Work rehabilitation programs: work hardening and work conditioning[1]

F. Franchignoni[2], M. Oliveri[3] and G. Bazzini[4]

Introduction

According to the American Commission for Accreditation of Rehabilitation Facilities (CARF), work hardening (WH) is "a highly structured, goal-oriented, individualised treatment program designed to maximise the ability to return to work, addressing the issues of productivity, safety, physical tolerances, and work behaviours" [1]. WH attempts to bridge the gap between the patient's residual functional performance capacity and the job requirements, focusing on physical (biomechanical, neuromuscular, cardiovascular/metabolic), functional, behavioural and vocational needs. WH involves a coordinated interdisciplinary team (including physiatrist, physical and/or occupational therapist, and – as needed – psychologist, vocational counsellor or other rehabilitation professionals) and consists of the following components: physical conditioning, simulated work activities, education, and psychosocial interventions. The duration of WH sessions is usually several hours (max. 8) daily, 5 days per week. In order to meet the need for a less comprehensive program, the American Physical Therapy Association (APTA) also defined a work conditioning program (WC). WC is a "work-related, goal-oriented treatment program for subjects with less complex conditions", provided by a single discipline, of up to 4 hours per day [2]. WC is limited to function and work related physical conditioning interventions and does not include behavioural and psychological components. WH or WC should be provided only to clients that are unlikely to return to work with less intensive and expensive treatments.

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1. Some parts of this chapter have been adapted from Oliveri M: Work Conditioning and Work Hardening. In: Lendenwirbelsläule. Ursachen, Diagnostik und Therapie von Rückenschmerzen. Edited by J. Hildebrandt, G. Müller et M. Pfingsten, Urban & Fischer, 2005 (with permission of Urban & Fischer).

2. Unit of Occupational Rehabilitation and Ergonomics, Rehabilitation Institute of Veruno (NO), "Salvatore Maugeri" Foundation, Clinica del Lavoro e della Riabilitazione, IRCCS, Italy.
3. Unit of Occupational Rehabilitation and Ergonomics, Rehaklinik Bellikon, Bellikon, Switzerland.
4. Unit of Occupational Rehabilitation and Ergonomics, Rehabilitation Institute of Montescano (PV), "Salvatore Maugeri" Foundation, Clinica del Lavoro e della Riabilitazione, IRCCS, Italy.

The first WH program was established in 1977 by the American psychologist Matheson [3]. In 1988, Mayer and Gatchel described the functional restoration program they had developed for spinal disorders [4]. WH and WC programs were subsequently described by many authors in the nineties [5, 6, 7, 9, 10], and their components have been extensively commented in occupational therapy books [11, 12, 13] and supplements of rehabilitation journals devoted to industrial rehabilitation medicine [14, 15, 16].

Clients

The APTA guidelines state that WH should start after resolution of the initial or principal injury/illness [2], when subjects are medically stable and without serious diagnosis as documented by a recent medical examination prior to program entry. As time off work is inversely correlated to the rate of return to work, early intervention is strongly recommended. When time of inactivity is kept short and use of passive modalities (physical agents, manual therapy, massage, etc.) is limited, individuals are less likely to develop symptom magnification and to assume a "sick role". Most of the studies in this field involve industrial "blue-collar" workers (mean age ranging from the mid-30s to the mid-40s) suffering from activity-related spinal disorders, particularly low back pain. For low back pain, admission to a WH program is recommended 6 to 12 weeks after the onset of acute symptoms [4, 17, 18, 19, 20]. Clients enrolled in WH programs are usually physically deconditioned, and their physical abilities do not meet the physical demands of a targeted job. A psychosocial dysfunction such as abnormal illness behaviour, fear and depression is often present, but important mental disorders should be excluded. There should be a reasonable expectation that the client can be reintegrated in a specified occupation. Motivation, of course, is crucial for the success of a WH or WC program. However, before starting the program it is often impossible to separate true motivation from a convincingly expressed pseudo-motivation like *"Of course, I will do anything that is good for my back"*. For this reason, it is advisable in doubt to enrol the client on a trial basis.

Program

Programs include flexibility, strength and endurance exercises (specific treatments can be added whenever necessary), and a highly individualised job-specific training (if return to previous job is possible, otherwise the goal is to get the person fit for any suitable work). The program follows an active therapy approach, requiring the "temporarily disabled" individuals to participate in a daily structured routine that mimics their job (in its physical, temporal and procedural structure) and minimises incentives for illness behaviour. The tasks are structured and graded to progressively improve physical and psychosocial work functions: functional performance capacity, psychomotor skills, work habits and rules (such as punctuality, attendance, compliance to safety instructions), work procedures and work-related skills (such as task completion, quality standards, productivity), interpersonal and communicative skills (with supervisors and peers). The training is

based on the worker's specific job demands and functional deficits, as defined by a WH assessment. The ultimate goal of WH is to help the client to achieve, in a safe and quick way, a level of acceptable productivity for the competitive labour market, increasing confidence for the resumption of productive work [21]. The duration of daily participation should begin at a comfortable level (based on baseline assessment), gradually increasing – as work tolerance improves – to the full-work level. Return-to-work rate is a common measure of success. Some clients may return to a modified light-work schedule and/or part-time work.

Equipment and space

WC and WH needs equipment for gym and work simulation activities. In order to simulate physical work demands, the latter should approximate as closely as possible to the actual work environment in terms of noise, light, humidity, etc. Rooms for counselling and additional treatments should be available, access to a gym hall for group exercise (e.g. aerobics, low impact, games) is recommended. In European countries, WH is usually located in a rehabilitation centre. For out-patients, return to part-time work may be implemented already during the program, and on-site work evaluation and/or rehabilitation can be added, if appropriate. In general, there is no need for expensive high-tech equipment. A set of devices for resistance training and simple work-simulation systems (such as bolt box, brick wall, assembly etc.) is usually sufficient; job-specific work stations are added for individuals with special work demands.

Assessment

A work-related baseline assessment should consider the physical and psychosocial factors affecting the person's ability to participate in the program and later return to work. Assessment should take account of neuromusculo-skeletal and cardiovascular status, work-related functional capacity, vocational status (including work demands) and incentives for return to work, behavioural issues (including strategies to cope with the actual disability and motivation to improve function, symptom magnification tendencies, abnormal pain behaviours, and work motivation), and other psychosocial or financial factors.

Structured interview and questionnaires on medical and psychosocial issues

The evaluation starts with a review of the worker's medical history and condition. The client should carefully report pain and other symptoms and how he copes with them, perceived functional limits and work tolerance, and use of medication or other treatments prior to the program. The key questions are: is the client's description of symp-

toms and limitations clear and specific, or is it vague, generalised and leaning to catastrophising *(cf. § [Recognition of symptom magnification and self-limitation])*? Is this description consistent with medical findings or not? Does the client use active strategies to cope with symptoms or to overcome limits? Did he/she have mainly passive modalities and medications or also active training as previous treatment, and what was the reaction to the treatments? Evaluation proceeds with a job description *(cf. § [Job evaluation])*, the person's work-related abilities and interests, the social environment and its interaction with the disability, and non-vocational activities involving employment-related behaviours (hobbies, sport, social groups, etc.) [7, 12]. A useful questionnaire for assessing clients' beliefs about their work-related abilities and deficits (which can differ from results of functional capacity evaluation) is the *Spinal Function Sort* [22]. A systematic and very helpful checklist of possible barriers for rehabilitation and return to work are the *yellow, blue and black flags* [23, 24]. Parts of this intake evaluation can be re-administered at discharge, for outcome evaluation.

Physical assessment

The clinical examination includes generalised testing of range of motion, manual muscle testing, sensory screening and tests for motor coordination and manual dexterity.

The main part of physical assessment is a work-related *Functional Capacity Evaluation* (FCE) *as described in chapter 6*. In addition to the FCE battery, an assessment of cardiovascular endurance (e.g. ergometer test or a walking test) is recommended, because a deficit in this field is common in clients with chronic disorders. For a minimal functional evaluation, at least the following tests of FCE should be performed at the beginning and end of the program: *lifting floor to waist, horizontal (waist to waist) and waist to overhead, unilateral carrying, standing and sitting for longer time, walking*. Other FCE tests can be done as part of a standard test battery or according to the work demands of the client: *pushing and pulling, grip strength, elevated work (overhead), forward bending (stooping), crawling, kneeling, crouching, squatting, stair and step ladder climbing, balancing, hand coordination*. In some cases, work-specific activities should be assessed as well (e.g. building a wall with bricks). The main criteria for these evaluations are: safety of administration, reliability, job relatedness, practicality, and predictiveness [12]. The FCE measurements should be compared with the physical demands of the job to which the client is expected to return (job match grid), to ensure a properly designed rehabilitation plan and reasonable return to work decision making. As discussed in the chapter of this book on FCE *(cf. § [Functional Capacity Evaluation])*, assessment of work-related functional capacity is complex and therefore a methodical challenge for studies. Only few studies on FCE have been carried out, and there is no universally accepted operational definition for FCE batteries [25, 26]. Nevertheless, many tests have reasonable content validity and good reliability, particularly those consisting of simulation of critical demands or functional tasks performed with standardised procedures [27]. For this reason, at present FCE is the best available option for assessment in work-related rehabilitation (widely recognised by rehabilitation professionals, by insurance companies and also in court). In

addition, FCE helps in identifying symptom magnification and self-limitation *(cf. § [Recognition of symptom magnification and self-limitation])*. In this case of observed self-limitation, the "maximum" performance does not represent the true functional capacity; the observations referring to this and the consequent drawbacks in the results' interpretation should be documented in the report on the assessment.

