
Pain management in musculoskeletal conditions

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This chapter describes a biopsychosocial model of pain and the way in which it can provide a basis for the assessment of pain and the use of non-pharmacological pain management strategies. Various non-pharmacological interventions for musculoskeletal pain are described and evaluated. These include physical, psychological and social/environmental interventions. Given the often complex nature of patients presenting with persisting pain, it is not surprising that single-modality treatments are rarely sufficient on their own, and combinations of interventions offer advantages, on theoretical grounds at least. However, a number of challenges facing clinicians and researchers in applying these methods, especially when done alongside invasive and/or pharmacological interventions, remains to be fully addressed. These challenges have implications for the roles of clinicians from all disciplines, as well as for their patients and the community at large.

Key words: biopsychosocial models of pain; acute and chronic pain; psychosocial assessment and management; self-management; evidence; cost–benefits; collaborative care.

A BIOPSYCHOSOCIAL PERSPECTIVE OF PAIN

Engel¹ described a conceptualization of illness in which symptoms were considered to be the result of a dynamic interaction between psychological, social and pathophysiological variables. This account of illness was the basis of what has become known as a biopsychosocial model. The model, or versions of it, have been applied to describing pain phenomena, and reviews of empirical support for this model in relation to pain can be found in Turk and Flor², Turk and Okifuji³, and Flor and Hermann⁴.

The version of the biopsychosocial model applied to pain by Fordyce⁵ and Loeser⁶, and later elaborated by others^{4,7}, incorporates the notions that at the physiological level (i.e. nociception and neuropathy) changes are initiated by trauma or pathology; psychological variables are reflected in the attention and appraisal of internal

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sensations; and these appraisals and behavioural responses are in turn influenced by social or environmental variables. At the same time, the model also posits that psychological and social variables can influence physiological responses, such as hormone production, activity in the autonomic nervous system, and physical deconditioning.² For example, behavioural responses such as avoidance of activity due to variables like pain, fear of pain, or expectation of further injury can result in generalized disability.^{8,9}

Evidence for the psychological modulation of pain experience and its impact on the individual is now well established. Key constructs that have been found to be particularly important in this regard are catastrophizing (or excessively negative appraisals of pain and other noxious events such as injury)¹⁰, fear-avoidance beliefs and behaviours¹¹, and self-efficacy beliefs (the degree of confidence in one's ability to function or achieve goals despite pain).¹² Recent research on the role of acceptance of persisting pain has also suggested that this can play an important part in a person's adaptation to their pain.¹³ The ways in which people try to cope with their pain have also been found to make an important contribution to their degree of adjustment. In particular, coping styles (or strategies) deemed to be passive (eg. resting, relying excessively on medication or other agents and/or other people) have repeatedly been found to be associated with poorer adjustment relative to the use of more active strategies (where the person tries to keep as self-reliant and active as possible using self-management strategies such as activity-pacing, goal-setting, and exercises).^{14,15}

The role of social/environmental variables in influencing pain experience and impact has also been substantiated in a number of studies. At the individual level there is evidence that classical and operant conditioning processes can lead to pain behaviours and experiences being learned through interactions with the environment. In the case of operant conditioning, pain behaviours (such as pain ratings) and associated physiological changes (GSR) have been found to be controlled by environmental reinforcement independently of level of noxious input.¹⁶⁻¹⁸ Flor and colleagues^{4,19} have also demonstrated the role of classical (or Pavlovian) conditioning in many chronic pain phenomena. Evidence for the impact of broader environmental contingencies on outcomes to treatment can be seen in the recent meta-analysis of outcomes of surgical treatment by Harris et al.²⁰ This study reviewed the outcomes from over 20,000 patients treated in a range of countries and concluded that, irrespective of type of surgery or site, the presence of a compensation claim was consistently associated with significantly worse outcomes. In other words, this large study suggested that outcomes for something as precise as surgery did not totally depend upon physical parameters. Rather, something about the context under which the treatment was undertaken seemed to influence the results achieved. Scuderi et al.²¹ reported a similar differential effect on outcomes following injuries in motor vehicle accidents according to the type of insurance cover held by those injured.

The availability or presence of social support, particularly from spouses and significant others, can play a significant role in the experience of chronic pain. At least two major influences have been associated with social support. On the one hand, perceived social support has been found to act as a 'buffer' against depression, especially in patients who are less active or more disabled.²² On the other hand, types of social support that have been labelled 'solicitousness' are often associated with lower levels of control and poorer functioning.^{23,24} While social support may help to promote a sense of independence and confidence to manage pain, solicitous behaviours are associated with over-protectiveness from the partner. Solicitous responses include expressing sympathy, taking over chores or duties, encouraging rest or inactivity, and discouraging healthy behaviours.²⁴

In a critical review of the literature examining spouse/patient interactions in chronic pain, Newton-John²³ concluded that the context of spouse/partner support, rather than the specific response alone, needed to be taken into account when evaluating these interactions, and that these interactions could change from one situation to another. What seems to be important is the level of marital satisfaction reported by patient and spouse.^{22,25} Punishing spouse responses to pain behaviours in the context of a good marriage can have a motivating effect for the patient, whereas recent research suggests that patient acceptance of chronic pain is negatively affected by a greater degree of both solicitous and punishing spouse responses.¹³

In the occupational context, the perceived nature of work (e.g. heavy or monotonous) and the responses of work colleagues and supervisors or employers (e.g. hostile versus accommodating) also seem to influence the persistence of injury-related disability and return to work following injury.²⁶

In sum, a biopsychosocial perspective of pain can provide a useful framework for making sense of the observed variable relationship between pain severity, physical pathology findings, and disability/pain behaviours (Figure 1). It has been found that many people with chronic pain seem to manage quite well, with many continuing to work, not becoming distressed or disabled, using few drugs, and seeking medical attention rarely.^{27,28} On the other hand, many people with chronic pain do become distressed and disabled and seek medical care at levels disproportionate to their numbers.²⁷⁻³⁰ It is this latter group that typically presents a challenge to those offering help. By considering these different groups within the framework of the biopsychosocial model we can see how the impact of different factors might lead to different outcomes even though other aspects of different individuals (e.g. their diagnosis) might be the same. Thus, two individuals could both have the diagnosis of *failed back surgery syndromelumbar spinal or radicular pain after failed spinal surgery*, but be quite different

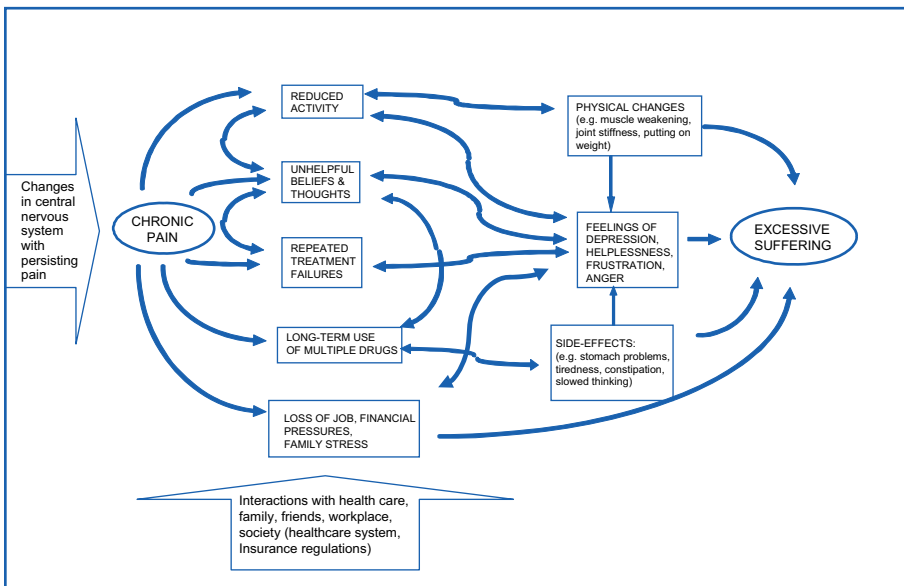


Figure 1. How chronic pain can become a complex problem.

in their levels of disability, distress, pain, and use of health services. By thinking about these cases in terms of the biopsychosocial model we might be to identify possible explanations for these differences and then what to do about them.

