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The Role of Exercise and Types of Exercise in the Rehabilitation of Chronic Pain: Specific or Nonspecific Benefits

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Abstract Chronic pain is one of the most common complaints seen in general practitioners' offices, and it contributes to social, emotional, physical, and economical losses. The management of this problem poses challenges for health care providers when the current treatment of choice for chronic pain is pharmacological management, which may not be a sufficient and/or holistic approach to the management of chronic pain. Our goal is to increase awareness of the significance of physical activity, as well as examine additional cost-effective, integrated approaches to help manage the complex and debilitating effects of this condition. This article summarizes the types of exercise in the rehabilitation of chronic pain patients and provides practical recommendations for the clinician based on empirical and clinical experience. This safe, cost-free, nonpharmacologic way of managing pain has been found to reduce anxiety and depression, improve physical capacity, increase functioning and independence, and reduce morbidity and mortality.

Keywords Adjunctive therapy · Aerobic exercise · Stretching · Flexibility · Anaerobic exercise · Interdisciplinary pain programs · Yoga · Pilates · Tai Chi · Pain management · Chronic pain · Rehabilitation

Introduction

An estimated 86 million Americans are affected by some form of chronic pain, more individuals than diabetes, heart disease, and cancer combined [1, 2], making pain the primary complaint of approximately 40% of patients seeking help from general practitioners. The costs associated with treatment of chronic pain are staggering, with over \$100 billion in treatment-related costs and lost work productivity [3–5]. In addition to the financial strain, chronic pain can contribute to decreases in quality of life through physical, relational, social, and psychological losses. Frequently, pharmacologic management is the treatment of choice in managing chronic pain; however, it may not treat both the physical and psychological losses of chronic pain. A growing body of literature has demonstrated that opioids may fail to provide pain relief and can lead to decreased functioning in many chronic pain patients. Nonetheless, opioids continue to be amongst the most commonly prescribed medications, accounting for over 235 million prescriptions [6, 7]. With this information, it is important to increase awareness of the significance of physical activity as well as to examine additional, integrated approaches to help manage the complex and debilitating effects of this increasingly difficult condition [5, 8].

Although there are few known effective treatment options for patients with chronic pain, integrating complementary therapies into a conventional medical treatment plan can help manage chronic pain and reduce reliance on

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medications. For many years, the treatment of choice for chronic pain included recommendations of inactivity and resting; recently, however the opposite has shown to be effective. Regular exercise programs can prove beneficial to those with chronic pain. Aerobic exercise leads to endorphins production that can effectively block pain and can produce feelings of relaxation [9]. Additionally, when individuals rest due to pain or fear of pain, patients become “deconditioned.” When this happens, further problems develop, in turn, worsening the pain. Exercise is also linked to weight loss, which has implications for chronic pain prevention and management. In general, the less weight on one’s joints, the less mechanical force and pain one may feel [10]. Finally, regular exercise helps to strengthen core muscles. These muscles support bones and cartilage and keep the joints flexible, relieving stiffness and acting as a natural brace for large bone structures commonly fraught with pain [11–13].

Before exploring the reconditioning research, it is important to review applicable definitions. *Physical activity* is broadly defined as any bodily movement generated by skeletal muscles resulting in energy expenditure. The terms physical activity and exercise are used interchangeably and are often viewed in nonspecific terms that include activities varying in type, frequency, intensity, and mode [13]. *Exercise* is a biochemical, social, and physical activity that can be manifested in a variety of forms, with the purpose of training or developing the body to promote physical health, specifically: (1) aerobic endurance; (2) anaerobic endurance; and (3) flexibility, coordination, and relaxation [14]. *Aerobic exercise* consists of physical work contained for long periods of time with the training designed to increase the efficiency of the oxygen transport system, such as distance running, cardiovascular training, walking, or playing soccer [15]. Conversely, *anaerobic exercise* consists of high-intensity work sustained for a short period of time, with the training designed to increase muscular strength (e.g., weightlifting). Finally, the third type of exercise increases *flexibility, coordination, and relaxation* (e.g., stretching, ballet and yoga) [14, 15]. Exercise does not encompass passive therapies such as mobilization, massage, or manipulation. In an efficacious exercise program for the treatment of chronic pain, a wide variety of exercises might be prescribed.

