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Moving on to Movement in Patients with Chronic Joint Pain

Many different conditions, such as osteoarthritis, rheumatoid arthritis, bursitis, gout, strains, and sprains, are characterized by painful joints. Joint pain is common, becoming more prevalent as people grow older. Joint pain can affect any part of the body, from the ankles and feet to the shoulders and hands, and can be widespread or generalized, as in fibromyalgia and chronic fatigue syndrome.

Many different causes may underlie joint pain, resulting in diverse pain mechanisms and different clinical pictures. When we look at the clinical guidelines for osteoarthritis, chronic low back pain, or fibromyalgia, we can see that the evidence for different therapy modalities, from surgery to medication to manual techniques, is often scarce or even conflicting. The sole modality that is always appropriate for chronic joint pain is physical activity or exercise. Although physical activity and exercise are differentiated by the World Health Organization, this issue of *Pain: Clinical Updates* addresses both concepts. Exercise is a subcategory of physical activity that is planned, structured, repetitive, and purposeful, with the goal of improving or maintaining one or more components of physical fitness. Physical activity includes exercise as well as other activities involving bodily movement during play, work, transportation, household chores, and recreation.[1]

Clinicians often emphasize the relevance of both exercise and physical activity for the management of joint pain, with statements such as "Exercise is medicine" or with regard to more general health effects, "Sitting is the new smoking." Yet clinicians often struggle to implement exercise interventions in clinical practice, especially for patients with chronic pain. What makes it so difficult to implement exercise in our approach? What are the barriers, and how must we deal with them?

Barriers

As described in a relevant overview by Kroll,[2] there are indeed multiple barriers against participation in both physical activity and exercise for patients with chronic pain. These barriers can be divided into patient-related factors, environmental factors, and health care delivery factors (Table 1).

While most of the environmental factors are rather general, such as lack of time or support, patient-related factors and health care delivery factors are more specific for the chronic pain population and deserve some further elaboration and, more importantly, some tips on how to target them.

Pain and Exercise-Induced Hyperalgesia

While in healthy participants, almost all types of acute bouts of exercise reduce pain sensitivity, the size and direction of the effects of exercise in chronic pain conditions are more heterogeneous and often adverse.[3] Both hypoalgesic and hyperalgesic responses have been reported.[4,5] In patients with chronic fatigue syndrome,

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Table 1
Exercise barriers for chronic pain patients

Patient Factors
▪ Pain, particularly centrally mediated pain
▪ Dysfunctional endogenous pain modulation
▪ Fear-avoidance and/or catastrophic (pain) beliefs
▪ Excessive deconditioning
▪ Lack of education and understanding about the neurophysiology of pain and central sensitization
▪ Strong beliefs that exercise can be harmful
▪ Depression
▪ Lack of self-efficacy
Environmental Factors
▪ Lack of access to a place to exercise
▪ Perceived or real lack of time to exercise
▪ Lack of support for exercise from one's family and workplace
▪ Variable accessibility of appropriate health care providers
Health Care Delivery Factors
▪ Overly strong focus on the biomedical model of pain
▪ Lack of attention to psychological and central nervous system contributions to pain
▪ Lack of coordination of care between the physician and therapist
▪ Poor communication between health care providers and patients regarding the value and importance of exercise
▪ Poor education of the patient about the meaning of pain
▪ Lack of sufficient supervision so that the patient feels safe exercising and understands appropriate strategies for progressively increasing exercise
Source: Adapted from Kroll.[2]

fibromyalgia, and chronic whiplash-associated disorders, for example, both aerobic and isometric exercise seem to decrease pain thresholds.[4–9] These patients are characterized by central sensitization, implying that descending pain inhibition is not working properly, leading to various complaints during and after exercise.[6,7] There is considerable debate concerning the terminology used to describe the clinical presentation of pain hypersensitivity where patients present with features of central sensitization. Some argue that central sensitization specifically refers to enhanced responsiveness of nociceptive neurons in the central nervous system, as demonstrated in preclinical studies, but because clinical assessment cannot specifically identify mechanisms, it is more accurate to use terms like "pain sensitization" or "pain hypersensitivity" in clinical practice.[10] On the contrary, Woolf argues that the term "central sensitization" and its definition reflect the spectrum of processes that may underpin pain hypersensitivity, including activity-dependent enhanced nociceptive signaling, as well as altered descending pain modulation.[11] Given the lack of consensus on this topic, we have selected the term "central sensitization pain" to reflect a clinical pain state whereby pain is largely driven by sensitization in the central nervous system and impaired descending pain modulation, although we acknowledge that peripheral inputs may contribute to this pain hypersensitivity and help maintain it.