IMPLICATIONS OF A BIOPSYCHOSOCIAL PERSPECTIVE FOR ASSESSMENT AND INTERVENTIONS

Before implementing any intervention (pharmacological or non-pharmacological), clinicians must consider what they are trying to treat and what might be causing it. This means that assessment of the presenting problem and its contributing factors is just as important with non-pharmacological approaches as it is with pharmacological ones.

An assessment based on a biopsychosocial perspective would be expected to include each of the three main domains: (1) the biological/physical findings; (2) the psychological findings; and (3) the social/environmental findings. An examination of the types of measures that might be used in these investigations is beyond the focus of this chapter, but it would be expected to include a physical examination (with or without relevant imaging), a semi-structured interview with the patient, and possibly the use of some self-report questionnaires. Guidance on these can be found in Williams.³¹ However, completing the assessment of the relevant domains is only part of the task; the information gathered needs to be synthesized and incorporated into a working hypothesis in order for a treatment plan to be devised. This may be done by an individual clinician or a team of clinicians from different disciplines, as is commonly found in multidisciplinary pain clinics.³²

For example: if it seems that anxiety is complicating the pain experience, it is important to first clarify what is causing the anxiety before simply treating it. If the anxiety is based on inaccurate beliefs or expectations about the pain, part of the intervention might include educating the patient on a more accurate picture of their pain.³³ This might be sufficiently reassuring for no further intervention to be required. If the anxiety persists, exploring ways that the patient might deal with their fears more effectively might be examined.⁹

The key point here is that from a biopsychosocial perspective, treatment (pain management) should not be directed against 'pain' alone. In the presence of contributions from psychological and environmental factors, attempts to deal with nociception in isolation are likely to be ineffective (see Nicholas et al³⁴ for a review of this in relation to opioid use). Instead, a pain management plan should consist of specific interventions aimed at appropriate targets. Thus, if electrotherapy (e.g. transcutaneous electrical nerve stimulation, TENS) is planned, it might be expected to alter pain sensations but not mood or activities. The latter might be addressed by specific psychological and exercise interventions. If social/environmental factors are contributing to the presenting problem, then they might require additional interventions, such as a meeting between the patient, clinician(s) and family or employer (or employer's representative).

NON-PHARMACOLOGICAL PAIN MANAGEMENT METHODS

The main non-pharmacological pain management approaches can be divided into:

- physical techniques (e.g. manipulation, hyperstimulation analgesia);
- psychological techniques (e.g. advice, cognitive behavioural therapy, hypnosis, relaxation/meditation); and
- social/environmental interventions (e.g. community support groups, work changes).

Physical techniques

These include manual therapies, electrical stimulation, and exercise methods, but as with all treatments the treatment provider would normally be expected to provide the patient with a rationale for the use of a particular treatment, its aims and appropriate expectations. The approaches used may depend upon the chronicity of the pain. Typically, pain relating to musculoskeletal injuries is divided into three phases: acute (from onset to 4 weeks); subacute (4–12 weeks) and chronic (beyond 12 weeks).³⁵

In general, the physical techniques are aimed at relieving pain severity, usually in the belief that once that is achieved then the patient will be able to resume normal activities or active rehabilitation. While this can be true in acute pain states, such as post-surgery, it seems less achievable in cases of chronic or persisting pain. For example, after a trial of morphine for chronic (non-cancer) pain patients Moulin et al³⁶ concluded that the morphine doses used might be of some analgesic benefit, but there was no benefit in terms of psychological or functional gains. Similarly, Sator-Katzenschlager et al³⁷ found that even substantial reductions in pain achieved via a range of interventions did not ensure equivalent gains in other domains in a large sample of chronic pain patients. In this context it should be recognized that community surveys have repeatedly concluded that large proportions of people experiencing persisting pain remain quite functional under their own management, especially when they utilize active coping strategies rather than passive approaches.^{14,28,38} Interestingly, these epidemiological surveys have also found that frequent use of health services in this population is associated with poorer functional outcomes. Accordingly, it would seem wise for practitioners from all disciplines to bear these points in mind; specifically, knowing when to stop ongoing treatments might be just as important as knowing which treatments to use.³⁹

Exercise and activities

In the early management of acute musculoskeletal pain, recent guidelines recommend management plans that are intended to facilitate progress through periods of acute pain and the early resumption of normal activities.^{40,41} To these ends, such guidelines typically include recommendations that the attending clinician provide information (explaining the pain), assurance (that recovery is expected and there is no major problem), advice/encouragement to gradually resume normal daily activities, and some form of pain-relieving intervention – usually agents such as paracetamol or non-steroidal anti-inflammatory drugs (NSAIDs).

After the acute phase, a graded reactivation programme, possibly using exercises, is often recommended to restore full joint movement and strength to the supporting muscles. However, for acute low back pain benefit of exercises is not supported by current evidence, and patients are generally encouraged to resume normal activities directly, but in a graded manner.⁴²

Encouragement to resume normal daily activities as soon as possible after the onset of acute pain can limit the development of chronic disability due to pain, and this does not require complete pain relief first.⁴³ Not only does waiting for complete pain relief before resuming normal activities appear to be unnecessary, it may promote fear-avoidance responses, leading to greater disability.⁹

A recent study evaluating the effect of exercises versus advice to resume normal activities, alone and in combination, for patients reporting subacute low back pain indicated that the combination was better than either alone for pain reduction and functional restoration.⁴⁴

As pain persists and becomes more chronic, physiotherapy that incorporates strengthening and flexibility exercises can reduce pain in some conditions (e.g. osteoarthritis, longstanding spinal pain).^{42,45} However, patient adherence to exercise programmes may be poor, and restoration of functional activity often requires more than exercise prescription. Schonstein et al⁴⁶, for example, found that those exercise programmes that incorporated cognitive-behavioural principles (e.g. setting specific goals and systematic reinforcement of progress) had better functional outcomes than exercises alone.

Manual therapies

Manual therapies include manipulation, mobilization and massage. In general, it seems from current evidence that while these modalities can have some short-term effects on pain, these effects do not persist, and there is widespread concern that repeated use may lead to dependency on the therapist for little functional gain. Ongoing use of these modalities for pain management is not supported by current evidence.⁴⁷ Recent reviews of randomized controlled trials (RCTs) of these modalities also comment that the effects on acute and chronic pain are not only short-term but often show no difference between the different manual therapies and other approaches, such as advice from the patient's doctor to remain active despite pain, analgesics or exercises.⁴⁷⁻⁵⁰

There is a general consensus that if these modalities are used for people with musculoskeletal pain that is persisting, then there is a growing consensus that they should not be used alone, as the effects are likely to be brief. The same applies to other forms of pain management whose effects tend to be brief.

Hyperstimulation analgesia

Methods of hyperstimulation analgesia include acupuncture, TENS, implanted spinal cord stimulators (SCS), ice massage, and needling. It is thought that the physiological mechanism for hyperstimulation analgesia is through activation of the brainstem descending inhibitory control system, which exerts an inhibitory effect on transmission of nociceptive information through the dorsal horn.⁵¹

Relative to other forms of hyperstimulation, the use of SCS is limited to certain conditions (e.g. failed back surgery syndrome), and its expense also reduces its availability, but many of the conclusions relating to the importance of patient selection and the combining of interventions apply as much to these treatments as to the other modalities in this section. A recent systematic review of available evidence concluded that for chronic low back pain the use of acupuncture, TENS, heat/cold, traction, laser, ultrasound, short wave, interferential, massage, corsets could not be recommended⁴⁷, but the same review did suggest that percutaneous electrical nerve stimulation (PENS) and neuroreflexotherapy may be considered, although the evidence is limited.^{47,51} Nevertheless, these modalities remain in common use for a range of musculoskeletal pain conditions, both acute and chronic.