Recognition of symptom magnification and self-limitation

Recognition of any symptom magnification and self-limitation is crucial, not only for judging the validity of the FCE results, but also for optimising program management and, in particular, training dosage. The rehabilitation team should therefore be able to assess whether clients are really working at their physical boundary or are limited by psychological factors. Self-limitation is mostly due to fear of movement (threat of tissue damage or pain aggravation). However lack of understanding of the program principles, unwillingness to return to work (e.g. due to problems at the workplace) and/or secondary financial sickness gain can also play a role. Symptom magnification and self-limitation are discussed in detail in the chapter of this book on FCE by Oliveri. For their evaluation, the following issues – based on the interview or questionnaires and physical examination – are most important:

– description of symptoms and limitations: specific or vague and global with catastrophising?

– social role of the symptoms: does the client have some control over the symptoms and does he/she still participate in various social activities, or do the symptoms dominate all aspects of life (the client as prisoner of the pain)?

– does the client estimate his/her own functional abilities as very low, e.g. resulting in a very low index of the Spinal Function Sort?

– does he/she clearly underestimate the level of function compared to results of functional test?

– is the client willing to perform the physical tests and continue until observed functional limits in spite of some pain increase or discomfort, or does he/she stop very early, before the therapist identifies any functional problem?

– are there important discrepancies between clinical examinations (e.g. Waddell signs), answers in the interview or questionnaires, and FCE-tests, or between different physical tests with comparable physical demands? [23, 24, 28, 29];

– is the client willing to perform a minimum of training tasks at a reasonable performance level and to gradually increase the performance level within the first week of the program (provided that any severe and strongly restricting clinical condition has been excluded)?

Clients focusing on pain should learn to accept that a quick resolution of their pain problem is not realistic, and that the primary goal of WH is restoration of function. In order to change the focus from pain towards function, weekly assessment of functional evolution (FCE tests or training performance level) and a formal feedback of the results for the client is critical. The clients should learn to really appreciate their functional improvements in spite of the fact that some pain is persisting.

Job evaluation

A job description from the client and/or company is the first preliminary method for obtaining a report of the worker's job tasks, including duration, the physical, functional, and psychological demands of the job, and the use of specific equipment, tools and materials [7]. Work-related sensory components and environmental conditions are also important.

An early visit to the workplace (usually by the therapist together with the client and possibly with an outside case manager) can play a significant role in the rehabilitation program. Such a visit can be part of both assessment and intervention:

– it shows the client the central value of his/her return to work within the WH program;

– it engages the employer and those in charge at the company in the WH concept and process, in order to find the best solutions for client's re-entry and maintenance at work, and remove prejudices towards the "handicapped" member of staff;

– it helps understanding of the exposures of a specific job and problems the client must overcome to return to the job, and it is essential for planning ergonomic modifications at the work site if needed *(cf. § [Ergonomic interventions at the work site])*;

– it makes it possible to design an accurate environment to simulate the job-specific tasks and establish the job performance criteria on which program goals are based. It also offers an opportunity for borrowing actual tools and materials that are appropriate for work-simulation training (if needed).

Sometimes, telephone contact with the company is sufficient or the only realistic option for geographical reasons.

In other cases an extended job analysis is compulsory [30, 31]. Furthermore, it is important to be aware that there are notable differences in workers' physical performance depending on gender (women have on average 65% of the strength of men), age (people at 55 years have lost on average 15% of the strength they had at 25 years of age) and inter-individual differences (both due to constitutional factors and specific skills acquired during work experience).

Intervention

General considerations regarding intervention

Relationship between psychologically-oriented interventions and physical training

As mentioned, many clients with (a tendency to) chronic musculo-skeletal disorders present not only severe deconditioning but also important psychological and behavioural problems. The latter include fear of movement, symptom magnification, disorganisation

of daily activities, stress, depression, loss of hope and life perspectives, problems related to financial uncertainty, etc. Psychological or behaviour-oriented interventions (such as the goal setting process, information and education on coping with pain, and symptom-negotiation training *(cf. § [Goaling process/Structured information and education on coping with pain/Enhancing self-efficacy beliefs])* pave the way for the physical training as they build up knowledge of the WH concept and willingness to tolerate intense physical training (in spite of pain and discomfort that often accompanies it, especially in the first period). These psychologically-oriented interventions may require a considerable amount of time: from 2 hours/day [32] to around half the daily duration of the program [33].

The client's role: personal responsibility and self-treatment

Patients' healing expectations – in particular the belief that passive modalities such as manual therapy or massage or extended medical investigations will heal their pain – often result in a dependence on doctor and therapist (that is sometimes also promoted by the two professionals). Waddell associated this medicalisation and extensive medical investigation of unspecific back pain and lack of self-activity and responsibility with the epidemic-like increase in disability due to back pain [29]. Matheson called the therapeutic approach to chronic pain that primarily aims at pain reduction "the feel good trap" [34]. Patient and therapist may be satisfied by the temporary effect of such modalities, but in the long term this approach is counterproductive. In contrast, clients in WH must take responsibility for their treatment, supported by the therapist and the whole rehabilitation team. They are learning to perform the training by themselves and to "negotiate" with their symptoms *(cf. § [Symptom negotiation training])*.

Role of the rehabilitation team: uniform treatment planning and patient management

The rehabilitation team (which comprises the doctor and therapist involved, as a minimum) is responsible for assessment, treatment planning – including the global and weekly goals – and therapy. The team approach must also guarantee the "unité de doctrine" [uniform doctrine] regarding method and program structure as well as the information that is given to the client.

Role of the therapist as a coach

In WH, the therapist is not a helper or a healer, but mainly a coach. The coach must be aware of the psychological implications of his/her therapeutic conduct, and behave as an enabler, not as a manipulator or someone who gives orders. He/she should not just confront his/her concepts and decisions, but merely holds up a mirror to the clients, i.e. presents them with the consequences their own ideas and behaviour. Coaching is thus an aid towards self-help, whereby other ways of thinking and action patterns should be stimulated. The coach should ask the correct questions, leaving the client to find the correct answer.

The greatest challenge in the art of coaching is the ability to negotiate and determine weekly goals at the crossing point between the requirements imposed by the primary goals of the program and the clients' capacity for achievement based on his/her current physical and mental state.

Goaling process

Primary goals

The selection of primary goals is one of the first steps in the WH program. It assists the client in communicating their concerns, preferences and attitudes and acquiring a sense of responsibility for their own behaviour, it also helps to develop a rational basis for planning and monitoring the interventions. The goals are both personal and job-related and must be negotiated with the client (taking also into account the targets of the employer and insurance company that pays for the program). Goals can be determined on an activity level (e.g. climbing stairs, carrying a shopping bag, putting goods on overhead shelves, or driving a car) and on a more global participation level (e.g. return to previous work, or pursuing a certain sport again). The goal setting process can include the following steps [34]:

– listing of occupationally-significant and personal goals by a structured interview;

– ranking of goals in ascending priority of importance (discussing first what is considered least important and ending with the most important item – this direction is easier for the client). Then the list is rewritten in the order of descending priority. The client is now asked to go through this list with at least one confidant and make meaningful corrections;

– formalization and distribution of the goal document: the client must hand copies of the definitive list to some confidants to inform them of his/her goals.

Many clients initially mention freedom from pain as their most important goal. After further discussions, most acknowledge that this goal is unlikely to be achieved in a few weeks after long-lasting pain. They then usually accept the formulation of more realistic and functional goals and give them higher priority than pain relief. Therefore, discussions about the goaling process also help to shift the client's focus from pain towards function and activities.

A useful tool for activity goal setting, the SMART form (Specific-Measurable-Acceptable-Realistic-Time), has been developed by the Pain Management and Research Centre of the University of Maastricht. It has proven its value at different pain clinics in Holland. Clients are asked to note down 5 activities in which they feel limited. They should then note how important each activity is for them (rating of 1 to 5) and how well they would assess their current ability to do that activity (1 to 5). Based on these answers, goals and time limit to achieve them are negotiated between the therapist and client and noted on the lower part of the sheet.

Role of weekly goals and visits in the goaling process

Measurable weekly goals can be derived from the primary goals. The art of setting weekly goals lies in "neither raising the bar too high nor leaving it too low". If goals are too ambitious they will remain unachieved, which demotivates the clients and undermines their self-efficacy *(cf. § [Enhancing self-efficacy beliefs])*. Conversely, if goals are too easy, the primary goals will not be achieved within the requisite time. Moreover, inadequate challenges do little to develop enthusiasm and self-confidence.

In weekly visits or conferences, goal achievement of the previous week is examined and the goals for the next week set. At least the doctor (senior physician or resident), the therapist in charge for treatment and the client should take part. A psychiatrist or psychologist, vocational counsellor or social worker may also be present if necessary. The visit should take place directly in the training premises, so allowing to look together at relevant or problematic exercises and make observations and proposals on the spot. Doctors can thus evaluate clients directly "at work" in the program, and – with their "authority" – praise or encourage them or admonish them for inadequate effort. The aim of combined on site observations is also to cross-validate the observations and assessments made by individual members of the team during the week. A central working instrument is the goal and progress form, in which the primary goals, problems, relevant weekly goals and goal achievement as well as the tasks of team members are continually updated. As already mentioned, most of the weekly goals should be measurable (e.g. weight or walking distance, number or duration of repetitions, number of series or laps per day) in order to monitor the performance and give objective feedback to the client (also in graphic form). Prior to the visit, the therapist's job is to enter the goal achievement of the past week with comments as well as proposals for next goals and proper pacing of the level of progressive challenges.

Structured information and education on coping with pain

The information and messages to the clients on coping with pain as well as behavioural therapy should be closely linked to clients' experience in practical training and possibly include additional measures for stress management, relaxation or pain treatment.