In contrast to these centrally sensitized patients, at the extreme end of the musculoskeletal pain continuum there are other chronic joint pain conditions that are more localized and are not always dominated by central sensitization. Think, for example, about patients with rheumatoid arthritis, osteoarthritis, or chronic shoulder pain. Although neuroplastic changes may result from continuous noxious stimulation, central sensitization only seems to be present in subgroups, and the clinical picture is dominated by nociceptive or inflammatory pain mechanisms. That is why contradictory findings may be observed in individual patients with a more localized or structural chronic pain complaint such as chronic low back pain, rheumatoid arthritis, or osteoarthritis. Different studies have reported both an increase and decrease in pain thresholds after these patients engage in different types of exercise. The effect seems to be dependent on the patient and on the type of exercise. General aerobic training[4,9,12] or strength training focusing on unaffected body parts[5,13]

can have pain-relieving effects in these patients by reducing pain sensitivity in the affected tissues. On the other hand, specific exercises that engage painful body parts do not always activate segmental or multi-segmental pain inhibitory mechanisms in patients with complaints like shoulder myalgia.[5]

Although exercise-induced hyperalgesia lasts for a limited time, it may have huge effects in the longer term, mediated by patients' perceptions and beliefs. The immediate effects of exercise may determine patients' future exercise behavior.

Patients' Understanding of Pain Neurophysiology

Therapy for patients with chronic joint pain is often presented within a biomedical model of pain. However, this "find it and fix it" model could perpetuate the notion that the joints are the only cause of pain, reinforcing biomedical beliefs.[14]

In that view of pain, it might be counterintuitive to the patient to exercise despite pain. As the joints are seen as the source of pain and exercise worsens pain, patients might consider exercise as "overloading" or endangering the joints. Patients interpret pain as an indicator of a biomedical problem or bodily harm. Therefore, attributing pain to exercise may lead people to believe they should stop exercising or avoid similar exercise in the future, compromising therapy compliance.

Patient's Beliefs and Self-efficacy

Hyperalgesic responses to exercise, combined with poor understanding of their pain, can result in inappropriate pain perceptions and beliefs in patients with chronic pain. Patients with chronic pain are often unaware of the fact that pain is frequently disproportionate to tissue damage, and they may keep on searching for a structural cause and consequently a "magic bullet" to solve the problem. This may result in low self-efficacy, inappropriate therapy expectations, and significant barriers to prevent reactivation despite pain. Self-efficacy remains one of the most consistent correlates or determinants of physical activity behavior.[15] Unfortunately, low levels of self-efficacy and external loci of control are common in patients with chronic joint pain, owing to their incorrect illness perceptions.

Indeed, when pain is interpreted in terms of harm and exercise results in pain exacerbations, exercise can seem dangerous or harmful. Reduced exercise tolerance may lead to fear of movement and avoidance of certain activities, resulting in disuse and inactivity, and eventually further deconditioning. Subsequently, the patient's tolerance further decreases, and pain responses to exercise bouts will only get worse, sustaining the vicious circle of exercise-induced hyperalgesia and avoidance (Fig. 1). Prescribing untailored exercise programs will fail in these patients. The outcome of pain-contingent activation will only be further empowerment of the pain neuromatrix, increasing pain behavior and inappropriate cognitions. Moreover, this approach will preclude grading patients' activity levels.