TENS is believed to stimulate large myelinated primary afferent fibres (A-fibres) activating inhibitory circuits in the dorsal horn, thus diminishing nociceptive transmission of C-fibre inputs. TENS is a non-invasive, non-addictive technique that is used with both acute and chronic localized pain of both nociceptive and neuropathic types. It is used for peripheral nerve disorders, phantom pain, spinal-cord and spinal-root lesions, low back pain, and muscle and joint pains. However, the evidence for

effectiveness of TENS in patients with chronic low back pain or neck pain is limited and inconsistent.^{52,53} Current guidelines recommend that TENS not be used as a sole treatment.⁴⁷

A proportion of patients with chronic musculoskeletal pain may also benefit from acupuncture, with reduction of pain severity for short periods at least. However, evidence for its effectiveness in different types or sites of musculoskeletal pain (acute, chronic, neck, shoulder, knee, low back) is conflicting, even when compared to placebo, sham acupuncture and other treatments.^{47,49,54–58} Again, most reviews recommend that acupuncture not be used as the sole treatment or for extended periods.^{47,58} Interestingly, there is less evidence for its use in acute pain, and in cancer-related pain acupuncture appears to be generally less effective than in chronic musculoskeletal pain.^{58,59}

In relation to hot/cold treatments, there is currently no evidence for its effectiveness with chronic low back pain, but there is moderate evidence for its effectiveness with acute/subacute low back pain, especially if combined with exercise.⁶⁰

Psychological techniques

While the care of all patients with pain requires the use of psychological techniques (e.g. active listening, providing advice, assurance, and encouragement), some patients need additional psychological intervention. Most health-care providers can (and should) learn to use basic psychological techniques. Some patients, however, require more highly trained providers, such as psychiatrists and clinical psychologists.

Psychological treatments can be used as an adjuvant in the management of pain, and sometimes they can be the primary intervention. Care should be taken to emphasize to patients that the use of a psychological technique does not mean that their pain is not real or that the pain is not being taken seriously. This is particularly important for patients with chronic pain. In general, psychological interventions are used to assist a patient to regain or maintain their independence and quality of life despite their persisting pain. Some psychological techniques can help the patient to develop a sense of control over their pain experience and to reduce distress and disability.

Before starting a psychological intervention, the treatment provider should establish a degree of rapport or acceptance with the patient, and provide some explanation as to the purpose of the intervention and the reasonable expectations the patient should hold for their outcome. These aspects help gain both the informed consent of the patient for the treatment, and their active cooperation.

As with all interventions, determining which patients might benefit from psychological interventions should be based on assessment. Multidisciplinary pain clinics typically include a psychological assessment as part of their standard work-up of all patients; however, medical practitioners without those resources can also conduct a basic psychological assessment of pain (see [Table 1](#)).

If it appears that the impact of pain on the patient is influenced by their beliefs/worries, their responses, mood state, or interactions with those around them, then psychological interventions should be considered. These should be directed according to the assessment findings. In some cases referral for more comprehensive, specialist assessment (e.g. at a multidisciplinary pain clinic) may be warranted, but local resources (e.g. clinical psychologists, psychiatrists) should also be considered.

Table 1. Topics that may be included in a basic psychological assessment of a patient in pain.

- A history of the person's pain, the treatments received (and results), and their demographic details (e.g. age, gender, family, culture/language, work status, compensation status)
- Their expectations/goals for this presentation
- The pattern of pain (including when it gets worse/better, especially in relation to the patient's activities: e.g. overdoing, resting, taking medication)
- The person's understanding of their pain (their concerns/worries/beliefs about their pain)
- Their responses to pain (e.g. what they do when their pain increases, and do they avoid activities that might increase pain?)
- Current mood state (e.g. fear/anxiety, depression, acceptance)
- Consequences of pain to patient (e.g. roles/activities at home, work, socially, and financial security, expectations for the future)
- Responses of significant others to pain (family, workplace, other health-care providers); are they overly solicitous, hostile, helpful/supportive?

Cognitive behavioural therapies

Cognitive behaviour therapies (CBTs) include a range of interventions that vary in detail according to the assessed nature of a presenting problem and the available evidence for efficacy, but all involve the systematic application of psychological principles to assisting patients to change unhelpful thought patterns (cognitions), emotions, and behaviours. Patients can often be treated effectively with CBT methods on a one-on-one basis. If more than one provider is involved, it is important that all support the approach, as any inconsistency can undermine the effectiveness of the intervention (especially if the other providers promote a 'pain relief first' approach while the CBT provider is encouraging a 'do it despite pain' approach). Most chronic patients will require 5–20 sessions. More disabled and/or distressed patients are likely to need more sessions, and a group-based, comprehensive, multidisciplinary programme is likely to be more effective.^{61,62}

With cognitive behavioural therapies the health-care provider works in a collaborative rather than a directive manner with the patient.⁶³ This requires initial clarification of their respective roles and expectations, and agreement on feasible goals to work towards. The health-care provider should act like a trainer. There should be a clear expectation that the patient takes an active role in implementing the treatment plan, and in generating ideas and possible solutions, rather than passively waiting for the health-care provider to come up with all the answers. The health-care provider should display a calm and reassuring manner, and encourage the patient to persevere with the management plan and to work towards their goals. Typical features of a CBT approach are:

- *defining specific and concrete goals* for functional activities and moods (e.g. drive car on freeway for 1 hour)
- *specification of steps towards achieving the desired goals* (e.g. drive on freeway for 10 minutes then exit; when this is achieved reliably for 3 days, increase to 15 minutes on freeway)
- *consistent reinforcement* of efforts towards goal achievement (e.g. praise by all providers)
- active involvement of the patient in:
 - (a) selecting their goals;
 - (b) monitoring their progress;

- (c) employing necessary skills;
- (d) identifying and modifying unhelpful patterns of thought and behaviour.

CBT methods can be used to change the ways in which pain sufferers perceive and react to their pain and other stressors; it can also help them engage in activities and exercises. There is strong evidence for the effectiveness of cognitive behavioural techniques in a range of chronic pain conditions, regardless of diagnosis and pain site.^{47,61,64–67}

A typical sequence for a CBT intervention is to start with a reformulation or reconceptualization of the pain experiences of the patient. This is intended to help them make sense of what they've experienced and what might need to change in order to alter these experiences and their impact on the patient. This often entails education about the likely basis of the pain, and about differences between acute and chronic pain. Specific goals for the intervention are then negotiated with the patient, as they must want to achieve the goals if they are going to put effort into them. These goals must be defined in terms of activity (such as walking to the shops and back), driving for an hour, etc. The goal of CBT is not pain relief but rather doing things despite pain, and the focus of treatment should be for the patient to be less troubled by pain. The patient may also need to be taught some specific skills to help them achieve their goals. These skills might include relaxation (or ways of reducing emotional arousal or tension) and other self-management strategies (e.g. activity-pacing, problem-solving, and thought challenging).