Contents

The pain concept of many clients is related to experience of acute pain: these clients associate pain with threat and fear of tissue damage, thus pain-producing activities are avoided and disability increases. This belief is also supported by damage-associated information from some doctors or therapists, for example, about "arthritis" or "slipped disks", and recommendations (beyond the acute phase) such as "*You shouldn't put any strain on your back, don't bend and don't pick up anything heavy*" [35]. Fear and stress lead in turn – via an increase in muscle tension and a lowering of pain threshold – to increasing pain. Explaining the difference between acute and chronic musculo-skeletal pain can help clients to reduce fear and stress and improve their willingness to participate in a WH pro-

gram. Information and training should be behaviourally oriented (cf. below in this § and also [Symptom negotiation training]) and not largely consist of medical explanations based on anatomy and pain physiology [20].

Important core messages to give the back pain client are:

– chronic pain does not mean harm! It is not dangerous to move and stress your body when you are in pain! In fact, this is necessary in order to escape from the vicious circle of avoiding physical activity, loss of fitness and pain;

– chronic pain usually cannot be reduced in a short time. However, it is possible to increase performance capacity with intensive training despite pain. In many cases, a reduction in pain will then occur in the long term;

– some pain increase usually occurs at the start of the program as under-used muscles and joints are now trained, and the body has to readapt to higher activity level. This is normal!

– in this program, the primary goal is not pain reduction but *increasing your performance capacity*. This will be measured weekly as the main criterion for your success. An intensive training program creates the prerequisites for successful return to work.

It is well-known that psychological factors play an important role in chronic pain. To explain the interdependent functioning of physical and mental factors, information may begin with the message: "*Psyche and body are not independent of each other. A physical change has an effect on the psyche and vice versa. For example, experiencing fear or stress leads to an increase of muscle tension, heart beat or sweating. The response from the emotions and the behavioural reactions can influence personal experience of pain. This is good news, because this offers possibilities to gain a certain control over back pain*" *(cf. § [Techniques of relaxation, awareness and diversion])*.

One important goal of psychologically-oriented intervention is to overcome fear-avoidance behaviour [24, 29, 36]. Fear cannot be "talked away": overcoming fear is a cognitive-behavioural therapeutic task. The goal is to create challenging situations in which clients can learn from their own experience to reduce their exaggerated fear about tissue damage during painful activities and thereby approximate their expectations to reality *(cf. § [Symptom negotiation training])*. In addition, the connection between fear and chronic pain can be illustrated using the Vlaeyen model "Fear of movement/(re)injury" [36, 37], that postulates two opposed reactions to fear of movement or tissue damage: *confrontation* and *avoidance*. If there is no serious back pathology, the confrontation with everyday challenges and more or less normal daily activity despite back pain probably leads – as an adaptive response – to a fear reduction and promotes functional recovery. In contrast, avoidance leads to the maintenance or exacerbation of fear and possibly to a phobia-like condition. Avoidance maintains the vicious circle of *feeling pain → catastrophic ideas of pain → fear of pain → avoidance of activities → reduction in tolerance to strain → (even more) pain.* Clients should be aware that back pain mostly is a harmless everyday problem that they can check themselves and not a serious illness that requires particular caution and care. This applies also to back pain after resolution of the primary damage in case of an injury.

If necessary, behavioural training regarding communication about back pain is also meaningful. It can help to get rid of the habit of talking incessantly about pain and frequently showing that one is in pain (e.g. limping, supporting one's back with the hand or

even using a stick when walking). Clients should understand that this behaviour promotes focusing on pain, and also leads to their complaints being taken less and less seriously. In contrast, communication on other topics helps to keep pain at a distance. Within the framework of the WH program, "rules of the game" can be agreed upon, e.g. *"In the morning, we discuss your pain because we take your pain seriously and would like to be informed about it. After that, however, you should not talk about it any more if possible until the next day and also show your pain as little as possible. Instead, try to find some diversion from pain. Think of all the other things in your everyday life, which are important to you and which you can talk about with others"*. In order to train this communication excluding pain issues, the therapist and doctor should show interest in other areas of the client's life (e.g. hobbies, things that happened at work or with the children, politics, etc.), and try to draw the patient out on these themes.

Methods for structured information

An individual explanation by a doctor, therapist and/or psychologist has many advantages: the information and advice can be tailored to intellectual levels and individual problems, the client is addressed directly, discretion is guaranteed, and the best language for communication can be selected (language is a problem for rehabilitation clinics with many immigrants). In comparison to group discussions, however, individual talks preclude any exchange of information and interaction between clients. From the clients' viewpoint, statements made by fellow patients often appear more credible than those made by seeming healthy doctors, psychologists or therapists who do not know what it means to suffer pain every day. Therefore, it is often worthwhile introducing information using the following approach: *"Just the other day, a patient told me that…" "Other patients have found that...*". This is better accepted than a theoretical approach. In the case of people from other cultures, it can be useful to have a mediator. A written booklet on how to learn to cope with pain can be very helpful in supporting education. The client is asked to read it and prepare questions for the next consultation with the psychologist, therapist or doctor. Stimulated by the patient pamphlet "The Back Book" [38], which gives advice on coping with acute or subacute back pain, the WH team of the Rehabilitation Clinic Bellikon has issued a learning program on coping with chronic pain [info@rehabellikon.ch]. The inclusion of such an assisted self-study task within the information process emphasises the principle of self-responsibility and provides a tool for evaluating the client's willingness to learn about coping with pain.

A closed education group can also be meaningful if the usually referred clients are linguistically and culturally fairly homogeneous. A combination of preliminary individual information and education and then participation in an open education group with exchange of experience may be a valid compromise.

Enhancing self-efficacy beliefs

In his important work "*Getting a handle on motivation: self-efficacy in rehabilitation*", Matheson set out the basic principles of self-efficacy, goaling process and motivation

referring also to works by Bandura and White [34]. Self-efficacy is based on the perception of personal competence and skills. It influences people's behaviour, motivation, ways of thinking as well as emotional reactions to challenging circumstances. According to Bandura, self-efficacy beliefs is an important component of motivation, it encourage one to carry out new activities. White postulated an urge towards competence (i.e., sense of the ability to influence and control one's surroundings) and self-assertion, and he positioned this urge at the same level as the urges for satisfaction of hunger, sex and safety. Specific goals in the occupational and private field can be understood as an expression of this urge. Normally, temporarily disabled people are motivated to discover every day what they can still do or do again in order to regain their skills as fast and completely as possible. In some people, however, this urge towards competence appears to be blocked, and they develop avoidance behaviour, mostly because they feel threat of damage or pain when performing movements. This results in lack of control over symptoms, increasing disability, hopelessness and poor motivation. Sometimes a more or less conscious sickness gain also plays a role. The result is not only persisting disability and lack of participation in social life but also, in particular, the feeling of being an invalid, i.e., an overall lack of self-efficacy.

How can this destructive process be stopped and reversed? There are two main means: the goaling process, and symptom negotiation training.

Goaling process as a means to enhance self-efficacy

The feeling of competence and/or trust in one's own strength is based on success. According to Harding, "*Increased self-efficacy is closely linked to successful rehabilitation... To increase confidence, patients need to attempt something previously feared, achieve it, and recognise it as their own achievement. Thus, persistent goal attainment will reinforce self-efficacy and lead to a perception of mastery over the problem and the task.... Goals must be personally relevant, interesting, measurable and achievable. Goal setting should be a matter of negotiation between the patient and the therapist*" [39]. The goaling process as a whole, the consistent, realistic and measurable weekly objectives, the relevant achievement of these weekly goals and the associated feeling of success are thus the cognitive-behavioural therapeutic alpha and omega of the rehabilitation process. In this way, clients learn to recognise and appreciate an improvement in their functions as a result of rehabilitation instead of clinging to a "pain barometer" as they had largely been doing before.

Symptom negotiation training

Many clients with chronic back pain cannot "negotiate" effectively with their symptoms or cope with their pain. They experience their symptoms as being more or less beyond their control. As they cannot predict the pain behaviour, they feel unable to exert control over their pain, themselves and their environment. This, in turn, increases the lack of self-efficacy. Symptom negotiation training is therefore an important training element for these clients in a WH program [34]. It is based on the following principle: when symptoms

can be predicted, they can be better controlled. To achieve this, the therapist must create situations in which the symptoms appear in a predictable way and for which prediction and control by the client are facilitated.

The most important strategies for symptom negotiation training are:

Graded activity

This approach is based on a tasks presenting a gradually increased activity level. The starting point and the increment are set by the therapist in such a way that a clear relationship between activity and symptoms can easily be felt by the client. For example, in a progressive lifting test, load, lifting height, speed or rate can be increased. The purpose of this exercise is not, however, to evaluate lifting performance, but to clarify the connections between stress level of the task and symptoms. Some clients have initially to learn to differentiate pain levels as shades of grey rather than as black-or-white (i.e., either no pain or catastrophic pain).

Graded exposure to feared movements

This method [36, 37, 40] resembles the "graded activity", but clients are exposed as realistically as possible to the specific physical stress that they are afraid of: "*For example, if the patient fears the spinal compression produced by riding a bicycle on a bumpy road, then the graded exposure should include an activity that mimics that specific activity, and not just a stationary bicycle. Such an approach gives the individual an opportunity to correct the inaccurate predictions about the relationship between activities and harm*" [36].

Pacing

Clients with painful disabilities often function according to an "on/off" principle ("Yes, I can" or "No, I can't"). They should experience that by adjusting their working pace there are intermediate options: e.g., doing things slower, making short breaks, doing some stretching, loosening up or relaxing exercises in between, alternating work activities, etc.