Benefits of Aerobic Exercise

Various clinical studies have found that aerobic interventions for those with chronic pain are increasing [16, 17]. Meiworm et al. [17] investigated the effects of aerobic exercise on patients with fibromyalgia. In their study, 27 patients participated, with the study group receiving an

aerobic exercise schedule including training for 25 min, 3 days a week for 12 weeks. At the conclusion of the study, pain decreased and fitness and well-being increased. Aerobic endurance exercises also are commonly used in the treatment of chronic low back pain (CLBP), and have been shown to reduce the pain threshold [18–22]. In fact, Hoffman et al. [19] found that individuals experience a decrease in pain perception that can last up to 30 min after the individual has exercised at an intensity of more than 75% maximal oxygen uptake for 30 min. In this repeated measure design, individuals with CLBP were given a visual analog scale before, 2 min after, and 32 min after treadmill exercise intervention. Again, pain ratings significantly decreased after exercise at both 2- and 32-min intervals, indicating exercise-induced analgesia.

In a recent study by Sullivan et al. [23••], patients who participated in a chronic pain rehabilitation program were administered a 10-min pre-established treadmill exercise protocol to determine the effect of exercise on physical conditioning, pain, and mood. Measures of heart rate, mood, pain, and perceived exertion were obtained. Results demonstrated significant short- and long-term benefits of exercise. Patients showed a statistically significant reduction in exercise-induced cardiac acceleration from admission to 3 weeks. The brief exercise protocol also produced significant immediate antidepressant and anxiolytic effects, along with decreases in perceived exertion. To date, this is the only study known that examined the immediate mood-changing benefits after only 10 min of exercise.

In sum, aerobic exercise combats the deconditioning cycle and is therefore a key component to treating chronic pain [24].

Benefits of Anaerobic Exercise or Strengthening Exercises

Although the scientific evidence suggests only modest improvements, anaerobic exercise is an important component of a pain-management exercise program. The anaerobic exercise of choice in this section is core lumbar strengthening exercises.

In 2000, Hayden et al., in a Cochrane review investigating the effectiveness of exercise for low back pain [25], reviewed 39 randomized controlled trials (RCT) of all types of exercise for patients experiencing acute and CLBP. They examined the impacted of exercise on pain intensity, functional status, overall improvement, and return to work. They concluded that there was no scientific evidence to support the effectiveness of exercise for acute low back pain, although exercise may be beneficial for CLBP [25].

Hayden et al. [25, 26] updated the 2000 Cochrane review, and published their critique of 61 RCTs (6,390 patients)

evaluating exercise therapy. Many of the studies did not supply adequate clinical information. For example, 90% of the published studies described their population sufficiently, yet only 54% described their exercise intervention adequately. Most of the studies (43 of 61) focused on exercise treatment for CLBP. Hayden's group [25, 26] concluded that exercise is slightly effective at lowering pain levels and improving overall function, especially those exercise programs that were individually designed. The exercise programs usually included strengthening or trunk/spine stabilization exercises.

Hayden and colleagues [25, 26] also reviewed exercise therapy for subacute (6–12 weeks duration) and acute low back pain. They found moderate evidence that a graded-activity exercise program improves work absentee outcomes for patients with subacute low back pain. Yet, there is no evidence that exercise is any more effective than any other treatment, including no treatment, for acute low back pain.

Guidelines endorsed by the American Academy of Physical Medicine and Rehabilitation (AAPMR), the North American Spine Society (NASS), and the 2007 joint guidelines from the American Pain Society and the American College of Physicians [27] recommend therapeutic exercise and education, as well as medication management, for patients with subacute and chronic back pain. Goals of intervention for patients with subacute back pain, between 6 weeks and 3 months, are to prevent progressive deconditioning and the materialization of psychosocial barriers, such as work absenteeism and impaired function at home [28]. Clinical experience has shown that patients respond favorably to an individualized exercise program and feel that this type of program involves themselves in their own recovery.

Thus, goals of physical rehabilitation for patients with persistent back pain include developing a plan for pain control, developing a home exercise program, establishing independence and self care, and returning to regular or normal activities of daily living. Issues that conspire to prevent success with a rehabilitation program include fear of reinjury and the over-reliance of passive treatments such as bedrest, local application of heat and/or cold, ultrasound, magnets, massage, corsets, and collars.

Historically, back pain disorders were commonly treated with aggressive and specific progressive resistance exercises (PRE) in the early 20th century [31]. DeLorme and Watkins [31] introduced their theory of PRE in the 1940s. They were the first to objectively quantify muscle strength by controlling the intensity (repetition maximum), the number of sets and repetitions, and the frequency. DeLorme and Watkins were careful that the spine extensor muscles were isolated during the PRE program. They prevented hip extension during the exercises. They discovered a gradual lessening of back pain as spinal strength improved.