Not every patient with chronic pain ends up coping by avoiding activity. Persisters are patients who continue to perform activities to their completion despite pain.[16] These patients try to ignore pain sensations and the (physical) boundaries of their body, suppress pain-related and anxious thoughts, and persist in daily activities (including physical activities), resulting in overactivity,[17] in an attempt to be their "ideal self." After activity completion, pain will increase, which in turn will force persisters to rest until the pain subsides.[18] In the long run, persistence behavior can be maladaptive and result in wide ups and downs (a "saw tooth pattern") in the level of activities of daily life.

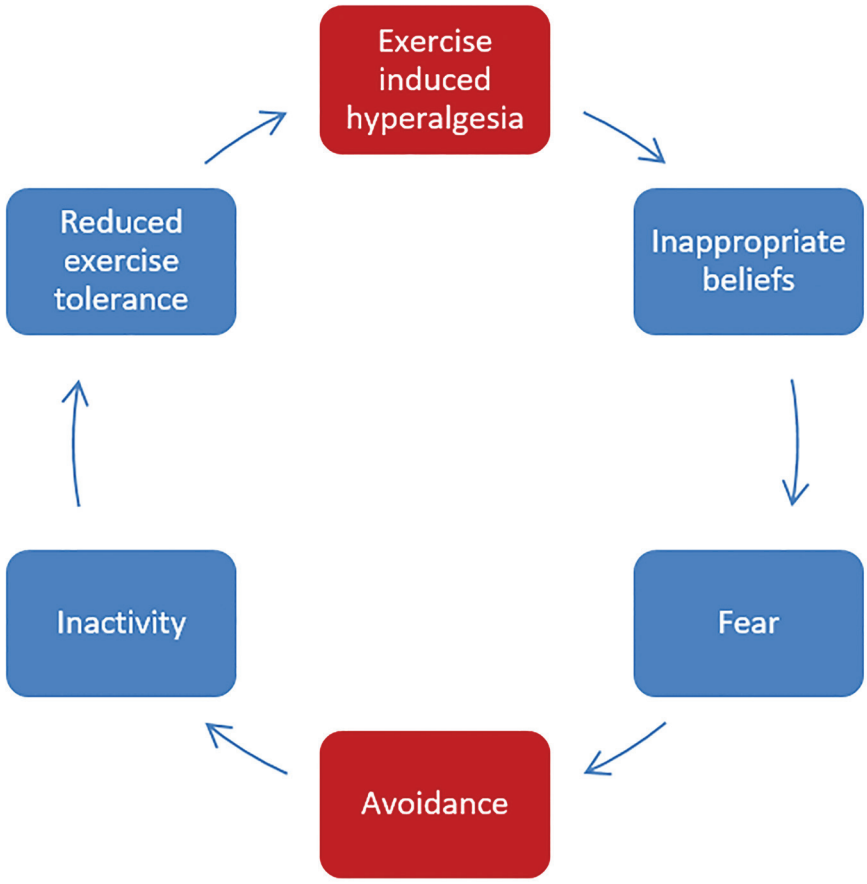

Fig. 1. Vicious circle of exercise-induced hyperalgesia and avoidance.

Taken togetherF, avoidance behavior, persistence behavior, or mixed behavior (avoiding certain activities or movements, while persisting in others) are all barriers to prescribing exercise for patients with chronic joint pain. Avoiding activities because of fear will undermine the success of graded activity programs, but the typical up-and-down pattern of activity in persisters also precludes any training effect.

Requirements

Despite the huge barriers patients may experience in initiating physical activity, it is important to note that many of these barriers can be influenced by physical activity itself. This means that many patients end up in a vicious circle of reduced physical activity and thus increased barriers to physical activity. While self-efficacy acts as a determinant of physical activity behavior, participation in physical activity can change one's self-efficacy for exercise.[15] The same goes for depressed feelings, deconditioning, and avoidance.

Thus, it seems important to prepare the patient to take the first steps toward exercise, taken into account the specific profile of the patient. If you can get patients moving, typically they will eventually feel better. The key to an effective exercise prescription for chronic pain is identifying and promoting strategies that facilitate actual participation in exercise.[1] The following steps may help in initiating exercise in patients with chronic joint pain.