Modification of working techniques, tools or workplace

Many clients with pain-related disabilities have not yet learnt to appreciate the value of working smart rather than working hard. They keep on working as uneconomically as they did before the accident/disease or even worse. Ways of modifying working techniques and requirements as well as tools and workplace *(cf. § [Tool modification]/ § [Job site modification])* should be evaluated [41].

Coping with exacerbated pain

An exacerbation of pain during rehabilitation is a challenge for a client's self-management and should be used for education of proper pain behaviour [39]. Clients should learn to avoid panic and assess the pain situation realistically, and to avoid, for instance, alarmed consultations at emergency wards. They should apply the learned self-treat-

ments for pain relief (e.g. cool packs, relaxation technics, the meaningful use of medicaments) and analyse the likely causes of the acute pain attack.

Physical conditioning and functional restoration

The avoidance of pain-producing activity generates physical deconditioning that should be treated through an exercise program aimed to increase muscle strength and endurance, flexibility, motor coordination, and cardiovascular fitness. The terminology for describing such programs includes "functional restoration", "physical reconditioning", "dynamic strength exercises" and so on [42].

Increasing strength

The prescription parameters for optimal strength training are as follows [43]:

Mode and intensity

The training stimulus to produce resistance can come from the weight of the body or any of its segments, from free weights, elastic bands or tubing, or weight machines. The exercise can be isotonic (alternating concentric and eccentric muscle activation that moves a body part through a range of motion against resistance), isokinetic (involving specialised equipment that provides "accommodating" resistance so that the joint moves at a constant angular velocity), isometric (muscle action that is performed against resistance at any point in a joint's range of motion, for periods of 5-10 seconds, and that produces no joint movement), or plyometric (requiring eccentric activation of muscles against a resistance, followed by a brief amortisation period, and after by "explosive" concentric activation).

When isotonic exercises are performed, the concept of a "Repetition Maximum" (RM) should be used to prescribe the weight or load that one lifts: "n" RM represents the maximal load a person can move for n repetitions before fatigue in conditions of good technique, for example a 1 RM is the maximal load for one (and only one) repetition. To elicit improvements in both muscular strength and endurance, the American College of Sports Medicine recommends performing 8-12 repetitions (i.e., 8-12 RM, corresponding or 60-70% of 1RM). Some other programs suggest 15-20 repetitions (corresponding 50-60% of 1 RM) for patients with musculo-skeletal disorders or older persons in order to avoid tissue strain, but there is no evidence to justify this precaution, with the exception of evident lack of tissue tolerance to strain (in such case, a starting dosage of 20 RM is usually adequate). A training for local muscular endurance (e.g., > 20 RM) is recommended when more repetitive activity is needed at work. Furthermore, also power development programs (using light to moderate loading for 6-10 repetitions with high repetition velocity) may help to optimise functional abilities.

Conversely, in some specific working activities the loads and repetitions established in the FCE tests can be transferred directly to training, e.g., the 5 repetitions used in the FCE lifting tests have proved appropriate also for lifting training.

Fig. 1 – Training of cardiovascular endurance and back stabilisation.

Figs. 2a and 2b – Training of back strength and flexibility.

Number of sets

One set of 8-10 exercises that conditions the major muscle groups might be enough for strength training in healthy subjects, but a 2-3 set regimen may provide greater benefits in the case of important deconditioning and pain, or when strength endurance is required at work.

Frequency per week

Two to five times a week (5 times applies more for rehabilitation of important deconditioning and/or self-limitation due to symptom magnification).

All three parameters (intensity, duration, frequency) contribute to the training volume. The volume should exceed that which the muscles normally encounter. This "overload" induces muscles to adapt and progressively increase their ability to generate force. Dynamic muscular strength improvement is greater when eccentric actions are included in the repetition movement. The training program should emphasise multiple-joint exercises and functional closed kinetic chain movements. Also free weights (e.g., dumbbells or exercise ball) are important because they produce patterns of intra- and intermuscular coordination that mimic the movement requirements of specific tasks. Coordination is also improved when doing work simulation training *(cf. § [Work simulation training])*.

The responses to strength training are both functional and structural [44]. Functional changes include more motor units recruited during a task, more synchronised recruitment of motor units, and less activation of antagonist muscles. Structural changes are increased activity in muscle metabolic enzymes, hypertrophy of muscle fibres, increased size and activity in mitochondria, and splitting of fibres (without true hyperplasia). Strength gains that occur in the first two to three weeks of an exercise program are due to functional changes. Structural changes take longer. The exercise prescriptions produce changes that are specific to: 1) muscle group; 2) joint angle or range of motion; 3) type of muscle action; 4) speed of muscle action; 5) muscle fiber type; 6) metabolic energy system. For these reasons, general motor performance and coordination improve more when the training exercise components also address the specific tasks or activities of the individual worker *(cf. § [Work simulation training])*.

Particular exercises can sometimes reduce muscle pain, especially when a more intense muscle training (at 10 RM) is performed. Possibly, a high recruitment demand has greater impact on muscle areas respectively fibres that are tense and painful (which do no longer react normally to a low level of neuromuscular recruitment). As a consequence, these areas get (better) activated, local blood circulation and metabolism will improve, and their increased contraction is then followed by (better) relaxation.

Strength training in painful conditions

Many clients with persistent or chronic pain feel pain or even more pain when doing resistance exercises. Should strength training take place under these conditions? Is it possible to gain strength and endurance when exercise performance is limited by pain? In general,

persisting or chronic pain is not a reason for avoiding resistance exercises, nor is it an absolute limit for dosage (dosage should be monitored by criteria of safety and fatigue) but appropriate consideration should be given to the pain behaviour. When clients are reliable and willing to join in, less "pushing" is necessary and you have to check that they do not overtrain. Conversely, self-limiting clients should be pushed as far as they tolerate the loads: it is essential to negotiate a compromise that permits both progress in training as well as client's cooperation. Under this condition, the "strength training" will be initially more akin to a pain tolerance training until the client tolerates weights that really produce a physical training effect. Given a linear ratio of pain and load, it is always possible to ask for a "more courageous" level without risk of delayed long-lasting pain or soreness, but particular caution is needed concerning initial performance levels if delayed and/or long-lasting pain due to exercises are known or expected by the patient. In selected cases, electromyostimulation can be added, especially when pain significantly inhibits active muscle recruitment. Strength training should not be applied in case of substantial painful muscle irritation, and people suffering from inflammatory musculo-skeletal disorders and fibromyalgia are not eligible for training in painful conditions.

Strength training through full range of motion?

As already mentioned, strength, coordination and stabilisation ability are specific for range of motion (ROM). If part of ROM is not loaded or trained for a long time (e.g. pronounced lumbar flexion), a local deficit of stabilisation ability will develop and persist. However, loading for instance in lumbar flexion occurs from time to time in daily activity or during work, and damage can easily occur. Therefore it is important perform strength training over the whole ROM. If tolerance to resistance is considerably diminished in the more painful part of ROM, temporarily splitting the movement into two arcs and training the more painful part at a lower resistance than the rest. A similar choice is recommended for a middle painful arc, where training should focus on both sides of ROM leaving out the painful area and aiming to progressively bring closer the two training sections. Appropriate maximal loading throughout the entire ROM can be obtained also with the accommodating resistance of a isokinetic device.

For certain disorders (e.g. osteoarthritis, disc herniation, spinal stenosis or spondylolisthesis) where repeated movements produce important pain increase, stabilisation training with only minimal movement in the middle part of ROM should be prescribed, as the "lesser of two evils". A good option therefore is the training concept "neutral spine" [45, 46], which is based on old well-known back exercises, but forms a unique concept because of its consequent instruction and implementation of the stabilisation principle. First of all, clients learn how to find and maintain their best individual (lumbar) "neutral spine" position (when pain is minimal). In the course of further training, they practise keeping this position stable at all times while increasing movements and exercises of the arms or legs. Corresponding training on weight machines can be done in such a way that the weight is only lifted and moved little in the "neutral spine" position.

Increasing flexibility

Flexibility exercises should be incorporated into the overall fitness program to improve and maintain range of motion (ROM) [43]. Daily exercises should stretch the major muscle groups. A greater flexibility improves joint function, enhances muscle performance, prevents muscle injury (especially during eccentric exercise) and other soft-tissue injury, and decreases post-exercise soreness. Furthermore, more flexible muscles permit greater storage of elastic strain energy and greater force production during plyometric activities. Relevant parameters for stretching protocols include intensity of stretching force, and duration and frequency of stretch. The most widely used protocols consist of static elongation for 10 to 30 sec at a range that causes mild discomfort. The majority of stress relaxation takes place during the initial 12-18 seconds. Slow rates of elongation permit greater stress relaxation than faster rates and generate lower tissue forces. For restriction of lumbar flexibility, repetitive self-mobilisation exercises according to McKenzie appear valuable [47]. A high number of repetitions (e.g., 10 x every hour) and effective stretch at the end of the movement is decisive in order to stretch also structures such as shortened ligaments or joint capsules. For flexibility training, strength training machines are also suitable: a low weight is chosen and full range of movement during the concentric and eccentric phase is emphasised.