Unhelpful responses to pain include a tendency to engage in catastrophic thoughts (e.g. 'this pain is killing me')¹⁰ and a tendency to overdo activities on 'good days' (when the pain is not so bad)⁶⁸, which often leads to aggravation of pain. By recognizing catastrophic thoughts and finding a way to defuse them, and moderating activity levels by taking regular breaks and alternating activities, patients can learn to reduce their sense of helplessness and to maintain most normal daily activities with minimal reliance on analgesics despite continued pain. Specific skills in problem-solving can also be taught to those who repeatedly feel defeated by their pain and keep waiting for their doctor to solve the problem for them. Typical problem-solving steps include identifying the problem, developing a number of possible options for dealing with it, selecting and trying one option, reviewing the outcome of that option and, if unsuccessful, considering the next option or reviewing the original identification of the problem, and repeating the other steps. Van den Hout et al⁶⁹ have found training in problem-solving to be a useful addition to a standard rehabilitation programme.

The patient must implement the coping (or self-management) strategies and goal-directed tasks at home between treatment sessions. During the session, the patient should report on their progress towards their goals, their implementation of agreed exercises and activity plans, and their use of specific skills. It may be helpful if they keep a diary.

Education/information provision

A patient's ability to cope with pain may be enhanced if they understand why they are suffering and what to expect in the future. Education is more than merely provision of information, and is best delivered in an interactive way where the patient has a chance to ask questions and the health-care provider can check the patient's understanding of the information by asking questions of the patient. An informed patient is equipped to implement a self-management approach to pain.

Research on the utility of education for musculoskeletal pain has been hampered by problems with definition. For example, the term 'back schools' can include a few hours of information provision on a one-to-one basis⁷⁰, but also multi-sessions with exercises, coping strategies, and home rehabilitation advice. A systematic review by Heymans et al⁷¹ concluded that there was moderate evidence to suggest that back schools, in an occupational setting, can reduce pain and improve function and return-to-work status, in the short- and intermediate-term, compared with exercises, manipulation, myofascial therapy, advice, placebo, or waiting-list controls, for patients with chronic and recurrent lower back pain. However, it needs to be recognized that the more effective 'back schools' in this review had many activity components, not just education/advice. These included cognitive behavioural interventions, exercises, and advice. In many respects these interventions resembled multidisciplinary pain management programmes (see above). Airaksinen et al⁴⁷ concluded that in low-disability cases one session of education may be useful, but high-disability cases need more extensive approaches. The use of a treatment manual is common in CBT programmes, and these typically contain educational information as well as guidance on the techniques being applied.^{72,73}

Relaxation techniques

A variety of techniques can help to decrease anxiety and muscle tension; these can include imagery, distraction, meditation, controlled breathing, and progressive muscle relaxation. Not surprisingly, these methods share many common features:

- frequent practice of the techniques;
- encouragement to avoid effort as part of relaxing (e.g. not forcing oneself to relax);
- encouragement to narrow attention onto something and to limit distracting thoughts or images (the attentional focus may be onto a sound, or part of the body, or an image);
- encouragement to release tension (e.g. through breathing out, or by releasing tensed muscles); and
- implementation at times of stress.

Pain patients often find meditation and breathing techniques more helpful than progressive muscle relaxation techniques that include muscle tensing, as this can aggravate some painful conditions. Relaxation techniques are closely related to, and often indistinguishable from, forms of meditation and self-hypnosis.

Relaxation methods require frequent practice, and the patient should apply them whenever they feel more stressed than usual, or in more pain.⁷⁴ This might be several times a day. Patients who are not helped by relaxation approaches may benefit from biofeedback (see below). In chronic pain, relaxation methods are rarely recommended for use in isolation. Seers and Carroll⁷⁵, for example, found insufficient evidence for its use (in isolation) with either acute or chronic low back pain. A critical review by Kerr⁷⁶ noted that it has had more support as one element of a more comprehensive cognitive behavioural treatment plan.

Biofeedback

Biofeedback can be used as an aid to relaxation or as a means of helping to control certain physiological functions, such as muscle activity. The term 'biofeedback' refers

to the presentation of information about a biological function to the patient. An example of biofeedback is the transduction and display of electrical activity from scalp muscle fibres to help a patient who is learning how to relax scalp and face muscles for the relief of chronic tension-type headaches. Most authorities recommend that before biofeedback is used, the patient should learn to use a relaxation technique, as this may be sufficient (and it will be less expensive).⁷⁷ Biofeedback should rarely be used alone; it should be part of a cognitive behavioural treatment 'package', where various cognitive, behavioural and situational factors are also addressed (see Andrasik⁷⁷ and Andrasik and Flor⁷⁸ for useful reviews).

There is some evidence supporting the use of biofeedback with relaxation and physiotherapy in primary headaches, migraine headaches (especially when used with other modalities), tension-type headaches, temporomandibular joint dysfunction (TMD), and chronic pain generally.^{79,80} There is almost no support for its use with acute pain.

Attentional techniques

These include instructions for the patient to alter their attentional focus in relation to pain. A range of strategies has been reported, from those involving distraction from the pain through attention to imaginal scenes/sensations to attention to external stimuli such as music, scenes or smells. Some techniques also involve attending to the pain, but in ways intended to modify or reinterpret the experience as something less threatening. One example of this is mindfulness meditation (see below). Attempting to alter the patient's emotional state, from stress or fear to comfort or peace, is also a common feature of many of these techniques. Commonly, these techniques are used in conjunction with relaxation methods, and at times these may be inseparable.

Elliott and Eccleston⁸¹ describe in some detail how attentional strategies might be used in the management of chronic pain. This incorporates a lot more than what might be termed 'simple distraction' and shares many of the features of cognitive behavioural treatments as well as mindfulness meditation. Elliott and Eccleston emphasize that their 'attention regulation' approach fits best within a CBT programme context. In their case they describe the technique of attention regulation as including acceptance of the presence of pain but reconceptualizing it as not a reliable signal of injury or damage, the development of non-reactive observation of the pain, a shift in focus of attention to what can be done despite the pain, deliberate avoidance of attempts to not think about pain (which are usually unhelpful), and the generalization of these skills towards lifestyle changes and ongoing management. For further information and reviews see Elliott and Eccleston⁸¹, Keefe et al¹⁵, and Syrjala and Abrams.⁸²

Meditation

Various meditation techniques have been reported, and most share many of the qualities of different relaxation techniques. However, meditation techniques are often described as intentional self-regulation of attention and a systematic mental focus on particular aspects of inner or outer experiences. While many meditation methods have been derived from religious or spiritual backgrounds (e.g. Buddhism), in most current clinical uses they share only loose connections with their origins. The most common types of meditation used in pain management are known as transcendental meditation and mindfulness meditation. Mindfulness-based approaches in pain management have been largely attributed to the work of Kabat-Zinn^{83,84} in the US in the 1980s.

Kabat-Zinn⁸³ outlined his approach in the context of what he called a 'mindfulness-based stress reduction' programme. The programme focuses upon the progressive acquisition of 'mindful' awareness or 'mindfulness'. He characterized 'mindfulness' as dispassionate, non-evaluative and sustained moment-to-moment awareness of perceptible mental states and processes. He proposed that this process includes sustained, immediate awareness of physical sensations, perceptions, affective states, thoughts, and imagery. He emphasized that mindfulness is 'non-deliberative' in that it involves sustained paying attention to ongoing mental content without thinking about, comparing, or in other ways evaluating the ongoing mental phenomena that arise during periods of practice. In the context of pain, this would mean encouraging the patient to focus their attention on their painful sensations without trying to block them or evaluate them (e.g. to consider how bad or terrible they might feel).