Today, there are two popular exercise treatment approaches: the McKenzie Method and lumbar spinal or core stabilization. Unfortunately, there is no agreement as to which anaerobic or strengthening exercise protocol is the most effective [32–34].

The McKenzie approach, developed by physical therapist Robin McKenzie, is one of the most frequently used types of physical therapy for back and neck disorders [35].

He suggested a classification-based treatment approach for patients with low back pain: Mechanical Diagnoses and Therapy, or the McKenzie Method. This classification is based on pain patterns noted during the evaluation. Centralization, moving pain from the leg or arm to the central back, is the most important and most studied pain pattern. McKenzie-trained therapists assess patients using a well-defined algorithm, which then leads to the spinal classification system. McKenzie [35] identified three mechanical syndromes: postural, dysfunction (shortened segments related to scar or fibrosis), and derangement (disruption of a motion segment). McKenzie exercises are not only extension exercises. The direction of the exercise is dictated by "directional preference," or when the back/neck pain moves centrally and lessens when certain movements are performed [33]. The McKenzie Method uses self-generated movement and positioning strategies for the control of acute and chronic spine pain [36]. A typical McKenzie-based exercise program in one study consisted of performing six specific exercises, five times per day; 5–10 repetitions of each exercise for an average of 15 days. The authors of that study found improved spine flexibility and less pain with their McKenzie therapeutic exercise protocol [37].

In another large trial of subacute and chronic back pain patients, 260 patients found that the McKenzie exercise approach, when compared with dynamic strengthening exercises, was slightly more successful at improving the patients' level of function at the 2-month follow-up, but the difference was not maintained at the longer follow-up evaluation [34].

Lumbar spinal stabilization exercises are also popular [34]. The goal of dynamic spinal stabilization exercises is to reeducate and strengthen the deep postural spinal muscles, such as the multifidi and transverse abdominis, thereby decreasing pain and centralizing symptoms. Theoretically, back injuries and back pain may be caused by the gradual degeneration of joints and other supporting spinal structures from repetitive microtrauma. Thus, if one strengthens and stabilizes the spinal muscles dynamically and statistically via stabilization exercises, one would note less back pain and improved spine function and strength [38].

Review of the available literature suggests that lumbar stabilization exercise is effective at improving pain and function in patients with chronic low back pain [39]. Standaert et al. [40] found only three eligible studies, two of high quality,

for their review of lumbar stabilization exercises for management of CLBP. Despite the popular prescription of exercise, there is limited research proving the efficacy of specific stabilization exercise and strengthening exercise.

Overall, therapeutic exercise is effective treatment for chronic low back pain and in the prevention of low back pain [41]. Most systematic reviews suggest more research is needed. Researchers are developing clinical prediction rules for spinal manipulation and stabilization exercise programs. Hopefully, these clinical prediction rules will lead to the improvement in the designed quality outcome studies investigating all forms of treatment options.

Benefits of Stretching and Flexibility

Stretching and flexibility exercises may be categorized into static or dynamic approaches. Static stretching consists of holding a body position in a manner that elongates muscles, with positions being held to tolerance and for a specific length of time [42•]. Dynamic stretching involves slow, deliberate movements, which induce muscular elongation and may also have a secondary benefit of strengthening engaged muscles [42•]. Exercise modalities such as yoga, Pilates, and Tai Chi incorporate stretching and flexibility in specific, defined manners, while also engaging the participant in a “mind–body” awareness of physical and psychological relaxation or tension. Such modalities use dynamic and static approaches to stretching and flexibility.

Yoga

In 1997, it was estimated that as many as 1.3 million Americans with back pain practice yoga, with the general practice of yoga continuing to increase nationally over the past decade to close to 13 million in 2007 [43•]. A number of studies have investigated the use of yoga as an adjunctive treatment for chronic pain. However, the scientific methodology of such studies often has been criticized due to lack of control groups or sufficient power to reach statistical significance [44].