Increasing cardiovascular endurance

Many clients with long-lasting musculo-skeletal disorders have poor cardiovascular endurance. The endurance training is thus an important component in a work conditioning or hardening program. The prescription parameters for optimal endurance training are as follows [43]:

Mode and intensity

Exercise should train large muscle groups (at least 1/6 of the global muscle mass), be continuous, and involve aerobic, rhythmic activities (e.g., walking or hiking, running or jogging, cycling, cross-country skiing, aerobic dance or group exercise, rope skipping, rowing, stair climbing or step trainer, swimming, skating). The most effective exercise prescription begins with an aerobic activity that the client enjoys. A prescribed schedule of stepwise increments in intensity, duration and frequency should gradually lead to a maintenance level of fitness. Exercise intensity is calibrated by establishing a training heart rate at 65%-90% of maximum heart rate (MHR, equal to 220-age in years) or 50-85% of HRR reserve (HRR = MHR – resting heart rate). Other widely used formulas for the training heart rate are 190-age or 170-[age/2]. Lower intensity exercise (55-64% of MHR or 40-49% of HRR) is appropriate for unfit individuals. While the equation based on MHR is easy to teach to clients, applying it to older people can be problematic, because it may calculate a training value that is too close to the resting heart rate (so forcing the person to exercise at only the most trivial intensities). In these cases, the intensity should be based on a HRR percentage or the "rating of perceived exertion", which rates the individual feeling of the exercise intensity by an ordinal scale from 6 ("very, very

light) to 20 ("very, very hard") (Borg scale). The latter also may be a relevant measure with clients using beta-blocker medication, where heart rate recommendations based on MHR do not apply.

Duration

It depends on intensity, and activity can be continuous or intermittent. Lower-intensity exercise should be performed for at least 30 to 60 min, whereas more intense exercise should last at least 20 min. The first type of exercise is safer and often associated with better adherence than the latter. Less fit individuals can start "building up" exercise bouts throughout the day as long as each bout lasts at least 10-15 minutes (including 3 minutes to achieve the steady state).

Frequency per week

Three to five times a week.

The main benefits of endurance training are:

1) it maintains and improves cardiovascular function; 2) it reduces risk factors associated with many common chronic diseases (coronary artery disease, diabetes mellitus, hypertension, obesity, etc.); 3) it improves bone health and reduces risk for osteoporosis (especially in postmenopausal women); 4) it improves postural stability and reduces risk of falling; 5) it improves general health status, and particularly mood and concepts of personal control and self-efficacy. Some of these features, of course, also apply to resistance training. Matheson demonstrated that both strength of back muscles as well as cardiovascular endurance contribute, independently of each other, to lifting performance capacity [48].

Circuit weight training

Circuit weight training (sequence training) is a useful compromise that allows to train strength, muscular endurance and cardiovascular endurance fairly efficiently in one training session [49]. Individuals proceed immediately from one weight machine (10 repetitions) to the other without any rest interval in-between. The sequence of the equipment is arranged so that the body region trained varies when the weight machine is changed. This prevents muscular fatigue from becoming a limiting factor in producing a cardiovascular effect. The choice of exercises includes about 8 to 12 machines that cover a wide spectrum of functions. Typical equipment includes a back extension and trunk bending, pull-down, shoulder press and leg press. For back training, the inclusion of trunk rotation, lateral flexion as well as hip abduction is important to train also stabilisation in the frontal plane and during rotation. This is important in asymmetric pain patterns (single-sided pain, radiating in the direction of the buttock or leg and/or with single-sided loads). Circuit training is a well-standardised form of basic training and can be quickly developed with clients as a basic module. Depending on the disorder, some of these exercises also address specific problems. In addition to sequence training, other more specific training exercises can be implemented if needed, for stabilisation of spine or peripheral joints, for example.

Work simulation training

Work simulation is the crucial part in the functional training of a WH program. It mimics many job situations, functional postures and tasks, so offering clients the opportunity of practising work activities and procedures in a "therapeutic" framework, in order to train job-specific deficits step by step. Moreover, this training allows one to monitor the client's safety practices, productivity, work behaviours, use of tools and equipment, and complex functions. In this way, clients can progressively regain confidence in their work-related abilities, e.g. when coping with loads and handling tools, in terms of endurance over several hours, and thus eliminate their fears of strain and demands in the workplace before they return to work. Work simulation training also emphasis the clear focus on return to work. As work-simulation training is related to real everyday and work activity, there are also some elements of "play": sometimes clients partially "forget" their pain and restrictions and work in this setting better than in other therapeutic surroundings. Observation of the client during work simulation activities will yield information also regarding cooperativeness, ability to follow instructions, reliability in following schedules or keeping appointments, and ability to get along with others.

Fig. 3 – Lifting and carrying.

The basis for work simulation is a work-oriented functional assessment: on the basis of the client's work-related deficits, the most suitable work samples (work stations) are selected for training. A work sample may address a single work trait (e.g. manual dexterity), a collection of tasks common to various jobs (e.g. a mix of strength, endurance,

Fig. 4 – Standardised workstation for bricklaying.

Fig. 5 – Standardised workstation for sorting and assembly (screws and nuts).

Fig. 6 – Bolt box – assembly in various body positions.

Fig. 7 – Standardised assembly work station (3 components) – performance standing or sitting.

Fig. 8 – For work simulation training, inexpensive devices can be used (assembly system of old tubes).

range of motion, etc.), the common critical factors of a job (but not all factors affecting it, e.g. not including the environmental stress), or all the key tasks of an actual job (e.g. in pipe fitting or electronic assembly) [11, 50, 51]. There are two main kinds of work station used in work-simulation training: standard or job-specific work stations, and computer-controlled work simulators.

Standard and job-specific work stations

Standard work stations are designed to ensure that important work-related skills can be simulated in a simple way. Typical examples are: *lifting, carrying, sorting, brick wall building, tool use (bolt box), electrical installation, installation of a sanitary pipe system*. With this kind of workstations (many are polyvalent with regard to the functions being trained), a wide range of work-related functions can be covered.

Fig. 9 – Work station for electro-installation.

Figs. 10a and 10b – Simple work-specific device conceived with the client for training to move in narrow tunnels (after hip injury).

Important features of standard workstations are:

– standardised working procedure, with clear instructions to the clients. Time to complete the task may be 20-30 minutes or more per station;

– the work done on a standard work station must be measurable in terms of completion time or number of parts per set time or error quota, etc. This allows reasonable goal setting;

– work-simulation training should be competitive for two reasons. Firstly, to provide an incentive for a successive increase in the work load (for example, clients should not simply set up and dismantle any brick wall several times a day, but should measure the time for a defined wall with "n" bricks, try to progressively improve their performance, and compare their current performance with that of a reference population). Secondly, the competitive work input required later in the workplace should be prepared for;

– availability of reference data (e.g., from groups of healthy people or groups such as low back pain patients) to allow comparison with the client's current performance, and help the rehabilitation team to better interpret the client's performance.

Most work stations can be set up by rehabilitation centres themselves with simple means. Some specially designed workstations are offered by companies, e.g. multifunctional work station or work bench (sets for screwing bolts) from Rolyan' [www.smith-nephew.com], or the Valpar Component Work Samples, such as "*Simulated assembly*" or "*Whole-body range of motion*" [www.valparint.com, under "product line/work samples"]. Basic sets of work material (e.g., bricks, shuttering planks, sandbags, ladders for construction workers) should be available. For those occupational requirements less covered by standard workstations, specific working procedures can be simulated providing actual working materials and tools.

Computer-controlled work simulators

Such machines can be used for the computer-controlled testing and training of work-related sets of movements for strength and endurance. The results can be printed out as a report and also in the form of charts. BTE Work Simulator [Baltimore Therapeutic Equipment, USA/www.bteco.com] and E-Link [Biometrics, UK/www.biometricsltd.com] are particularly well-suited to the evaluation of the upper extremities; E-Link also offers computer-animated training, firstly for movement and strength exercises for arms and hands and, secondly, for attention and concentration. Consideration must, however, be given to the relatively high cost of such devices.

Education of ergonomics

At common back schools, the usual choice of activities for training working techniques, and duration and frequency of such training are often too limited to consistently modify the worker's behaviour [20]. Evidence that these ergonomic recommendations are effective (in chronic low back pain) has only been shown when they are carried out at the workplace [19]. But education of ergonomic working techniques may be just as effective

during work simulation training as in the workplace. The information must be carefully adapted to the individual's understanding [52] and should be given consistently and repetitively by the members of the rehabilitation team [53]. An educational program may cover body mechanics and proper posture (and eventually a simple review of the anatomic and physiologic background), means for prevention of strain or pain at work, clarification of the role of exercise, and – most important – practical training in safe and economic work performance. In education, direct therapist/client interaction is required. Also videotapes of the client performing simulated work tasks can provide an opportunity for group discussion and be an effective instructional aid.

Education of a worker who manually handles materials should include training to: 1) estimate one's own capacities and limits; 2) always keep the weight to be moved as close to the body as possible; 3) lift the weight slowly and gradually and avoiding brisk movements; 4) divide the weight and distributing it evenly on the upper limbs; 5) distribute very heavy weights into more than one container or between people; 6) use the free hand as a support or rest the foot on a small box/step when flexing the trunk. Conversely, subjects working mostly sitting or standing during the work shift should be aware of how to correctly adjust office furniture and to create conditions of postural changes. The significance of pacing, in particular the structuring of breaks during training or prolonged work activity breaks (e.g., getting up and moving about for a while) and/or monitoring working speed, has already been explained *(cf. § [Symptom negotiation training])*. Work pacing is a very important ergonomic tool for enhancing work performance and limiting activity-related pain.

Ergonomic interventions at the work site

Depending on the clients' work, an in-depth analysis of the working tools and workplace, and possible adaptations, may be appropriate. A work conditioning or work hardening program that regularly treats clients of a particular company may establish a closer relationship between the centre for rehabilitation ergonomics (that provides the program) and the company, leading to collaboration regarding ergonomic interventions at the work site in order to prevent work-related disorders and long-term disability.