Assessing the Patient

First, a comprehensive biopsychosocial assessment is necessary, to recognize the dominant pain mechanisms, identify possible biomechanical deficits, understand patients' beliefs and perceptions, evaluate their psychological readiness, unravel possible barriers to success, and clarify environmental factors.

Although it seems that exercise therapy programs are beneficial for all patients with chronic pain and that they could even be a tool to reactivate or strengthen endogenous pain-inhibitory mechanisms, the dominant mechanism responsible for the chronic pain seems pivotal for the patient's response to acute exercise. In patients with more localized chronic pain complaints (without dominant central sensitization), endogenous pain inhibition is active during exercise, resulting in generalized increased pain thresholds during and after exercise.[4,5,9,13] When exercise involves the afflicted body parts, pressure pain thresholds can decrease locally, indicating that peripheral processes underlie local exercise-induced hyperalgesia[5,13] Conversely, in patients with a dominant picture of central sensitization, the type of exercise or the body parts involved do not seem to matter, as these patients show a generalized exercise-induced hyperalgesic response to a single bout of exercise.[4,6] Thus, depending on the dominant pain mechanism, the therapist can adapt training to be general or more specific (see "Tailoring exercise programs"). Lacking a gold standard for assessing central sensitization pain in clinical practice, clinicians can rely on the pain characteristics (localization, pain intensity, and related disability) and other possible signs of hypersensitivity (assessed according to the Central Sensitization Inventory[19]).[20]

Additionally, patient evaluation should identify possible biomechanical deficits, which also allows for individualized tailoring of activities later on, specifically targeting strength, flexibility, or aerobic fitness.

Fear-avoidance behavior, physical inactivity, disuse of painful body parts, and consequent disability often result from negative thoughts about one's

current or previous pain experiences. Clinicians should ask patients about such thoughts and about their beliefs, emotions, and behavior. What is their understanding of their pain? Do they believe there is a specific source of nociception in their body? In that case, it is unlikely that they will persevere with an exercise program.[2]

Before deciding on an exercise prescription, clinicians should thoroughly understand the patient's activities, including daily activities and sports, to assess whether or not, when, and why the patient is avoiding or persisting in activities. An activity diary may aid in this process.

Any discrepancy between objective measurement and subjective perception of a patient's physical activities is an important topic for consideration. It seems that many patients with chronic pain are not very good at estimating or reporting their physical activity level. This problem might (partly) be attributed to self-discrepancies, depressed feelings, cognitive problems, or malingering. Both under- and overestimation are reported in the literature.[21–23] For instance, measurement of objectively measured physical activity levels indicated that there were no significant differences between an avoidant and persistent group (based on self-report) with chronic low back pain.[23] Therefore, accurate knowledge of the actual physical activity pattern at baseline is necessary to steer treatment strategy correctly and to follow progress. These results could imply that the focus during rehabilitation can vary between increasing physical activities or exercise, reducing avoidance behavior toward certain important daily activities, or applying more cognitively directed therapy modalities.

Priming the Patient

Before patients can benefit from exercise, patients need to be "primed." The first step is providing pain neuroscience education, which has shown efficacy in changing patients beliefs' and facilitating exercise participation.[2] By explaining concepts of central pain processing and how it relates to physical activity, the relevance of beliefs and perceptions, the real meaning of pain that is chronic, and the effects of exercise, many inappropriate and pain-facilitating beliefs can be altered and patients' readiness and participation can be enhanced. It is important to give patients proper education about the expected effects of exercise, emphasizing that the occurrence of pain (or an increase in pain) is not the consequence of (further) damage. In fact, these exacerbations are only short-lasting and are most likely to occur at the beginning of the training period, but will become less severe from session to session during the intervention period,[12] as exercise therapy is a tool to retrain pain inhibition mechanisms.

If patients adopt the new insights and are ready for other therapy modalities, including exercise programs, it is important to continue the philosophy of pain education and to use consistent communication. For instance, rather than "selling" the exercises as a tool to correct biomechanical deficits, explain that exercise is a tool to retrain the brain and an analgesic intervention. Be careful with pain-contingent approaches, because they only strengthen biomedical beliefs, and pain is not a rational guide in cases of chronic pain.