Mindfulness has also been described as a form of naturalistic observation, or participant-observation.⁸⁵ In this case the objects of observation are the perceptible mental phenomena (e.g. pain, thought, emotions) that normally arise during waking consciousness. Most recently, McCracken⁸⁶ published a book titled *Contextual Cognitive-Behavioral Therapy for Chronic Pain* that describes the use of mindfulness-based methods as part of a broad cognitive behavioural pain management approach. In this case, rather than attempting to directly challenge unhelpful thoughts or perceptions, the patient is encouraged to employ a mindfulness strategy as outlined above. To date, there is no evidence that this version of CBT is more effective than other versions of CBT pain management, but some findings have indicated that it is similarly effective⁸⁷, as might be expected when it has many features in common. Rather than trying to determine whether one version of CBT is more effective than another, it is likely to be more productive if we can identify which version is suitable for which patient.^{88,89}

Hypnosis

Spiegel⁹⁰ described hypnosis as a 'normal state of highly focused attention, with a relative diminution in peripheral awareness'. Hypnosis often shares many features of relaxation and imagery, and has a long history of use in acute pain conditions. The variable or unstandardized nature of hypnotic procedures has made it difficult to compare studies or draw general conclusions, although some more standardized (by manual) procedures are now available.^{77,82,90-93}

There is moderate evidence that hypnosis can be useful in acute pain, such as pain related to invasive medical procedures, burn wound care, and labour. The evidence for its use with chronic pain is weaker, and it may not offer any advantages over different forms of relaxation training.⁹⁴ It does not appear enough on its own to achieve functional gains in chronic pain patients.⁶⁷

Careful patient evaluation and selection, including an assessment of hypnotizability or responsiveness to hypnosis, are thought to be essential considerations. For the most effective pain reduction, it is recommended that hypnosis be considered as part of an overall cognitive behavioural treatment programme.

Contraindications to hypnosis include severe mood disturbance, the presence of a psychotic illness or thought disorder, or a diagnosis of personality disorder. Prior to using hypnosis for pain management, it is important to identify other factors that may interfere with response to treatment, including phobias and medical conditions not related to the pain complaint. In such situations the hypnotic technique has to be modified.

In using hypnosis for pain management, it is usually recommended that the suggestions made are appropriate. In particular, that no suggestion of a complete elimination or suppression of pain is promoted, as patients may need to be aware of changes in sensation in case there is some new underlying problem emerging that they need to respond to, or so that they do not aggravate their condition by overdoing activities.

Psychotherapy

Psychotherapy refers to forms of psychological treatment that emphasize verbal interactions and the relationship between the therapist and the patient to produce an alteration in the patient's behaviour, feelings, and modes of reacting. The term psychotherapy can include cognitive behavioural therapies, but in general use psychotherapy usually refers to methods based on psychodynamic theories of personality. Many of these types of treatment are long-term; however, there are shorter versions with more specific aims. One such approach (which may assist with the maintenance of some patients with chronic pain) is supportive psychotherapy.⁹⁵ In this approach, rather than trying to explore the whole of a patient's life, the therapy is focused on strengthening the patient's own coping mechanisms using suggestion, advice, reassurance, clarification, abreaction, and encouragement.

Psychotherapy should not be confused with simply providing advice to someone. Rather, it usually involves a therapist helping a patient to make sense of particular intrapsychic or interpersonal problems, often lifelong or recurring difficulties (e.g. in relationships). This can help the patient to work out possible ways of dealing with these problems. It can, therefore, be helpful to someone with chronic pain, but it may not be enough. It has been found that psychological therapies that emphasize not just understanding but also getting the patient to make changes in the ways they behave and think between sessions are more helpful in achieving mood and functional gains in people with chronic pain (see Basler et al⁹⁶ for a discussion).

Currently, there is no evidence from randomized controlled trials for the use of psychodynamic psychotherapy with pain patients, but clinical experience supports its use in selected cases, often as an addition to the more action-oriented approaches.

Social/environmental interventions

It follows from a biopsychosocial perspective that if environmental factors appear to be contributing to the presentation of a patient's persisting pain and associated difficulties, then some intervention at the environmental level would be appropriate.⁹⁷ This may not always be feasible. For example, McClusky et al⁹⁸ found that a guideline-based psychosocial intervention for the early management of musculoskeletal disorders was effectively undermined by workplace organizational obstacles, such as policies and procedures. However, there is evidence that interventions which do manage to integrate clinical and workplace processes have better functional (return-to-work) outcomes.⁹⁹ These may entail direct liaison between the treatment provider and the workplace supervisor of an injured worker to ensure that appropriate arrangements are in place for a graduated return to work, or attention to specific issues such as conflict between the worker and his/her supervisor.¹⁰⁰ However, in this area it is also important to recognize that many, possibly most, individuals with persisting work-related pain do return to work with little or no help and in the face of personal and workplace variables that seem to be major obstacles to others.¹⁰¹ So, perfection in terms of no pain or no workplace problems may not be necessary in

a large proportion of cases, but when they are a problem it means that some attention is likely to be helpful.

At a broader, society level, there is also evidence that a public education campaign to inform the population and encourage early return to work after onset of low back pain can achieve reductions in claims for low back pain at work, as well as reduced medical costs for these conditions.¹⁰² The findings of this Australian study were attributed to attitude changes among the community and their general medical practitioners, as these changed in the state where the education campaign occurred but not in the neighbouring state where there was no similar education campaign. In the control state there was also no change in claims for back injuries at work or their treatment costs over the period studied. This was not a randomized controlled trial, and was aimed at acute/subacute low back pain, but the results may be relevant to preventing disability from chronic pain.

COMBINING TREATMENTS

As noted in the earlier section on the implications of a biopsychosocial perspective for managing persisting pain, it is frequently the case that multiple interventions might be appropriate in individual cases. Typically, these would be directed against different targets, but before commencing such a multidimensional intervention process it would seem important to ensure that some planning had taken place to coordinate these interventions as they can easily appear at cross purposes. For example, a patient could be told to take something to relieve pain while also being told to accept the presence of the pain and to exercise despite the pain. Nevertheless, there is mounting evidence that a strategy of combining treatments aimed at different targets in chronic pain patients can lead to better results than a single treatment on its own.^{46,103–113} In terms of economic value, Turk¹¹⁴ concluded that multidisciplinary pain rehabilitation programmes are significantly more cost-effective than spinal cord stimulators, implantable drug delivery system (IDDS), conservative care, and surgery for a range of chronic pain syndromes. These findings should not be that surprising, especially when it seems almost obvious that complex cases are likely to require complex solutions.¹¹⁵

CONCLUSIONS

The term 'pain management' is applied to a wide range of treatment modalities, including giving people advice. In some contexts it refers to pain relief, while in others it refers to acceptance of pain and maintenance of normal activities despite pain. Few, if any, treatments reliably achieve both. In the case of chronic or persisting pain, no lasting relief is likely from current treatments. In this context, continuing to seek pain relief as the focus of treatment could even risk making patients' disability and quality of life worse. Thus, clinicians must carefully balance the chances that their interventions for persisting pain may help their patients against the chances that they could add to the burden of their patients' pain. There is a growing consensus that pain management with persisting pain should be focused on facilitating the independence of those who develop such pain. This has been termed a 'self-management' approach. To this end those treatments that assist a patient to manage their persisting pain with as little interference in daily life as possible are clearly to be preferred. If treatments have only short-term benefit in terms of pain relief but require repeated

visits to a clinic, then their overall value must be questioned. The challenge for all clinicians in this area remains to develop ways of helping patients to care for themselves as effectively as possible. A biopsychosocial perspective offers a way forward in this regard. While this may have implications for the roles and responsibilities of different clinicians, as well as their patients, it does provide a framework for action. Specifically, it means that clinicians of all disciplines who deal with patients whose pain is persisting, even in the so-called 'acute phase', are likely to be more effective if they attempt to employ combinations of interventions aimed at the different targets identified in assessment.