Tool modification

In order to reduce the risk of developing work-related musculo-skeletal disorders, tools should: 1) allow work to be done with the wrist in a neutral position, avoiding excessive flexion, extension, ulnar and radial deviations; 2) be of a congruous and balanced weight (the centre of gravity must correspond to the centre of the hand grip, in order to avoid the tool sliding or rotating); 3) include functionally advantageous levers, particularly if the task requires great strength; 4) have a large area of contact with the hand in order to avoid excessive localised pressure; 5) be usable by both hands so that the hands can be alternated during the task [54]. Biomechanical analysis is basic for identifying stress points [55]. For example, conventional pliers produce a significant pressure on the palm of the hand, thus compressing vessels and nerves, while pliers with asymmetrical handles

shaped according to the hand form, with a wider diameter and covered with soft plastic, reduce the pressure on palm and interphalangeal joints. Scissors and pliers should also have automatic opening to avoid local trauma to the dorsal surface of the fingers. The high and low frequency vibrations of electrical instruments can be isolated or reduced by using special covers over the areas in contact with the worker. Gloves incorporating vibration-absorbing materials are commercially available.

Job site modification

There are well-established ergonomic rules and criteria which apply to designing/modifying a workplace [30, 41, 56]. The systematic approach should consider spatial arrangements, the nature and variety of work tasks to be carried out, and the anthropometric characteristics of the employee. The analysis should include the following:

– movements carried out during the work and awkward postures associated with fixed or constrained body positions. For instance, for the upper limbs: raised elbows and arms, manoeuvres involving rotational movements, lack of alignment of the axis object/hand-wrist; for the back: abrupt straightening and bending movements especially if associated with rotation;

– frequency and duration of the work cycles. For instance highly repetitive movements, with cycles lasting less than 30 seconds; frequency and length of breaks;

– strength needed in different tasks. For Instance knobs to rotate and equipment with short levers that require excessive force to move; the frequent need to use a hand strength greater than 20% of the maximum isometric force; use of inappropriate gloves (worn to protect against abrasions, cuts and blisters, but which reduce the coefficient of friction between the hand and the instrument: consequently a stronger grip must be produced during the task); excessive weight of the material being moved (acute dynamic overload).

Characteristics of the workplace, which can cause exposure to mechanical trauma. For instance a table with sharp edges; slippery surfaces; lack of mechanical aids; vibration stress (electrical equipment); thermal stress.

The importance of a properly structured workplace (together with correct positions and work manoeuvres) should not be overlooked, remembering that during heavy tasks: 1) bending forward to lift a weight can increase the load on the back by up to 2.5 times that of the same weight lifted with a straight back and the knees bent; 2) lifting a weight above shoulder height decreases the tolerable weight by 25-30% of that which can be lifted to lower heights; 3) a load held at arms' length produces five times more stress on the spine than does the same weight held close to the body; d) the maximum load that can be lifted highly varies according to lifting frequency, and so on. Such considerations highlight the importance of structuring the workplace where manual material handling is performed, in order to: 1) arrange the materials to move at a height between the hands and the shoulders, and minimise all distances with respect to hand positions; 2) use appropriate work surfaces; 3) minimise the length of transports; 4) optimise the grip of the weight and accessibility (and robustness) of storeroom shelves; 5) minimise the weight of containers and study their best shape; 6) use mechanical systems for lifting (elevators) and transport (trolleys) for heavy or cumbersome loads.

Similarly, when manual work is carried out in the sitting position, the workplace must be planned in such a way that: 1) the height, distance and any slope of the work bench are appropriate; 2) the parts on which the forearms and elbows rest are padded; 3) no postures or movements are necessary that involve joint excursions to the maximum limits, but rather the task can be performed while maintaining the joints in a neutral position for as much time as possible; 4) containers for objects are at bench height, slightly tilted towards the worker and have low sides. In VDT workstations, the choice of a work chair should be based not only on anthropometric criteria but also on ergonomic principles such as the presence of: 1) adjustable seat height; 2) adjustable, tilting, body-contoured back support; 3) prong base with no-slip swivel casters; 4) armrests. As for computer screens, there must be at least 50-70 cm between the screen and the person looking at it and the screen must not be placed in front of light sources, such as windows. Moreover, the desk should have a sufficient width and depth and its height should assure leg room (the usual range is 65-85 cm.). The use of a footstool could be also considered if height of the desk is not freely adjustable.

Likewise, the main ergonomic parameters for a driver's seat are: 1) that the back rest is inclined at about 30° with respect to vertical, encompassing the thoraco-lumbar tract, and has a lumbar support cushion about 5 cm thick; 2) that there is a reasonably firm seat, slightly inclined with respect to the horizontal plane; 3) possibly, an automatic gear box, for those who drive for many hours in city traffic.

Further measures regarding stress and pain management, specific counselling

Stressors lead to increased mental as well as muscular tension. Examples of stressors are troubles at the workplace, family problems and vocational or financial insecurity, disturbed sleep. In addition, pain of course is a stressor itself, often connected with fear of no improvement (or even further deterioration) or fear of a severe disease. Stress-related muscular tension, in turn, is a very important pain factor, probably due to a worsening of local blood circulation and metabolic processes with the distribution of pain mediators into the tissue. Stress probably also lowers the pain threshold via direct psychosomatic mechanisms. The relationship between pain and stress is a vicious circle. An important means of stress management is information and education on coping with pain *(cf. § [Structured information and education on coping with pain])*. Further measures are explained below.

Techniques of relaxation, awareness and diversion

Interesting "mind/body techniques" such as progressive muscle relaxation (first described by Jacobson) or other relaxation concepts [57, 58], meditation [59], "creative visualisation" [60], autogenous training, yoga or other methods have proved to be valuable components of psychological intervention. Sometimes, individual psychological advice on how to cope with stressors is needed.

Therapeutic modalities and medication

Therapeutic modalities can support training by helping to reduce pain and tension, improve mobility and promote the healing soft-tissue disorders. Primarily, self-treatment measures should be taught wherever possible. Sometimes clients can also benefit from massage, physical agents or other modalities and thus train better, but there is the previously mentioned risk of the "feel good trap" *(cf. § [The client's role: personal responsibility and self-treatment])* and of therapeutic dependence. For this reason, the benefits and chances of success must be carefully balanced against any possible disadvantages regarding the individual client. The following modalities might be used: self-application of cold or heat; manual soft-tissue treatments like trigger-point or fascia massage techniques, classical massage techniques; manual therapy; electromyostimulation (inducing repetitive muscle contraction), TENS, targeted pain-point electrotherapy; complementary medicine interventions, etc.

Many clients that are sent for WH take a lot of pain medicaments, including also opioids. Often this medication is not even helping much, but the clients feel dependent on such daily medication. In most of these cases (there might be a few exceptions), it is mandatory to cut the medication down to zero or an absolute minimum (preferably only paracetamol and only when needed, e.g. if pain prevents sleep) prior to the program, in order to allow a realistic and optimal training dosage. Pain management by reasonably adapted activity, pacing, diversion and relaxation techniques and self-application of modalities such as cold packs is much more help in building up self-efficacy than taking a lot of chemicals.

Psychological/psychiatric evaluation and counselling

If needed, specific psychiatric/psychological evaluation and counselling can help to reduce stress and tension and support the training program, especially if the therapist or doctor has communication problems with the client, or when special psychological advice/care is required by the team (e.g. in significant psychiatric disorders such as anxiety and depression, neurosis, post-traumatic stress disorder) or by the client. However, not all clients with problems or signs of symptom magnification are a "case for the psychiatrist". The "small psychological counselling and support" is also one of the tasks of doctor or therapist in their position as coach. The function of a psychologist or psychiatrist is also to supervise the therapists and doctors when dealing with challenging clients.

Occasionally, in connection with stress management, advice should be focused on the way clients run their life. Aspects such as disadvantageous sleeping habits (fatigue because clients do not sleep enough), overweight, excessive coffee drinking (sleeplessness, nervousness, stomach problems), excessive consumption of medicaments, alcohol or drugs, smoking and a lack of meaningful daytime activity (boredom also promotes a focusing on pain) are stress factors. However, it must taken into consideration that these problems not only may cause stress but can themselves also be a consequence of stress.

Vocational evaluation and counselling, social advice

Quite a number of clients have problems regarding their vocational prospects, in particular when they are without secure employment or do not have the possibility to return to their company. In these cases, vocational evaluation or counselling may be required. Additionally, other non-clarified or unsolved socio-economic questions can have a substantial effect on the client's motivation; in such cases, social advice or advice regarding insurance issues may be important.

Discharge from a WH or WC program

Recommendations at discharge

To recommend discharge with return to a specific job, the team has to demonstrate, based on results of FCE tests, that the worker has reached the goals stated in the plan or a plateau in his/her functional levels. For those clients with a specific job to return to, the care providers must document the worker's ability in relation to the job requirements, and the discharge recommendations may consist of the following options: return to work with full duty, modified duty, or reasonable accommodations [7]. If, after training, the worker's residual physical and behavioural functions do not meet the requirements of the job, a further vocational planning, possibly including vocational training, is necessary. Occasionally, additional medical investigation and therapeutic measures may be recommended. In cases of lack of cooperation and willingness to perform the training program and to accept weekly increases of activity level (which should be tolerated based on the functional test or training observation according to the FCE-criteria), the program should be terminated prematurely, and the relevant observations regarding behavioural issues should be documented in the discharge report.