Tailoring the Exercise Program: Patient-Centered Health Care

The message is clear: "Get your patient moving." Yet the question remains: "How?" Clearly there is no straightforward answer to this question, as shown by various meta-analyses in different chronic joint populations. Responses to training programs are also heterogeneous. Although the long-term response to exercise programs is beneficial for all chronic musculoskeletal pain conditions, overall effect sizes are sometimes small and standard deviations are large, indicating very diverse responses.[24,25] The variation in response is reflected in the number of responders and nonresponders. Lack of response may be due to the frequent lack of individually tailored exercise programs, based on a thorough prior biopsychosocial assessment.

When central sensitization is not dominating the picture and patients present with a more local chronic joint complaint, as is the case for many patients with chronic idiopathic neck pain or the majority of patients with knee or hip osteoarthritis, research points out to the benefits of more specific exercises.[12,26] Specific strength training is the most efficacious in reducing pain and increasing pain thresholds (both local and distal) in the longer term, with a lasting effect after cessation of training, compared to general fitness training, for example in patients with chronic neck pain.

Nevertheless, specific strength training acutely increases pain (up to 2 hours afterwards) and reduces pain thresholds, whereas general training does not.[12] Therefore, to counter the temporary local pain increase, it is probably advisable to vary the exercises and combine more specific strength training with general fitness or nonspecific training to activate endogenous pain inhibition, especially in the early stages of training. Even a temporary minor decrease in pain may be a motivating factor for persons with severe pain to overcome barriers to exercise.

In relation to these findings, these patients would benefit from an exercise program in which both nonspecific and specific exercises are combined, with greater emphasis on the nonspecific component in the beginning period,

and a gradual increase of the specific component, once central pain modulation gets underway (Fig. 2).

An important aim of exercise therapy is to train the brain, along with the musculoskeletal system. Evidence points to an amelioration of centrally mediated pain modulation. Indeed, local pressure pain thresholds and pain thresholds of a pain-free reference muscle will increase in response to both specific strength training and aerobic training, indicating a general effect of physical activity on pain sensitivity.[27,28] Researchers also found that a 2-minute specific training period gave the same pain reduction and the same increase in both local and distant pain thresholds, compared to a 12-minute specific training period. This finding emphasizes that a large part of the pain reduction is due to changes in central pain processing, since a 12-minute training period is more efficacious in enhancing muscle performance.[28]

When central sensitization is dominating the picture, initiating exercise therapy is more difficult. Training unaffected body parts is often unrealistic, and patients' adverse response to an exercise bout seems not to depend on the exercise format, but rather to reflect a generalized failure of endogenous pain inhibition.

Therapists face a risky balancing exercise in tailoring an exercise program for such patients. On the one hand, they should account for the dysfunctional response of patients with chronic pain and their aberrations in central pain modulation in response to acute exercise, but on the other hand they should try to distract patients from focusing on pain, which is an unreliable "alarm sign" in these patients. Therapists should not encourage hypervigilance for pain. Therefore, education is crucial to help patients interpret pain during exercise in the correct context, before they begin reactivation programs.

Besides tailoring the exercise program according to the pain mechanism, the clinician should take into account the behavior and perceptions of the patient. Activity persistence or avoidance often seem to be reflected in self-reports alone. In that case, the patient's misperception is the subject of attention, and the focus is on restoring a realistic perception of actual activity levels and on setting realistic and relevant goals. Nevertheless, when the clinician deems that avoidance or persistence are in fact occurring, the approach to activity management differs between persisters and avoiders.