Practice points

- in those who develop chronic pain, complete pain relief is usually not achievable with current treatment options
- with chronic pain, pain relief should not be the sole focus of an intervention, as that risks diverting attention from other factors that may be contributing to disability and suffering
- striking a balance between pain reduction options and independent self-management by the patient represents a major challenge for all clinicians
- a biopsychosocial perspective offers a helpful framework for both the clinician and pain sufferer, as it reinforces the importance of a coordinated, multifaceted approach where a number of parties may need to contribute for successful outcomes to be achieved
- the focus of pain management is on resuming and maintaining as normal a lifestyle as possible despite persisting pain
- developing the means to achieve that is the joint responsibility of the clinician and patient

Research agenda

- despite repeated calls, we still have limited ability to answer the question of which treatment is best for which patient. Systematic reviews of the research literature are still mostly based on pain site and chronicity. Research studies need to describe their patient samples as comprehensively as possible, preferably using standardized measures
- given that no single treatment can deal with the complexity of many chronic pain patients, studies of treatment combinations targeting different aspects of these cases are urgently required
- research is also needed to identify the best ways of enabling clinicians of different disciplines to work in a collaborative manner with the same chronic pain patients
- as an understanding of a biopsychosocial perspective on pain is critical for those patients expected to take a self-management approach, research on effective ways for clinicians to explain this perspective on pain would facilitate this process

REFERENCES

1. Engel CL. The need for a new medical model: a challenge for biomedical science. *Science* 1977; **196**: 129–136.
2. Turk DC & Flor H. Chronic Pain: a biobehavioral perspective. In Gatchel RJ & Turk DC (eds.). *Psychosocial factors in pain: critical perspectives*. New York: Guilford Press, 1999, pp. 18–34.
3. Turk DC & Okifuji A. Psychological factors in chronic pain: evolution and revolution. *Journal of Consulting and Clinical Psychology* 2002; **70**(3): 678–690.
4. Flor H & Hermann C. Biopsychosocial models of pain. In Dworkin RH & Breitbart WS (eds.). *Psychosocial aspects of pain: a handbook for health care providers. Progress in pain research and management* 2004; vol. 27. Seattle: IASP Press, 2004, pp. 47–75.
5. Fordyce WE. *Behavioral methods for chronic pain and illness*. St. Louis: Mosby, 1976.
6. Loeser JD. Concepts of pain. In Stanton-Hicks M & Boas R (eds.). *Chronic low-back pain*. New York: Raven Press, 1982, pp. 145–148.
7. Waddell G, Bircher M, Finlayson D & Main CJ. Symptoms and signs: physical disease or illness behaviour? *British Medical Journal* 1984; **289**: 739–741.
8. Troup JDG & Videman T. Inactivity and the aetiopathogenesis of musculoskeletal disorders. *Clinical Biomechanics* 1989; **4**: 173–178.
9. Vlaeyen JWS & Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: A state of the art. *Pain* 2000; **85**(3): 317–332.
10. Sullivan MJL, Lynch ME & Clark AJ. Dimensions of catastrophic thinking associated with pain experience and disability in patients with neuropathic pain conditions. *Pain* 2005; **113**: 310–315.
11. Leeuw M, Goossens MEJB, Linton SJ et al. The fear-avoidance model of musculoskeletal pain: current state of scientific evidence. *Journal of Behavioral Medicine* 2007; **30**(1): 77–94.
12. Nicholas MK. The Pain self-efficacy questionnaire: taking pain into account. *European Journal of Pain* 2007; **11**: 153–163.
13. McCracken LM & Eccleston C. A prospective study of acceptance of pain and patient functioning with chronic pain. *Pain* 2005; **118**: 164–169.
14. Blyth FM, March L, Nicholas M & Cousins M. Self-management of chronic pain: a population-based study. *Pain* 2005; **113**: 285–292.
15. Keefe FJ, Rumble ME, Scipio CD et al. Psychological aspects of persistent pain: current state of the science. *The Journal of Pain* 2004; **5**(4): 195–211.
16. Lousberg R, Groenman NH, Schmidt AJM & Gielen AACM. Operant conditioning of the pain experience. *Perceptual and Motor Skills* 1996; **83**: 883–900.
17. Flor H, Knost B & Birbaumer N. The role of operant conditioning in chronic pain: an experimental investigation. *Pain* 2002; **95**: 111–118.
18. Jolliffe CD & Nicholas MK. Verbally reinforcing pain reports: an experimental test of the operant model of chronic pain. *Pain* 2004; **107**: 167–175.
19. Schneider C, Palomba D & Flor H. Pavlovian conditioning of muscular responses in chronic pain patients: central and peripheral correlates. *Pain* 2004; **112**: 239–247.
20. Harris I, Mulford J, Solomon M et al. Association between compensation status and outcome after surgery a meta-analysis. *JAMA: The Journal of the American Medical Association* 2005; **293**(13): 1644–1652.
21. Scuderi GJ, Sherman AL, Brusovanik GV et al. Symptomatic cervical disc herniation following a motor vehicle collision: return to work comparative study of workers' compensation versus personal injury insurance status. *The Spine Journal* 2005; **5**: 639–644.
22. Goldberg GM, Kerns RD & Rosenberg R. Pain-relevant support as a buffer from depression among chronic pain patients low in instrumental activity. *The Clinical Journal of Pain* 1993; **9**: 33–40.
23. Newton-John TRO. Solicitousness and chronic pain: a critical review. *Pain Reviews* 2002; **9**(1): 7–27.
24. Romano JM, Turner JA, Friedman LS et al. Chronic pain patient-spouse behavioural interactions predict patient disability. *Pain* 1995; **63**: 353–360.
25. Weiss LH & Kerns RD. Patterns of pain-relevant social interactions. *International Journal of Behavioral Medicine* 1995; **2**: 157–171.
26. Main CJ. Concepts of treatment and prevention in musculoskeletal disorders. In Linton SJ (ed.). *New avenues for the prevention of chronic musculoskeletal pain and disability*. Amsterdam: Elsevier, 2002, pp. 47–63.

