce more consistent improvements on several variables, compared with no-treatment controls or single-technique treatments. Most multidisciplinary programs address some or all of somatic, affective, behavioral, and cognitive aspects (for reviews, see 8–12). A common problem has been that studies are hampered by design problems. Many studies are conducted without control groups or with control groups composed of samples that may not always be appropriate. Some studies suffer from inappropriate descriptions of study samples and methods. In spite of these drawbacks, an increasing number of controlled studies indicate that the evidence is in favor of multidisciplinary rather than single-modal treatments of musculoskeletal pain. In a review on outpatient multidisciplinary rehabilitation studies, Feuerstein *et al.* (12) calculated that the average return-to-work rate after 12 months, based on seven studies, was 67% for the treatment groups and 44% for the control groups. Variables predictive of return to work included younger age, male, no legal claims, not in the top workers' compensation brackets, less time off work, and availability of former job. Physical predictors were flexibility and strength, lower pain levels, and lower reported impairment due to pain. Psychological predictors comprised lower levels of depression, hypochondriasis, distrust, premorbid pessimism, and higher levels of cooperativeness and satisfaction with treatment.

The importance of psychological and behavioral aspects of the individuals' resources for the rehabilitation outcome has been stressed by several authors (e.g., 13). The perception of pain and strategies found to cope with the pain influence the rehabilitation outcome (14), as does a strong internal locus of control belief (15). Women and men appear to cope with musculoskeletal pain in different ways (16, 17).

There is, however, a lack of studies that also involve the workplace as a significant part of the rehabilitation program. A number of specific workstation improvements may be performed in occupational settings. These interventions commonly improve adjustability and comfort, but are not necessarily associated with health and work ability (18). A workplace includes not only physical and biomechanical aspects, but also organizational management policy, and psychosocial factors such as participation, job discretion, and social interaction. For example, Bonsall *et al.* (19) found that altered management attitudes towards short-term sickness absence had a more positive effect than various types of physiotherapy in a factory setting. In this article, I will consider the role of the workplace in the development of musculoskeletal disorders and for successful rehabilitation and prevention of these disorders. Finally, a participative, problem-based strategy for rehabilitation of musculoskeletal disorders, emphasizing the role of the workplace will be presented. Hereby, an attempt will be made to integrate some of the information obtained from etiologic studies with knowledge obtained from rehabilitation studies.

WORK RELATED ETIOLOGIC FACTORS

First, which work conditions promote musculoskeletal problems? Quite a few studies have investigated which aspects of the work environment may be hazardous to the individual. Most studies hitherto are cross-sectional. A drawback of such studies is that risks may be underestimated, due to health-related selection out of the job for those suffering most severely (20), and due to the difficulty to ensure that an exposure actually preceded the disease (21). In particular, this objection may be applicable when a multiple-symptom disease is being considered, and the relevant exposures are also multifactorial, as appears to be the case for musculoskeletal disorders. In spite of these limitations it is possible to draw some conclusions regarding work-related hazards and musculoskeletal disorders.

Uncomfortable work postures, particularly those entailing fixed positions and inducing a static load, may impose a risk for musculoskeletal disorders. Highly repetitive movements are associated with muscle-tendon symptoms. Heavy work, not only the actual lifting of weights by the hands and arms, but also weight-bearing *per se*, in particular if performed at a distance from the body, is associated with musculoskeletal disorders. Repetitive arm movements, work performed at or above shoulder level, vibrations, too much or too little sitting, and lack of work breaks are all factors that contribute to these disorders (22–25). Repetitiveness and level and duration of exposure are considered to be the most important aspects of physical exposures (26). Bammer (27) in a meta-analysis of work-related neck and upper-limb disorders among visual display unit workers concluded, however, that biomechanical improvements are important but not sufficient to reduce work-related musculoskeletal disorders. She suggested that the main focus of prevention and intervention must be improvements in work organization. Cross-sectional studies that include organizational and psychosocial exposures indicate that high time pressure or a high work pace, monotonous tasks, unstimulating work content, low social support, and uncertainty about how to perform one's work tasks promote the development of musculoskeletal disorders in a number of different professions (28–33).