For *persisters* it may be necessary to start by restructuring their activity pattern in order to stabilize the symptom pattern, given the negative association between fluctuations in activity and a patient's disability level.[29] Restructuring the activity pattern to avoid peaks of overactivity can be achieved by pacing strategies. While definitions of pacing are varied, it generally refers to a strategy to divide one's daily activities into smaller, more manageable portions. Such pacing allows individuals to participate in

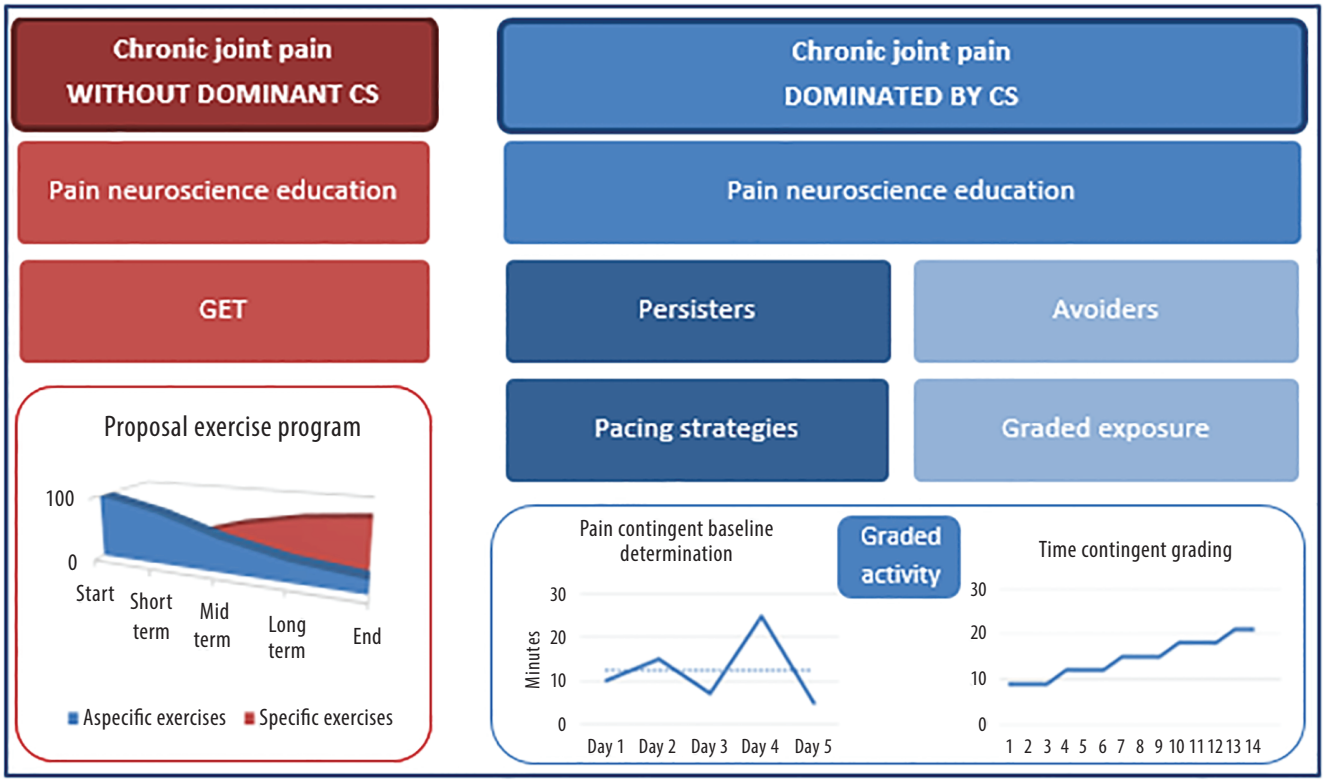

Fig. 2. Overview of the possible design of exercise or activity programs. CS, central sensitization; GET, graded exercise therapy.

activities without exacerbating their pain, which then allows planned and calculated increases in activity. This behavioral coping strategy is different from the natural use of activity pacing. Patients sometimes naturally use pacing (as a reactive strategy to alleviate pain), which is quite different from the way pacing is taught in pain management programs (as a preplanned strategy used in conjunction with a graduated activity program to increase one's activity level). Possibly, the way patients naturally pace their activity eventually leads to a functional decline if it is not used to gradually increase one's activity levels,[30] as the natural use of pacing is often more equal to a pain-contingent activity approach.