27. Miedema HS, Chorus AMJ, Wevers CWJ & van der Linden S. Chronicity of back problems during working life. *Spine* 1998; **23**(18): 2021–2028.
28. Blyth FM, March LM, Brnabic AJM et al. Chronic pain in Australia: a prevalence study. *Pain* 2001; **89**(2(3)): 127–134.
29. Frymoyer JW. Back pain and sciatica. *The New England Journal of Medicine* 1988; **318**: 291–300.
30. Blyth FM, March LM, Nicholas MK & Cousins MJ. Chronic pain, work performance and litigation. *Pain* 2003; **103**: 41–47.
31. Williams ACdeC. Assessing chronic pain and its impact. In Dworkin RH & Breitbart VS (eds.). *Psychosocial aspects of pain: a handbook for health care providers. Progress in pain research and management* 2004; vol. 27. Seattle: IASP Press, 2004, pp. 97–116.
32. Nicholas MK. When to refer to a pain clinic. *Best Practice & Research Clinical Rheumatology* 2004; **18**(4): 613–629.
33. Waddell G & Burton K. Concepts of rehabilitation for the management of low back pain. *Best Practice & Research Clinical Rheumatology* 2005; **19**(4): 655–670.
34. Nicholas MK, Molloy AR & Brooker C. Using opioids with persisting noncancer pain: a biopsychosocial perspective. *The Clinical Journal of Pain* 2006; **22**(2): 137–146.
35. Merskey H & Bogduk N (eds.). *Classification of chronic pain. task force on taxonomy*. 2nd edn. Seattle: IASP press, 1994.
36. Moulin DE, Iezzi A, Amireh R et al. Randomised trial of oral morphine for chronic non-cancer pain. *Lancet* 1996; **347**: 143–147.
37. Sator-Katzenschlager SM, Schiesser AW, Kozek-Langenecker SA et al. Does pain relief improve pain behavior and mood in chronic pain patients? *Anesthesia and Analgesia* 2003; **97**(3): 791–797.
38. Smith BH & Elliott AM. Active self-management of chronic pain in the community. *Pain* 2005; **113**: 249–250.
39. Loeser JD. Mitigating the dangers of pursuing cure. In Cohen MJM & Campbell JN (eds.). *Pain treatment centers at a crossroads: a practical and conceptual reappraisal*. Seattle: IASP Press, 1996, pp. 101–108.
40. Australian Acute Musculoskeletal Pain Guidelines Group. *Evidence-based management of acute musculoskeletal pain guidelines for clinicians*. Australian Academic Press, 2004.
41. Van Tulder, et al., 2005 European Guidelines for the management of acute nonspecific low back pain in primary care. Working Group on Guidelines for the Management of Acute Low Back Pain in Primary Care.
42. Koes BW, van Tulder MW & Thomas S. Diagnosis and treatment of low back pain. *British Medical Journal* 2006; **332**: 1430–1434.
43. Indahl A, Velund L & Reikeraas O. Good prognosis for low back pain when left untampered: a randomized clinical trial. *Spine* 1995; **20**: 473–477.
44. Pengel LHM, Refshauge KM, Maher CG et al. Physiotherapist-directed exercise, advice, or both for sub-acute low back pain: a randomized controlled trial. *Annals of Internal Medicine* 2007; **146**(11): 787–796.
45. Hayden JA, van Tulder MW & Tomlinson G. Systematic review: strategies for using exercise therapy to improve outcomes. *Annals of Internal Medicine* 2005; **142**: 9.
46. Schonstein E, Kenny DT, Keating J & Koes BW. Work conditioning, work hardening and functional restoration for workers with back and neck pain. *Cochrane Database of Systematic Reviews* 2003; (Issue 3). doi:10.1002/14651858. Art. No.: CD001822.
47. Airaksinen O, Brox JI, Cedraschi C et al. European guidelines for the management of chronic nonspecific low back pain. *European Spine Journal* 2006; **15**(Suppl. 2): S192–S300.
48. Assendelft WJJ, Morton SC, Yu Emily I et al. Spinal manipulative therapy for low-back pain. *Cochrane Database of Systematic Reviews* 2004; (Issue 1). doi:10.1002/14651858. Art. No.: CD000447. pub2.
49. Cherkin DC, Sherman KJ, Deyo RA & Shekelle PG. A Review of the evidence for the effectiveness, safety, and cost of acupuncture, massage therapy, and spinal manipulation for back pain. *Annals of Internal Medicine* 2003; **138**: 898–906.
50. van Tulder MW, Koes B & Malmivaara A. Outcome of non-invasive treatment modalities on back pain: an evidence-based review. *European spine journal* 2006 Jan; **15**(Suppl. 1): S64–S81.
51. North RB. Spinal cord stimulation for chronic, intractable pain. In Schmidek HH & Sweet WH (eds.). *Operative neurosurgical techniques*. Philadelphia: W.B. Saunders Co., 1995, pp. 1403–1411.
52. Khadilkar A, Milne S, Brosseau L et al. Transcutaneous electrical nerve stimulation (TENS) for chronic low-back pain. *Cochrane Database of Systematic Reviews* 2005 Jul 20; (3).

53. Kroeling P, Gross AR & Goldsmith CH. Cervical Overview Group. A Cochrane review of electrotherapy for mechanical neck disorders. *Spine* 2005 Nov 1; **30**(21): E641–E648.
54. Brinkhaus B, Witt CM, Jena S et al. Acupuncture in patients with chronic low back pain: a randomized controlled trial. *Archives of Internal Medicine* 2006; **166**: 450–457.
55. Green S, Buchbinder R & Hetrick S. Acupuncture for shoulder pain. *Cochrane Database of Systematic Reviews* 2007; **3**.
56. White A, Foster NE, Cummings M & Barlas P. Acupuncture treatment for chronic knee pain: a systematic review. *Rheumatology* 2007; **46**(3): 384–390.
57. Manheimer E, White A, Berman B et al. Meta-analysis: acupuncture for low back pain. *Annals of Internal Medicine* 2005; **142**: 651–663.
58. Venesy DA. Physical medicine and complementary approaches. *Neurologic Clinics* 2007; **25**: 523–537.
59. Lee H, Schmidt K & Ernst E. Acupuncture for the relief of cancer-related pain – a systematic review. *European Journal of Pain* 2005; **9**: 437–444.
60. French SD, Cameron M, Walker BF et al. Superficial heat or cold for low back pain. *Cochrane Database of Systematic Reviews* 2006 Jan 25; (1). CD004750.
61. Guzman J, Esmail R, Karjalainen K et al. Multidisciplinary rehabilitation for chronic low back pain: systematic review. *British Medical Journal* 2001; **322**: 1511–1516.
62. Haldorsen EMH, Grasdal AL, Skouen JS et al. 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* 2002; **95**: 49–63.
63. Von Korff M. Collaborative care. *Annals of Internal Medicine* 1997; **127**: 1097–1102.
64. Dixon KE, Keefe FJ, Scipio CD et al. Psychological interventions for arthritis pain management in adults: a meta-analysis. *Health Psychology* 2007; **26**(3): 241–250.
65. McCracken LM & Turk DC. Behavioral and cognitive-behavioral treatment for chronic pain: outcome, predictors of outcome, and treatment process. *Spine* 2002; **27**(22): 2564–2573.
66. Morley S, Eccleston C & Williams A. Systematic review and meta-analysis of randomized controlled trials of cognitive behaviour therapy and behaviour therapy for chronic pain in adults, excluding headache. *Pain* 1999; **80**(1-2): 1–13.
67. Nielson W & Weir R. Biopsychosocial approaches to the treatment of chronic pain. *The Clinical Journal of Pain* 2001; **17**: S114–S127.
68. Gil K, Ross SI & Keefe FJ. Behavioral treatment for chronic pain. Four pain management protocols. In France RD & Krishnana KRR (eds.). *Chronic pain*. Washington: American Psychiatric Press, 1988, pp. 376–413.
69. Van den Hout JHC, Vlaeyen JWS, Heuts PHTG et al. Secondary prevention of work-related disability in nonspecific low back pain: does problem-solving therapy help? A randomized clinical trial. *The Clinical Journal of Pain* 2003; **19**: 87–96.
70. Moseley L, Nicholas MK & Hodges PW. A randomised controlled trial of intensive neurophysiology education in chronic low back pain. *The Clinical Journal of Pain* 2004; **20**: 324–330.
71. Heymans MW, van Tulder MV, Esmail R et al. Back schools for nonspecific low back pain: a systematic review within the framework of the Cochrane Collaboration Back Review Group. *Spine* 2005; **30**(19): 2153–2163.
72. Butler DS & Moseley GL. *Explain pain*. Adelaide: Noigroup Publications, 2003.
73. Nicholas MK, Molloy AM, Tonkin L & Beeston L. *Manage your pain*. Sydney: ABC Books, 2000.
74. Ost LG. Applied relaxation: description of a coping technique and review of controlled studies. *Behaviour Research and Therapy* 1987; **25**(5): 397–409.
75. Seers K & Carroll D. Relaxation techniques for acute pain management: a systematic review. *Journal of Advanced Nursing* 1998; **27**: 466–475.
76. Kerr K. Relaxation techniques: a critical review. *Critical Reviews in Physical and Rehabilitation Medicine* 2000; **12**: 51–89.
77. Andrasik F. The essence of biofeedback, relaxation and hypnosis. In Dworkin RH & Breitbart WS (eds.). *Psychosocial aspects of pain: a handbook for health care providers*. Seattle: IASP Press, 2004, pp. 285–308.
78. Andrasik F & Flor H. Biofeedback. In Breivik H, Campbell W & Eccleston C (eds.). *Clinical pain management: practical applications and procedures*. London: Arnold, 2003, pp. 135–146.