There are few long-term or case-control studies on the joint effects of physical, organizational, and psychosocial workload for musculoskeletal morbidity. Brisson *et al.* (34) and Andersen and Gaardboe (35) measured the association between musculoskeletal disorders and duration of employment in pieceworkers and sewing machine operators, respectively. For both occupations, duration of employment was found to be associated with increased disability in the neck and shoulders. The association was independent of age, smoking habits, education, type of work task, total length of employment (34), exercise (35), and previous childbearing (35). A case-control study (36) reported increased risk for disorders in the neck and shoulders due to high work pace, uncertainty whether one could manage the work or not, unstimulating work content, low decision latitude, and high demands on attention. Vasseljen *et al.* (37) in another case-control study found perceived tension to have stronger association with shoulder and neck pain than psychosocial variables. Theorell *et al.* (38) observed strong associations between muscle tension and emotional states. They also observed an association between psychological demands

and lack of the possibility to talk to work mates and muscle tension and emotional states. The results by Vasseljen *et al.* (37) may accordingly indirectly reflect an association with adverse work conditions. In a 10-year follow-up study (39), the social relations at work and the work content predicted change in musculoskeletal morbidity scores, independently of physical work load. In the same study group, reports of work content and physical work conditions improved among those who were promoted or who had changed employer, as compared to those who remained in the same job (40). Other studies have shown that satisfaction with the social interaction at the workplace decreased reports of back injury at a 4-year follow-up (41), and problems in the social interaction at work increased the 3-year incidence of sciatic pain (42).

To summarize, epidemiologic studies strongly support the idea of incorporating work environment improvements in programs of prevention. To prevent musculoskeletal disorders improvements might include physical adjustments, but also organizational and psychosocial interventions at the workplace, to reduce time pressure, and to increase mental and physical task variety, job predictability, job discretion, and to facilitate the social interaction at the workplace.

INTERVENTION PROGRAMS AT THE WORKPLACE

There are few studies on work environment interventions that comprise both physical and organizational or psychosocial aspects. Most intervention studies hitherto mainly focus on reduction of static muscle strain. Westgaard and Aarås (43) scrutinized an ergonomic adaptation program designed to reduce static muscle load. The introduction of height-adjustable work stands, chairs with armrests, and other measures to improve working postures reduced the static load on the trapezius muscle. In addition flexibility in working hours was introduced along with a fixed pay system. Long-term sick-leave was reduced by 33% and labor turn-over decreased, most likely due to the intervention program. Ratings by the workers indicated that increased flexibility to alter the position of the work table and to change work posture, along with the fixed pay system contributed most to the improvement in health measures. Parenmark *et al.* (44) reported a comparison between an old plant with traditional assembly work and a new plant with the same equipment and hardware in which workers were taught how to use the equipment properly. In addition, in the new plant all work tasks were based on group organization which involved quality control, external contacts, and production planning. Extra workplaces were introduced to buffer for rehabilitation needs, on-the-job training to reduce muscular load, and training of newcomers. The work pace was set at about 75% of the production at the old plant. The wage-system was adjusted to compensate for age-related reduction of physical capacity, and working hours were flexible to adjust for individual preferences. The sick-leave rate decreased 5% and labor turn-over decreased from 35% to about 10%. The production quality increased, providing a diminished total production cost of about 10% compared to the old plant during the first year. Some less extensive intervention programs have also been reported. Symptoms diminished in a group of females performing repetitive work after or-

ganizational changes that involved an increased number of short breaks and shortened continuous working hours (45). Similar results were described by Ohara *et al.* (46). In their study, the prevalence of occupational cervichobrachial disorders decreased for cash register operators and film-rolling workers after improvements of working conditions involving in particular a greater number of minor rest periods and reduced continuous operation time.

In a consensus paper for prevention of work-related musculoskeletal disorders Hagberg *et al.* (47) suggest necessary changes to comprise the introduction of flexible equipment and lifting aids, job rotation, job enlargement, flexibility in production planning, and increased responsibility for the employees. The authors also suggest that employees should have opportunities to increase their skill and knowledge and wages should be organized so that they encourage job enlargement and the development of competency and responsibility. In the previously cited empirical studies interventions at the workplace were usually multifactorial. As such interventions are complex in character, it is not always possible to more precisely specify what has determined the outcome.