Case management as a means to support return to work

In order to support a successful return to work in some difficult cases, case management in terms of communication with all the important "players" is recommended. The first step is an analysis of the client's environment, which may include protagonists such as partner or other important family members, family doctor, employer, insurance company, lawyer, etc. It is important to gain a picture of this environment and, in particular, to identify possible "brake blocks". It may be useful to contact the negative protagonists, to explain the program and the goals agreed with the client and enlist their support of the client on the way to achieving the goals. Naturally, the inclusion of positive protagonists can also support clients. Sometimes, an external case manager works in close cooperation with the rehabilitation team. There is a moderate evidence for case management that promotes communication, cooperation and the joint goal setting between clients,

the rehabilitation team and other medical specialists involved, and employers or supervisors at work [20].

As the work-hardening programs are particularly focused on work, contact with employers is essential. If the client's workplace is in the neighbourhood and reintegration at the regular workplace appears realistic, a visit to the workplace, usually by the therapist together with the client and, possibly, with an external case manager, is highly recommended *(cf. § [Job evaluation])*. External contacts must be carefully planned: the people to be contacted and the right moment have to been determined, and the team member in charge for organising the visit has to be selected.

Quality assurance

A system of quality assurance and certification for the cost-intensive work conditioning or work hardening programs is needed and also required by the insurance companies. This includes guidelines for quality standards or minimum criteria for the program structure, process and outcome evaluation [8], as well as a control system that certifies providers and then checks for quality at regular intervals. One important prerequisite for quality is a structured training for the therapists and physicians for WH. The only WH training of this type so far on offer in Europe is from the Swiss Association for Rehabilitation [www.sar-rehab.ch → Who is who → Interessengemeinschaften → IG Ergonomie].

The main focus for quality assurance is outcome. A continuous review of the results by means of a simple cohort study (including soziodemographic data, some of the questionnaire and functional test results, the judgement of readiness for work at discharge and if possible a follow up regarding return to work) is crucial to reflect on the rehabilitation team's results and compare them with benchmarks provided by published studies. However, such comparisons are complicated by the great differences in outcomes in terms of return to work after WH or functional restoration programs. For example, the following return to work rates in a follow-up of 1 to 2 years have been reported: 87% [61], 77% [62], 63% [32], 32% [63]. These differences may be partially due to differences in quality and intensity of the programs, but many other factors play an important role in the substantial differences in outcome [10]. Some of these factors are:

– differences in patient groups – in terms of medical problems, vocational and social features (e.g. work status, level of physical demands of work), proportion of immigrants (and degree of their integration), proportion of clients in litigation, general motivation. These features are highly relevant but sometimes difficult to measure;

– different environmental factors relating to the social security and public health systems (e.g. legislation and rules regarding working ability, work-related benefits, or pensions), pre-evaluation and expectations of the referring institution (e.g. insurance company) as well as the family relationships, doctors providing primary care for a WH program, more or less restrictive medical assessment of ability to working (before and after the program), workplace security for clients with limited abilities, and labour market

situation. With these factors it is a question of the degree of support and the incentive to resume work;

– different determination of relevant outcome parameters.

Such wide dissimilarities make it difficult to compare studies and benchmark a team's own results. At least, it is important to analyse and recognise the factors that may be responsible for important differences in outcome.

Discussion

WC and particularly WH programs are critical when return to work after injury or illness is expected (from a medical point of view), but the usual care and physical therapy have not attained this goal. There are many possible reasons for this failure:

– important client's deconditioning: there is a big gap between actual functional capacity and the physical demands of the specific job;

– lack of work-oriented goals in usual care and physical therapy (these treatments often are pain oriented and do not focus on prompt increase of work related functional capacity, nor do they include work simulation tasks, and they are usually not intensive);

– relevant psychosocial barriers, many of them are listed in the yellow and black flags [23, 24]. They include high levels of pain perception, stress, and depression; catastrophising; hysteric symptoms and hypochondria; low self-esteem; dissatisfaction with the program, poor cooperation and willingness to perform; low job satisfaction; low expectation/intention of return to work, conviction that pain is work-related or that one will no longer be able to restart working; alcohol abuse and other chemical dependence; resentment, anger and frustration; sickness gains – such as avoidance of responsibility, and attention received from others); pending litigation; other financial opportunities – such as unemployment benefits, welfare benefits, worker's compensation, etc. [11, 20, 36, 42, 64, 65, 66].

In order to overcome the multiple barriers to recovery as far as possible, work hardening is not only based on intense and function – and work-oriented physical training (gym and work simulation), it also emphasises education and extensive psychosocial interventions. Important issues are goal setting, self-efficacy, self-responsibility and self-management of pain.

Optimisation of working techniques, tools, equipment and work organisation should be emphasised as well. This approach focuses on adapting the methods of carrying out a task to best suit the individual worker. For example, employee rotation between different tasks would be very useful, alternating the main job with a lighter one, training the subject to early recognise development of health problems and thus call quickly for advice and help. It has been clearly demonstrated that intermittent work with brief pauses (1-2 minutes) alternated with intense efforts is more efficient and healthier than prolonged work with pauses of 20-30 minutes. The ideal option would be to identify the best pace to carry out repetitive tasks (at any rate) and teach it to workers, starting from a lower grade.

A recent Cochrane review concluded that work-related physical conditioning programs including a cognitive-behavioural approach plus intensive physical training seem to be effective in reducing the number of sick days for workers with chronic low back pain when compared with usual care [42]. Similarly, two systematic reviews concluded that there is moderate evidence showing that multidisciplinary biopsychosocial rehabilitation offers some benefit for adults with chronic/subacute low back pain [67, 68]. Nachemson came to the following conclusions in a comprehensive review: 1) concerning prevention of back pain, there is strong evidence for strengthening back muscles, general body building and fitness training; 2) with regard to conservative treatment for chronic back pain, there is strong evidence for training therapy and in the short term for a multidisciplinary treatment program [19]. According to a review by Waddell [20], there is moderate evidence for a comprehensive rehabilitation program, particularly in a work-related setting, and when associated with an organisational intervention (case management) to support the return to work. Haldorsen found in an Norwegian study that multidisciplinary treatment is effective concerning return to work when given to patients who are most likely to benefit from that treatment [69]. A recent meta-analysis on randomised controlled studies regarding non-acute and non-specific back pain came to the following conclusions: treatment sessions with training therapy alone or as part of a multidisciplinary program reduce the number of days off work. The effects are stronger in patients with longer duration of back pain and diminish over time [70].

Because many of the analysed studies have some methodical shortcomings and multidisciplinary return-to-work programs are expensive and need to demonstrate their cost-effectiveness also in the long term (to demonstrate their benefit and justify reimbursement), there is still the need for high-quality trials in this field to address issues such as patient selection, the optimal intensity and duration of programs, and the most effective treatment components.

References

1. Commission for Accreditation of Rehabilitation Facilities (CARF) (1988) Work Hardening Guidelines. Tuscon
2. American Physical Therapy Association (APTA) (1992) Guidelines for programs in industrial rehabilitation. Magazine of Physical Therapy 1: 69-72
3. Matheson LN, Ogden LD, Violette K *et al.* (1985) Work hardening: occupational therapy in industrial rehabilitation. Am J Occup Ther 39: 314-21
4. Mayer TG, Gatchel RJ (1988) Functional Restoration for Spinal Disorders: The Sports Medicine Approach. Philadelphia, Lea & Febiger, p 1-321
5. Campello M, Weiser S, Van Doorn JW *et al.* (1998) Approaches to improve the outcome of patients with delayed recovery. Baillieres Clin Rheumatol 12: 93-113
6. Darphin LE (1995) Work-Hardening and Work-Conditioning Perspectives. In: The Comprehensive Guide to Work Injury Management. (Ed. Susan J, Isernhagen P). Gaithersburg, Maryland, Aspen Publishers, p 443-62
7. Demers LM (1992) Work hardening. A practical guide. Boston, Andover Medical Publishers

8. Hart DL, Berlin S, Brager PE *et al.* (1994) Development of clinical standards in industrial rehabilitation. J Orthop Sports Phys Ther 19: 232-41
9. Isernhagen SJ (1991) Functional Capacity Evaluation and Work Hardening Perspectives. In: Contemporary Conservative Care for Painful Spinal Disorders. (Eds. Mayer TG, Mooney V, Gatchel R). Philadelphia/London, Lea & Febiger, p 328-345
10. Lechner DE (1994) Work Hardening and Work Conditioning: Do they affect disability? Physical Therapy, p 74
11. Burt CM (2001) Work evaluation and work hardening. In: Occupational therapy. (Eds.Pedretti LW, Early MB). St. Louis, Mosby 5: 226-36
12. Fenton S, Gagnon P (1998a) Evaluation of work and productive activities: work performance assessment measures. In: Willard & Spackman's Occupational Therapy. (Eds.Neistadt ME, Crepeau EB). Philadelphia, Lippincott William & Wilkins 9: 208-13
13. Fenton S, Gagnon P (1998b) Treatment of work and productive activities: functional restoration, an industrial rehabilitation approach. In: Willard & Spackman's Occupational Therapy. (Eds.Neistadt ME, Crepeau EB). Philadelphia, Lippincott William & Wilkins 9: 377-82
14. Industrial rehabilitation medicine (1992) Arch Phys Med Rehabil 73[5-S]: 3-28
15. Industrial rehabilitation medicine (1997) Arch Phys Med Rehabil 78[3 Suppl]
16. Industrial medicine and acute musculoskeletal rehabilitation (2002) Arch Phys Med Rehabil 83[3 Suppl 1]: 1-39
17. Andersson GBJ, Frymoyer JW (1991) Treatment of the Acutely Injured Worker. In: Occupational Low Back Pain. (Eds.Pope MH, Andersson GBJ, Frymoyer JW, Chaffin DB). Mosby Year Book, p 183-93
18. Krause N, Ragland D R (1994) Occupational disability due to low back pain: a new interdisciplinary classification based on a phase model of disability. Spine 19: 1011-20
19. Nachemson AL, Jonsson E (2000) Neck and Back Pain. Lippincott Williams & Wilkins. Philadelphia USA, p 1-473
20. Waddell G, Burton A K (2001) Occupational health guidelines for the management of low back pain at work: evidence review. [www.facoccmed.ac.uk → Publications]. Occup Med (Lond) 51: 124-35
21. Foye PM, Stitik TP, Marquardt CA *et al.* (2002) Industrial medicine and acute musculoskeletal rehabilitation. 5. Effective medical management of industrial injuries: from causality to case closure. Arch Phys Med Rehabil 83: 19
22. Matheson LN, Matheson ML (1996) Spinal Function Sort (PACT-Test, edited in different languages). Swiss Association for Rehabilitation SAR, Working group Ergonomics [www.sar-rehab.ch → Who is who → Interessengemeinschaften → IG Ergonomie]
23. Kendall NAS, Linton SJ, Main CJ (2004) Guide to assessing psychosocial yellow flags in acute low back pain: risk factors for long term disability and work loss. Wellington (NZ), Accident rehabilitation and Compensation Insurance Corporation of New Zealand and the National Health Committee [www.nzgg.org.nz → guidelines → musculoskeletal disease]
24. Main CJ, Spanswick CC (2000) Pain Management. An Interdisciplinary Approach. Churchill Livingstone
25. Fishbain DA (2000) Functional capacity evaluation. Phys Ther 80: 110-2
26. King PM, Tuckwell N, Barrett TE (1998) A critical review of functional capacity evaluations. Physical Therapy 78: 852-66
27. Jones T, Kumar S (2003) Functional capacity evaluation of manual materials handlers: a review. Disabil Rehabil 25: 179-91