In *avoiders*, the goal is reactivation. Because fear can hamper this approach, graded exposure may offer a solution to increase daily life activities. Graded exposure encourages a confrontation response by exposing patients to specific situations of which they are fearful.[31] There is indeed moderate evidence that graded exposure effectively decreases catastrophizing in the short term.32 Also, for patients in whom even very gentle activity is painful, graded exposure can be a (first) step to more active therapy modalities. The aim is to reduce the threat associated with the task. This approach may involve breaking the movement down, using mirror box therapy, or performing imaginary movements (which are imagined to be pain-free), all to make the task less daunting.[33] These strategies activate motor mechanisms in a manner that is explicitly nonthreatening. A successful experience reinforces the cognition that physical activity can be safe, even though it might not be pain free.

After preparing patients in this way, therapists can move on to coaching them in graded activity or exercise programs. Regardless of the content being more activity or exercise oriented (depending on the patient's condition and needs), the first step entails the identification of an appropriate baseline and goal setting.[34] The specific types of exercises or activities are based on personal goals. Questionnaires can be used to determine these goals, which should focus not on pain reduction but on positive new behavior. The baseline level should be safe and achievable, so that the patient can start with a successful experience. Baseline setting can be performed in a pain-contingent way, meaning that a safe and conservative baseline is determined on the basis of prior pain-controlled trials. Afterwards, a safe and realistic rate of progression is negotiated with the patient. The rate of progression is based on a predetermined quota of activity per day, independent of the pain. Time-contingent approaches should replace pain-contingent approaches (which are not reliable) to enhance self-efficacy. In any case, the patient should experience success during exercise.[34] Subsequently, the grading phase includes grading of the activity bouts using a time-contingent approach. The type of activities and exercises should be discussed with the patient and implemented in a daily program containing activities as well as moments of rest or relaxation and necessary tasks such as work, household activities, or child care. This type of activity program is in line with our current understanding of chronic pain neuroscience.[2,33–35]

Facilitating Adherence

Finally, self-efficacy seems to be an important factor in exercise adherence. Therefore, it is necessary to consistently continue the principles of pain neuroscience education throughout the entire rehabilitation period and to have a therapist serve as a coach who is available to help with any doubts or questions.

A successful rehabilitation program must consider the patient's preferences and be consistent with his or her individual circumstances, fitness level, and prior experiences.[2] Shared decision making implies a consultative rather than a prescriptive process, and as such patients are in charge of their own rehabilitation program (content, goal setting, grading, etc.). Their preferences should shape the program, but various exercises or activities should be integrated.[26] Prior experiences of exercise-induced pain exacerbations are important barriers to self-efficacy. Therefore, a time-contingent approach is very important once a safe baseline is installed. The coach must tell patients not to do more when they feel good, or less when they feel bad, but to stick to the specific quota for that day. This approach allows patients to be successful and less fearful, which will increase self-efficacy.[2]

Evaluation

To assess the efficacy of interventions, we refer to the IMMPACT recommendations. There is a consensus that chronic pain clinical trials should assess outcomes representing six core domains: (1) pain, (2) physical functioning, (3) emotional functioning, (4) participant ratings of improvement and satisfaction with treatment, (5) symptoms and adverse events, and (6) participant disposition. Not all domains have to be improved for a therapy to be considered efficacious.

To determine the clinical importance and the recommended benchmarks, we must consider the changes that occur within individuals from the beginning of a clinical trial to its conclusion. For example, decreases in patients' pain intensity of >30% are considered "moderately important" improvements, whereas decreases of >50% are considered "substantial" improvements. Responders are defined

as those patients presenting at least a 30% improvement. However, because this multifactorial evaluation must consider the benefits and risks of the treatment and of other available treatments for the condition, it is dangerous to give specific cut-offs or guidelines to determine which difference is clinically meaningful.[36]

Conclusion

In conclusion, we would like to emphasize the importance of physical activity programs for patients with chronic joint pain. Although it is one of the primary modalities in the care of these patients, "prescribing exercise" requires a broader biopsychosocial framing, and many barriers must be overcome before a complete exercise program can be successful. A thorough assessment of the patient is necessary to be able to provide patient-centered health care, in which the activity or exercise program is individually tailored to the specific patient, taking into account his or her pain, beliefs, perceptions, and activity behavior, as presented in Fig. 2.

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