COMBINATIONS OF TRAINING AND WORKPLACE CHANGES

Individual variations in work technique are large (48). Attempts to prevent disorders by vocational training indicate that it may be possible to teach appropriate techniques to new employees, while experienced workers are less able to re-learn work techniques (49).

Some authors report interventions that combine attempts to improve the supervisors' or the individuals' skills in addition to work environment improvements. Chatterjee (50) applied four types of interventions in an assembly plant. Supervisors and engineers were trained in detecting early signs of disorders and in safe working practices. Employees with an early diagnosis were prevented from further exposure to risk factors, but the author does not specify what was considered to be a risk factor. Engineering modifications involved reduction of repetitiveness by more regular rest breaks, job rotation, more manpower, and automation. Work tasks involving uncomfortable work postures were changed, vibrations were eliminated by replacing the power tools. A steering committee was established for carrying out effective planning and implementation of the procedures, to ensure appropriate rehabilitation and for monitoring the progress of the intervention program. Half of the subjects that were detected as having upper limb disorders could not continue in repetitive work, but the incidence rate for new cases fell from 2.1 before engineering modifications were commenced to about 0.1 afterward. Possibly, the reduced incidence rate may not only mirror the engineering modifications, but may also be an effect of the selection of the employees to comprise mainly healthy people after intervention was peformed. McElliott *et al.* (51) described a three-stage rehabilitation program involving a plant-wide educational lecture on mechanisms of injury and prevention of back injuries, which was given to all new employees, initiation of an on-site physical therapy facility for injured patients, and an on-site rehabilitation workshop that provided specialized jobs in a protected environment for those

in the physical therapy program. In addition to these efforts, job evaluations initiated ergonomic redesign of some work conditions. In total, 273 workers participated in the program during the first year and all returned to work within 60 days, which was a considerable improvement. The authors stress the importance of the opportunity to return to specialized jobs with less physical demands, which made the transition to normal employment easier. Related ideas were put forth by Battié (52) in suggesting a disability management system, which in essence implies the development of a more responsive and humane system within the workplace for dealing with injuries and for supporting recovery and return to work. She emphasizes training of management and first-line supervisors to provide an environment that is more supportive of early return to work, improved communications among all parties involved in the rehabilitation process, and temporary modification of duties during the recovery period.

Neck and back schools are increasingly utilized as a prevention strategy at the worksite. The basic philosophy underlying most back schools is that education of patients about their problems will lead to willingness on their part to share the responsibility for their own management with the rehabilitation professional, to become active participants rather than passive observers, and to learn how to cope with pain (53). The results are not always successful (54, 55), but Versloot *et al.* (56) reported a substantial reduction in mean length of absenteeism among bus drivers as a result of a back school program. The study was longitudinal during a 6-year period and the effect of the back school persisted during a 2-year follow-up.

WORK-RELATED FACTORS AFFECTING THE LENGTH OF A DISABILITY AND THE RISK OF RELAPSE

Few studies focus on the secondary and tertiary aspects of prevention, i.e., which are the hindrance factors for early re-entry to work, and which factors prevent relapse once subjects are back at work after rehabilitation. Jonsson *et al.* (57) followed female employees in the electronics manufacturing industry for 2 years. Musculoskeletal disorders were assessed at the outset of the study and after 1 and 2 years. During the 2-year follow-up, some employees changed their main working tasks and these new tasks were more physically and mentally dynamic and varied than previously. Among those who remained at the same job after the first year, the prevalence of moderate and severe symptoms increased, while there was a significant improvement of severe symptoms among those who were reallocated. Multivariate analysis showed that improvement was associated with reallocation to new jobs, physical activity during spare time, and high productivity after 2 years. Ekberg *et al.* (58), in a 2-year follow-up compared two different rehabilitation strategies on subjects with disorders in the neck and shoulders. Subjects who had obtained new work tasks or new employment had a significantly better prognosis in terms of days on sick leave, irrespective of the type of rehabilitation obtained, than those who returned to the same job. Low quality of work content, in terms of low influence on the job and few opportunities for development, in addition to physical demands, were significant predictors of more sick leave days during the first year

after rehabilitation (59). Schmidt *et al.* (60) observed that those who had obtained a new job after rehabilitation had greater job satisfaction than those who returned to their former employment. Conversely, there was no reduction of the prevalence of musculoskeletal symptoms among subjects who reported an over-exertion injury and thereafter had reduced work loads (61), or among shipyard workers after retirement (62). In these studies, several other aspects may have influenced the outcome, e.g., more severe disorders, long-term sick leave after the over-exertion injury, and the mere fact of being retired.