28. Waddell G, McCullock JA, Kummel E *et al.* (1980) Nonorganic Physical Signs in Low-back pain. Spine 5: 117-25
29. Waddell G (1998) The Back Pain Revolution. Churchill Livingstone, p 223-40
30. Grandjean E (1991) Fitting the Task to the Man. A textbook of Occupational Ergonomics. London, Taylor & Francis
31. Rajan JA, Wilson JR (1997) Introduction to task analysis. In: Musculoskeletal Disorders in the Workplace: Principles and Practice. (Eds. Nordin M, Andersson GBJ, Pope MH). St. Louis, Mosby, p 167-90
32. Pfingsten M, Hildebrandt J, Leibing E *et al.* (1997) Effectiveness of a multimodal treatment program for chronic low-back pain. Pain 73: 77-85
33. Gatchel RJ, Mayer TG, Hazard RG *et al.* (2002) Editorial: Functional Restoration. Pitfalls in Evaluating Efficacy. Spine 17: 988-95
34. Matheson LN (1995) Getting a Handle on Motivation: Self-Efficacy in Rehabilitation. In: The Comprehensive Guide to Work Injury Management. (Ed.Susan J.Isernhagen). Gaithersburg, Maryland, Aspen, p 514-42
35. Kopp HG, Oliveri M, Thali A (1997) Erfassung und Umgang mit Symptomausweitung. Medizinische Mitteilungen der Suva 70: 56-78
36. Vlaeyen JW, Linton SJ (2000) Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. Pain 85: 317-32
37. Vlaeyen JW, De Jong J, Geilen M *et al.* (2001) Graded exposure in vivo in the treatment of pain-related fear: a replicated single-case experimental design in four patients with chronic low back pain. Behav Res Ther 39: 151-66
38. Burton AK, Waddell G, Tillotson KM *et al.* (1999) Information and advice to patients with back pain can have a positive effect. A randomized controlled trial of a novel educational booklet in primary care. [www.coventrypainclinic.org.uk → Spinal Pain → The Back Book]. Spine 24: 2484-91
39. Harding VR, Simmonds MJ, Watson PJ (1998) Physical Therapy for Chronic Pain. Pain Clinical Updates VI
40. Vlaeyen JW, De Jong J, Geilen M *et al.* (2002) The treatment of fear of movement/(re)injury in chronic low back pain: further evidence on the effectiveness of exposure in vivo. Clin J Pain 18: 251-61
41. Kroemer KHE, Kroemer HB, Kroemer-Elbert KE (1994) Ergonomics: How to design for ease and efficiency. Englewoods Cliffs, Prentice Hall
42. Schonstein E, Kenny DT, Keating J *et al.* (2003) Work Conditioning, Work Hardening and Functional Restoration for Workers with Back and Neck Pain (Cochrane Review). The Cochrane Library [4]. Chichester, John Wiley ans Sons, Ltd
43. Kraemer WJ, Adams K, Cafarelli E *et al.* (2002) American College of Sports Medicine position stand. Progression models in resistance training for healthy adults. Med Sci Sports Exerc 34: 364-80
44. Deschenes MR, Kraemer WJ (2002) Performance and physiologic adaptations to resistance training. Am J Phys Med Rehabil 81: 3-16
45. Saal JA (1991) The New Back School Prescription: Stabilization Training Part II. In: SPINE: State of the Art Reviews. (Ed.White LA). Philadelphia, Hanley & Belfus, Inc. p 357-66
46. Saal JA, Saal JS (1991) Postoperative Rehabilitation and Training. In: Contemporary Conservative Care for Painful Spinal Disorders. (Eds.Mayer TG, Mooney V, Gatchel RJ). Philadelphia, Lea & Febiger 1: 318-27

47. McKenzie RA, May S (2003) The Lumbar Spine. Mechanical Diagnosis and Therapy. 2[1 & 2]. Waikanae, New Zealand, Spinal Publications
48. Matheson LN, Leggett S, Mooney V *et al.* (2002) The contribution of aerobic fitness and back strength to lift capacity. Spine 27, 1208-12
49. Gunnari H, Evjenth O, Brady M (1984) Sequence exercise. The sensible approach to all-round fitness. Oslo, Dreyers Forlag, 1:1-151
50. Bernard BP (1997) Musculoskeletal Disorders and Workplace Factors. Cincinnati, NIOSH
51. Pruitt WA (1986) Vocational evaluation. In: Menomonie, W. Pruitt Associates, p 105-35
52. Cedraschi C, Nordin M, Nachemson AL *et al.* (1998) Health care providers should use a common language in relation to low back pain patients. Baillieres Clin Rheumatol 12: 1-15
53. Nordin M, Cedraschi C, Balague F *et al.* (1992) Back schools in prevention of chronicity. Baillieres Clin Rheumatol 6: 685-703
54. Putz-Anderson V (1988) Cumulative trauma disorders: A manual for musculoskeletal diseases of the upper limbs. London, Taylor & Francis
55. Amstrong TJ (2000) Analysis and design of jobs for control of work related musculoskeletal disorders. In: Occupational Ergonomics: Work Related Musculoskeletal disorders of the Upper Limb and Back. (Eds.Violante F, Amstrong T, Kilbom A). London, Taylor & Francis, p 51-81
56. Chaffin DB, Andersson GBJ (1991) Occupational Biomechanics. New York, John Wiley & Sons
57. Benson H (2000) The Relaxation Response. New York, HarperTorch/HarperCollins Publishers, p 1-227
58. Bernstein DA, Borkovec TD, Hazlett-Stevens H (2000) Progressive Relaxation Training: A Guidebook for Helping Professionals. Praeger Publishers. München, Verlag J. Pfeiffer, p 1-176
59. Kabath-Zinn J (1991) Full Catastrophe Living. Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness. New York, Delta; Dell Publishing, 1:1-467
60. Gawain S (2002) Creative Visualization. Use the Power of Your Imagination to Create What You Want in Your Life. Novato (California), Nataraj Publishing/New World Library, 1:1-175
61. Mayer TG, Gatchel RJ, Mayer H *et al.* (1987) A Prospective Two-Year Study of Functional Restoration in Industrial Low-Back Injury. An Objective Assessment Procedure. Jama 258: 1763-7
62. Lanes TC, Gauron EF, Spratt KF *et al.* (1995) Long-term follow-up of patients with chronic back pain treated in a multidisciplinary rehabilitation program. Spine 20: 801-6
63. Corey DT, Koepfler LE, Etlin, Day HI (1996) A Limited Funcitional Restoration Program for Injured Workers: A Randomized Trial. Journal of Occupational Rehabilitation 6
64. Beissner KL, Saunders RL, McManis BG (1996) Factors related to successful work hardening outcomes. Phys Ther 76: 1188-201
65. Niemeyer LO, Jacobs K, Reynolds-Lynch K *et al.* (1994) Work hardening: past, present, and future – the work programs special interest section national work-hardening outcome study. Am J Occup Ther 48: 327-39
66. Petersen M (1995) Nonphysical factors that affect work hardening success: a retrospective study. J Orthop Sports Phys Ther 22: 238-46
67. Guzman J, Esmail R, Karjalainen K *et al.* (2001) Multidisciplinary rehabilitation for chronic low back pain: systematic review. Bmj 322: 1511-6

68. Karjalainen K, Malmivaara A, Van Tulder M *et al.* (2003) Multidisciplinary biopsychosocial rehabilitation for subacute low back pain among working age adults. Cochrane Database Syst Rev CD002193
69. Haldorsen EH, Grasdal AL, Skouen JS *et al.* (2002) Is there a right treatment for a particular patient group? Comparison of ordinary treatment, light multidisciplinary treatment, and extensive multidisciplinary treatment for long-term sick-listed employees with musculoskeletal pain. Pain 95: 49-63
70. Kool J, De Bie R, Oesch P *et al.* (2004) Exercise reduces sick leave in patients with non-acute non-specific low back pain: a meta-analysis. J Rehab Med 36: 49-62