79. NIH Technology Assessment Panel on Integration of Behavioral and Relaxation Approaches into the Treatment of Chronic Pain and Insomnia Integration of behavioral and relaxation approaches into the treatment of chronic pain and insomnia. *JAMA : The Journal of the American Medical Association* 1996; **276**: 313–318.
80. Crider AB & Glaros AG. A meta-analysis of EMG biofeedback treatment of temporomandibular disorders. *Journal of Orofacial Pain* 1999; **13**(1): 29–37.
81. Elliott E & Eccleston C. Attentional regulation for adults with chronic pain. In Breivik H, Campbell W & Eccleston C (eds.). *Clinical pain management: practical applications and procedures*. London: Arnold, 2002, pp. 135–146.
82. Syrjala KL & Abrams JR. Hypnosis and imagery in the treatment of pain. In Turk DC & Gatchell RJ (eds.). *Psychological approaches to pain management: A practitioner's handbook*. 2nd edn. New York: The Guilford press, 2002, pp. 187–pp.209.
83. Kabat-Zinn J. *Full catastrophe living: using the wisdom of your body and mind to face stress, pain and illness*. New York: Delacorte, 1990.
84. Kabat-Zinn J, Lipworth L & Burney R. Four-year follow-up of a meditation-based program for the self-regulation of chronic pain: treatment outcomes and compliance. *The Clinical Journal of Pain* 1987; **2**: 159–173.
85. Grossman P. Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research* 2004; **57**: 35–43.
86. McCracken LM. *Contextual cognitive-behavioral therapy for chronic pain*. Seattle, WA: IASP Press, 2005.
87. McCracken LM, MacKichan F & Eccleston C. Contextual cognitive-behavioral therapy for severely disabled chronic pain sufferers: effectiveness and clinically significant change. *European Journal of Pain* 2007; **11**: 314–322.
88. Turk DC. Customizing treatment for chronic pain patients: who, what, and why. *The Clinical Journal of Pain* 1990; **6**(4): 255–270.
89. Vlaeyen JWS & Morley S. Cognitive-behavioral treatments for chronic pain: what works for whom? *The Clinical Journal of Pain* 2005; **21**: 1–8.
90. Spiegel D. Self-regulation skills training for adults, including relaxation. In Breivik H, Campbell W & Eccleston C (eds.). *Clinical pain management: practical applications and procedures*. London: Arnold, 2003, pp. 113–119.
91. Ellis JA & Spanos NP. Cognitive-behavioral interventions for children's distress during bone marrow aspirations and lumbar puncture: a critical review. *Journal of Pain and Symptom Management* 1994; **9**: 96–108.
92. Kuttner L & Culbert T. Hypnosis, biofeedback, and self-regulation skills for children in pain. In Breivik H, Campbell W & Eccleston C (eds.). *Clinical pain management: practical applications and procedures*. London: Arnold, 2003, pp. 147–162.
93. Svensson PW. Hypnosis in the management of acute and persistent pain: Support from the recent literature. *Australian Journal of Clinical and Experimental Hypnosis* 2004; **32**(1): 103–110.
94. Jensen M & Patterson DR. Hypnotic treatment of chronic pain. *Journal of Behavioral Medicine* 2006; **29**(1): 95–124.
95. Bassett D & Pilowsky I. A study of brief psychotherapy for chronic pain. *Journal of Psychosomatic Research* 1985; **29**: 259–264.
96. Basler SC, Grzesiak RC & Dworkin RH. Integrating relational psychodynamic and action-oriented psychotherapies: treating pain and suffering. In DC Turk & RJ Gatchel (eds.). *Psychological approaches to pain management*. 2nd edn. New York: Guilford, 2002, pp. 94–127.
97. Blyth FM, Macfarlane GJ & Nicholas MK. Understanding the role of psychosocial factors in the development of chronic pain: the key to better outcomes for patients? *Pain* 2007; **129**: 8–11.
98. McCluskey S, Burton AK & Main CJ. The implementation of occupational health guidelines principles for reducing sickness absence due to musculoskeletal disorders. *Occupational Medicine* 2006; **56**(4): 237–242.
99. Franche R-L, Cullen K, Clarke J et al. The institute for work & health (IWH) workplace-based RTW intervention literature review research team. Workplace-based return to work interventions: a systematic review of the quantitative literature. *Journal of Occupational Rehabilitation* 2005; **15**(4): 607–632.
100. Schultz IZ, Crook J, Meloche GR et al. Psychosocial factors predictive of occupational low back disability: towards development of a return-to-work model. *Pain* 2004; **107**: 77–85.

101. Pransky G, Benjamin K, Savageau J et al. Outcomes in work-related injuries: a comparison of older and younger workers. *American Journal of Industrial Medicine* 2005; **4**: 104–112.
102. Buchbinder R, Jolley D & Wyatt M. Population based intervention to change back pain beliefs and disability: three part evaluation. *British Medical Journal* 2001; **322**: 1516–1520.
103. Haythornthwaite JA. Clinical trials studying pharmacotherapy and psychological treatments alone and together. *Neurology* 2005; **65**(suppl 4): S20–S31.
104. Holroyd KA, O'Donnell FJ, Stenland M et al. Management of chronic tension-type headache with tri-cyclic antidepressant medication, stress management therapy, and their combination – a randomized controlled trial. *JAMA: The Journal of the American Medical Association* 2001; **285**: 2208–2217.
105. Kishino ND, Polatin PB, Brewer S et al. Long-term effectiveness of combined spinal surgery and functional restoration: a prospective study. *Journal of Occupational Rehabilitation* 2000; **10**: 235–239.
106. Leibing E, Pflingsten M, Bartman U et al. Cognitive-behavioral treatment in unselected rheumatoid arthritis outpatients. *The Clinical Journal of Pain* 1999; **15**: 58–66.
107. Molloy AR, Nicholas MK, Asghari A et al. Does a combination of intensive cognitive-behavioral pain management and a spinal implantable device confer any advantage? A preliminary examination. *Pain Practice* 2006; **6**(2): 96–103.
108. Moseley L. Combined physiotherapy and education is efficacious for chronic low back pain. *The Australian Journal of Physiotherapy* 2002; **48**: 297–302.
109. Nicholas MK, Wilson PH & Goyen J. Comparison of cognitive-behavioural group treatment and an alternative non-psychological treatment for chronic low back pain. *Pain* 1992; **48**: 339–347.
110. Sharpe L, Sensky T, Timberlake N et al. A blind, randomized, controlled trial of cognitive-behavioural intervention for patients with recent onset rheumatoid arthritis: preventing psychological and physical morbidity. *Pain* 2001; **89**: 275–283.
111. Sullivan MJ, Adams H, Rhodenizer T & Stanish WD. A psychosocial risk factor – targeted intervention for the prevention of chronic pain and disability following whiplash injury. *Physical Therapy* 2006; **86**(1): 8–18.
112. Turk DC & Okifuji A. Treatment of chronic pain patients: clinical outcomes, cost-effectiveness, and cost-benefits of multidisciplinary pain centers. *Critical Reviews in Physical and Rehabilitation Medicine* 1998; **10**: 181–208.
113. Turk DC. Combining somatic and psychosocial treatment for chronic pain patients: perhaps 1 + 1 does = 3. *The Clinical Journal of Pain* 2001; **17**(4): 281–283.
114. Turk DC. Clinical effectiveness and cost-effectiveness of treatments for patients with chronic pain. *The Clinical Journal of Pain* 2002; **18**: 355–365.
115. Clark TS. Interdisciplinary treatment for chronic pain: is it worth the money? *Baylor University Medical Center Proceedings* 2000; **13**: 240–243.