Linton and Warg (63) studied a group of 145 white-collar and blue-collar employees and found that job dissatisfaction increased the risk for back pain almost sevenfold, and, dissatisfied people tended to attribute the cause of their pain to the work environment. Not only actual work demands, but also the individual's perception of work conditions may be associated with the rehabilitation outcome (59, 64). Feuerstein and Thebarge (65) discuss the importance of an individual's cognitions or perceptions for the outcome of work of re-entry after rehabilitation. In their study a work-disabled group viewed their former work environment as lower in peer cohesion, supervisor support, and autonomy, and higher in work pressure and supervisor control than those working with pain. In a study by Linton and Bradley (66) of 36 subjects who had returned to work after rehabilitation for back pain, subjects reported that time-management factors and psychosocial aspects in the work environment were the most important hindrance factors for returning to work.

There appear to be differences in attributions about the cause and prevention of musculoskeletal disorders between different occupational groups. White-collar workers tend to attribute more causal factors to the individual and also believe in individual-oriented health-promoting activities, while blue-collar workers to a larger extent believe in work-related causal factors and in work-related changes for health promotion (63, 67, 68).

Opportunities for the individual to influence their own rehabilitation process may be crucial for a positive outcome (69), as dependency on the rehabilitation provider may be detrimental to successful rehabilitation (70). Numerous epidemiologic studies on stress-related disorders show the importance of having possibilities to influence the job for a good health outcome. Work organization principles have gradually evolved from systems of motivation based on extrinsic control to systems based on intrinsic motivation (71). Similarly, in rehabilitation the concepts of participation, self-management, and the like are gradually coming into focus as essential for a successful rehabilitation process, emphasizing intrinsic motivation of the patient rather than extrinsic steering of the rehabilitation process.

This brief literature review underscores several points of potential importance for preventing work-related musculoskeletal disorders. These factors also appear to reduce the length of already established disorders and to facilitate early return to work:

1. Physical, organizational, and psychosocial work conditions must be considered as integrated parts of the work situation; often it is not enough to change just one aspect. Workplace changes should comprise physical adjustments, but also organizational and psychosocial interventions at the

workplace to reduce time-pressure, and to increase mental and physical task variety, job predictability, job discretion, and to facilitate the social interaction at the workplace.

2. Appropriate working techniques should be taught to the newly employed.
3. Supervisors and managers may need training or information on supportive attitudes and behavior toward early return to work of those with disorders.
4. New or changed work tasks should be offered to those with a work-related disability. Sometimes work tasks have to be modified for a period of time.
5. Opportunities for communication and social interaction at the workplace as well as between those involved in the rehabilitation process need to be improved.
6. The individual's opportunities to actively take part in and be responsible for the rehabilitation process need to be improved. The individual's suggestions with regard to workplace improvements should be recognized.

PROBLEM-BASED REHABILITATION

As an example of a possible way to integrate prevention and rehabilitation of work-related disorders, a preliminary study based on a problem-based approach will be briefly presented. The heuristic model for the approach is presented in Table I. The problem-based rehabilitation strategy (PBR) was designed to encourage and support intrinsic motivation by means of participation and by providing opportunities for social networks and for the development of constructive strategies for coping with strenuous conditions at the workplace. A basic assumption was that the patient is the best expert on how the rehabilitation process, including preventive actions at the workplace, should proceed and which goals for the rehabilitation should be given priority in the short and long run. It was considered essential that the patients themselves formulate the goals for their rehabilitation and develop individual strategies to reach these goals. A second hypothesis was that individuals who return to the workplace with high intrinsic motivation to handle strenous work conditions and to apply constructive coping strategies for excessive demands, would initiate changes at the workplace and provide good examples for their work mates. The strategy of problem-based rehabilitation is founded in problem-based learning (72), but adapted to the present context.

SUBJECTS

In a preliminary pilot study subjects were recruited from three industrial health care units. To qualify for the study, the person must have had some sickleave related to musculoskeletal pain during the past 6 months, but not more than 30 consecutive days. The subjects also had been employed at their present workplace for at least 6 months and had worked for at least 4 of the last 6 months before the project was initiated. These criteria were set in this preliminary study to exclude individuals who had chronic musculoskeletal problems. Disorders due to or asso-

Table I. Heuristic Model for the Problem-Based Rehabilitation Approach

Factors at the workplace	Intrinsic factors	Health outcome
Biomechanical load	Job satisfaction	Pain
Repetitiveness	Motivation	Symptoms
Duration	Social communication	Physical functioning
Organizational and psychosocial conditions	Coping ability	
Supervisors	Attributions	Psychological functioning
Training		
Time management		Quality of life
Job discretion		
↑	↑	↑
Workplace changes ←	Problem-based rehabilitation	→ Individual treatment
	Level of intervention	

ciated with traumatic events or infectious agents, malignancy, rheumatic diseases, abuse, and pregnancy were excluded. All subjects were at work and aged between 20 and 55. In all, the study comprised 20 female patients from three industrial health care units who participated in PBR and 24 female patients from the same three industrial health care units who had traditional rehabilitation. The subjects were clinically examined before treatment and diagnoses were set according to criteria by Waris *et al.* (73). The subjects were randomly asssigned to PBR or traditional treatment.

The mean (SD) age in both the PBR and the control groups was 43 (7) years. On average, subjects had worked for 11 years at their present workplace. In the PBR-group ten subjects were day care workers, nursery school workers, or nurses for the elderly, three subjects were laboratory technicians, one was a metal worker, one was a cook, four were office workers involving VDU tasks, and one was a shop assistant. In the control group, ten subjects were day care workers, nursery school workers, or nurses for the elderly, three subjects were metal workers, one was a cook, three had office work involving VDU tasks, one was a shop assistant, two were cleaners, two were administrators, and two were school assistants.

METHODS AND PROCEDURE

At each industrial health care unit, subjects were randomly assigned to either problem-based rehabilitation or to traditional, more symptom-focused rehabilitation, which varied somewhat in content between the units and mainly comprised

Table II. Overview of the Method in Problem-Based Rehabilitation

Activity by the group	Example of outcome in the group
1. Decide on a theme to discuss	Hindrances to work
2. Brainstorming on the selected theme	Supervisors attitude, pain, headache, time pressure, uncertainty about how to perform the work task, work hours, monotony, too tired, stress, heavy work, repetitive work, low self-esteem, etc.
3. Sort the outcome of the brainstorming process into themes	Health variables, work task, supervisory behavior, lack of fit between duties at home and at work, etc.
4. Decide on a theme to work with—decide on a subgoal to accomplish until next meeting	Supervisory behavior—initiate a discussion with supervisor about instructions for how to perform the work task better *Other subjects in the group may decide on other subgoals within the theme*
5. Next meeting: discuss how subgoals were accomplished, hindrances, other experiences while attempting to reach the subgoal, support and hints from the group	Managed to call the supervisor, had problems to explain the need for more continous support and instructions at first, but managed at a meeting with the supervisor
6. Decide on a new theme to discuss or continue with the same theme	Physical work conditions

different types of physical training or physiotherapy. There were between six and eight patients in each PBR-group. The PBR patients worked in groups for about 2 hours every week for 3 months. At each meeting, the group followed a strategy for the PBR-method, as shown in Table II. The group decided on a theme to be discussed, such themes could for example be hindrance factors for work, what causes stress at work, exercise, self-esteem, what makes me feel well. The group then had a brainstorming session on the selected topic and the outcomes of the brainstorming process were grouped according to content areas. This process gave rise to many new ideas and associations for the group members. Each group member then decided on an individual goal within the selected topic area to work with until the next meeting. At the next meeting, the group discussed how they had managed to reach their goals, hindrances, experiences, giving hints and support to each other. Each group had a tutor, who was trained in PBR methods. The tutor ensured that the group process proceeded, but did not get directly involved in the substance discussed by the group.

In addition to the PBR group work, the workplace of each subject was visited by the industrial health care unit and in several instances the health care unit had discussions on improvements with the supervisor at the workplace. Finally, those subjects who needed physical rehabilitation or training were offered this at the industrial health care unit. The rehabilitation period was predetermined to have a duration of 3 months.

All subjects filled a number of questionnaires before and after the rehabilitation period. The major measure of health outcome was the SF-36 Health Survey

(74). It measures health on eight multi-item dimensions comprising functional status, well being, and overall evaluation of health. All subjects also completed questionnaires on pain, work-related distress, social networks, and social support, coping ability, and questions about the organizational, psychosocial, and physical work conditions. The results of the questionnaires will be presented after a 6-month follow-up. In this context, the subjective evaluation of the PBR strategy is the major focus.

SUBJECTIVE EVALUATION OF PRB

All groups were interviewed at their last session to get an evaluation of whether the PBR method had worked at all. The interview did not comprise health aspects, since the main aim was to evaluate the PBR method. Critical aspects of the method are listed below with examples of statements given in the interviews.

Find Strategies for Own Rehabilitation

The subjects found it easy to get started in the groups and to work toward their goals, with the support of the group. In particular, it was stressed that the motivation to continuously attempt to reach new individual goals was considerably strengthened by the group support. Subjects found it valuable to get opportunities to consider the entire, complex situation of external and internal hindrance factors at work and for other activities.

Coping Abilities

The opportunity to discuss problems and different ways to solve them strengthened the motivation to try different strategies. Patients dared to talk about difficulties they had never discussed before. The positive experience of talking about problems and hindrance factors made them capable of bringing up such matters at the workplace.

Over-Flow to the Work Situation and to Superiors

If superiors had been involved in the recruitment of patients to the PBR groups, there was considerable interest and a positive over-flow to the workplace. In some instances, the activities of the PBR groups initiated contacts from the management to the Industrial Health Care Unit for discussions on how to improve the work environment. According to some patients, management began to listen to complaints and suggestions which previously had been neglected.

Over-Flow to the Home Situation

It was a common experience among the PBR patients that the group activities enabled them to change the pattern of responsibility at home. In addition, quite a few of the patients developed a more relaxed attitude to home duties.

Social Support

The PBR groups provided a strong social network and were important sources of social support for the members. Several patients stated that they had never previously had such an experience of positive social interaction and support.

The PBR Method

The PBR method encouraged the patients to take responsibility for their own rehabilitation process. Most patients stated that the method was motivating and stimulating, for example as compared to lectures only, and promoted a more active attitude toward work- and health-related problems.

To summarize, according to the subjective evaluation of the PBR method, it appeared to fulfill most of the criteria we had set up in order to expect positive effects in terms of improved health. The study still has to await long-term evaluation with regard to motivational improvements, changes at the workplace, and preventive interventions.

Immediately after rehabilitation was terminated, several of the health indices had improved in the PBR group. Comparisons were made between ratings before and after rehabilitation, using the Kruskal-Wallis approximative chi-square test. Significant improvements were obtained in two of the four scales measuring functional status. After rehabilitation, physical health interfered less with work or other daily activities and with social activities in the PBR group. Wellbeing improved in scales measuring pain and vitality. The personal perception of health also improved over the rehabilitation period. There was no improvement in the control group over the same period of time.

DISCUSSION

Currently there are several views on the etiology of occupational back pain, and similar views are applicable for neck and shoulder disorders. The perspective of causality naturally affects which strategies are chosen for rehabilitation and prevention. The three prevalent schools of thought, according to Frank *et al.* (75), may roughly be grouped into the clinical pathology view, focusing on pathology and prognosis of the individual, the biomechanical exposures view, focusing on adverse physical workplace exposures, and the perverse incentives view, focusing on the disability-promoting mechanisms of societal compensations and benefits. In addition, reactions as described by Reid *et al.* (76) in their analysis of the epidemic of

repetition strain injury (RSI) in Australian industry during the early 1980s may have to be considered, in that skepticism from the doctors, supervisors, and collegues forced the patients into a pattern of credibility seeking, which possibly maintained and prolonged their illness.

Much of the information obtained on rehabilitation of musculoskeletal disorders emanates from the clinical pathology view, i.e., studies on rehabilitation have their focus on treatment and coping of symptoms. A substantial amount of resources have been invested in "early" and "active" rehabilitation, and there has been a virtual consensus regarding the positive effects of such treatment. A considerable number of problems are involved with measuring the outcome of rehabilitation efforts. Conditions of improved physical strength and mobility, or reduced pain do not necessarily imply that a treatment has led to better health in terms of improved ability to work or function in normal life. Improved physical health may be a necessary, although not a sufficient condition for improved work ability. A reduced physical capacity for work and experiencing pain may make it difficult to perform some tasks. Lack of understanding from superiors and work mates for any such dysfunction may cause the individual to avoid some tasks or to withdraw from the work group to avoid social pressure. Such secondary psychosocial effects may become causes of sick leave, even if the physical incapacity is eliminated.

The biomechanical exposures view that would lead to preventive work focus hitherto mainly on reduction of physical loads and improved movement patterns to increase physical variability. Workplace interventions to a large extent have comprised introduction of job rotation between work tasks that in essence only vary with respect to which muscles are used. There are a number of fairly well specified risk factors in the work environment that are associated with musculoskeletal disorders. Epidemiologic studies of work-related risk factors for musculoskeletal disorders emphasize the importance of considering organizational and psychosocial aspects, as well as the physical work conditions, in preventive work. An understanding of risk factors and the ability to identify and alter them is the basis for effective prevention programs. Some specific workstation improvements have been performed in occupational settings with the primary aim of reducing heavy physical loads or static loads. Unfortunately, few intervention studies comprise systematic and controlled changes at the organizational and psychosocial levels, in spite of the potential importance for long-term preventive effects.

Frank *et al.* (75) suggest a more transdisciplinary research approach integrating models and methods from the various disciplines to reach more conclusive risk models for musculoskeletal disorders. In particular, it appears necessary to merge the present knowledge on etiologic aspects and knowledge on prognosis into the same frame of reference, since there is a lack of studies encompassing the workplace as a significant component of rehabilitation programs, and, in general, integration of prevention and rehabilitation is not well developed. A rehabilitation program that does not comprise elimination or at least changes of those conditions that contributed to the development of the disorder, will in all likelihood not produce a persistent positive health outcome, as it is likely that work conditions that once contributed to the individual's disorder will be perceived as unsatisfactory or hazardous by the individual. Several studies showed that opportunities to try new jobs

or new work tasks improve the prognosis for work ability after rehabilitation. Prevention and rehabilitation programs have to appreciate not only external factors at work, but also internal factors such as perception of work conditions and opportunities for efficient coping strategies at work as important components. The role of the supervisors and management attitudes were stressed in several studies as important to facilitate re-entry at work.

In the briefly presented pilot study using problem-based rehabilitation, attempts were made to cope with some of these issues. A cornerstone in the problem-based approach is that the patient must be actively responsible, not only for determining subgoals during the rehabilitation process, but also for finding strategies to reach the goals. Patients may have different hindrance factors and different goals for their rehabilitation, and some patients may need more time than others to obtain their goals. Such differences did not create any problems in the groups. The source of motivation was the group and intrinsic motivators were emphasized. A number of epidemiologic studies have shown that job discretion is important to prevent stress-induced disorders. In analogy, if the rehabilitation process and the goals for the process are pre-determined by experts, i.e., if the patient cannot influence the rehabilitation process, similar negative health mechanisms may be activated and we may end up with a patient who feels worse and more passive than before rehabilitation started.

Social support and recognition by supervisors has been observed in several studies as important for primary prevention and for facilitating re-entry after rehabilitation. The experiences of the problem-based rehabilitation study indicate that if supervisors or managers were involved from the start of the rehabilitation period, their interest was maintained throughout the period. In essence, the attention and interest paid to the patient from the group and from supervisors and work mates, is considered as an active component of the rehabilitation strategy, rather than as a confounder. A positive attitude from the superior promotes a successful re-entry at the workplace.

Ideally, a rehabilitation program should combine efforts to prevent the first occurrence of the disorder, to reduce the length of a disability, and to hinder or reduce the risk of relapse (77). Rarely have any programs so far managed to encompass all these aspects. The literature, however, rather strongly suggest that involvement of the workplace in the rehabilitation program is a necessary condition to fulfill these aims. The problem-based rehabilitation strategy may be one way to approach this issue.

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