In recent years, several promising RCTs studying yoga in CLBP have proven to employ more methodologically sound designs, while also demonstrating improvements in pain and disability. In a study by Williams et al. [45], 60 patients with CLBP were randomly assigned to either a 16-week educational control group or Iyengar yoga therapy group. Patients participating in the yoga group attended weekly 1.5-h sessions. Both groups received weekly newsletters and attended two 1-h educational sessions related to self-care of low back pain. Statistical analyses demonstrated significant decreases in pain, disability, and pain medication use in patients who participated in the yoga therapy, which were sustained at 3-month follow-up. While both groups

demonstrated overall improvements, the authors point to the significant difference in improvements between the yoga and control group as providing preliminary support that yoga therapy may provide greater benefits than an educational program for CLBP. However, the notable dropout rate in this study (28%) is a significant limitation and should be considered in light of the authors’ overall conclusions. Sherman and colleagues [46] reported similar findings in a group of 101 adults with CLBP who were randomly assigned to either 12-week Viniyoga, conventional exercise classes (including aerobic, strength, and flexibility training), or to self-guided education (self-care book). At 6, 12, and 26 weeks, patients in the yoga group demonstrated statistically significant improvements in function compared to the self-guided education group. While notable differences also were revealed in functional improvements between the yoga and exercise groups (with yoga participants reporting greater function), such findings did not approach statistical significance. Pain improved in all three groups, although maintenance of symptom reduction was only sustained in the yoga group. Tekur et al. [47] investigated the use of a brief, intensive residential yoga program in a group of 80 patients with CLBP. Patients were randomized to either a week-long intensive yoga therapy group or wait-list control group, consisting of combined physical exercise and education. Spinal mobility and pain-related functioning were measured post-treatment. Patients participating in the yoga group demonstrated greater and statistically significant improvements in both disability and spinal flexibility compared to the control group. Thus, findings from these studies suggest that yoga provides greater and potentially longer lasting improvements in patients with CLBP, than simply educational interventions. Such benefits in pain and functioning may even be obtained in brief, albeit intensive, yoga training. However, there is minimal evidence at this time that yoga provides benefits above and beyond that, which has been demonstrated through participation in conventional exercise treatment programs.

Future/Current Research

Recently, Sherman and colleagues [43•] provided a comprehensive proposal and study protocol for an RCT in which the authors aim to investigate if yoga therapy is superior to self-care and conventional exercise. Importantly, the authors’ research will expand upon previous research by exploring specific factors that may account for the therapeutic effects of yoga. In this study, 210 patients with CLBP will be randomly assigned to either yoga, conventional exercise (combined stretching, aerobic warm-up, and strength exercises), or self-care groups, with each patient participating in 12 weeks of each respective modality. Pain, function, and psychological variables will be assessed at 6,

12, and 26 weeks. Psychological variables measured in the study are notably more comprehensive than previous studies and include fear avoidance, self-efficacy, self-awareness, psychological distress, perceived stress, and positive states of mind. Also, saliva samples will be gathered upon conclusion of treatment (12 weeks) to assess for cortisol and dehydroepiandrosterone (DHEA). While results of this study are forthcoming, this trial provides promise for research that may elucidate factors by which yoga provides a therapeutic benefit in CLBP.

Pilates

While the literature on the effects of Pilates-based exercises for the rehabilitation of chronic pain is limited, the benefits of Pilates for CLBP are increasingly noted. It has been suggested that Pilates provides relief by increasing flexibility, joint mobility and strength [49]. To date, there have been two reviews of Pilates-based exercises for rehabilitation purposes, which reviewed a limited number of studies before 2006–2007. In a recent meta-analysis by Lim et al. [48], the authors aimed to provide a more comprehensive and methodologically sound approach. In their review, the authors included seven RCTs involving patients with CLBP in which Pilates-based exercises were compared with alternative interventional approaches, including other forms of exercise, massage, or minimal intervention/usual care. The authors found that Pilates-based exercises provide a significantly greater therapeutic benefit in terms of pain reduction than minimal intervention, but provide equally effective pain reduction as other forms of exercise. Additionally, Pilates-based exercises are equally effective as minimal intervention/usual care or other exercise in reducing pain-related disability. Limitations of this meta-analysis include a small number of studies included in the review and short follow-up periods to assess for sustained benefits of Pilates on CLBP.

Muscle Strengthening Versus Flexibility

While many studies have examined the impact of exercise programs with combined aerobic, strengthening, and flexibility exercises in chronic pain, a paucity of studies have looked at the effects of each exercise component independently. However, Jones et al. [49] initiated such efforts to determine the effects of the individual components of exercise programs in an RCT of 68 women who met the American College of Rheumatology criteria for a diagnosis of fibromyalgia. Patients participated in a 12-week exercise program and were assigned to either a muscle strengthening group or a flexibility training group. Both groups met for 60 min, twice per week in a group- and classroom-style format. Measures of muscle strength, flexibility, body fat,

pain, mood, quality of life and self-efficacy were obtained 2 weeks before the intervention and again 2 weeks post-intervention. Notably, the authors found no statistically significant differences between strengthening and stretching/flexibility groups in this study. However, within-group differences were detected and revealed that while both groups improved by participation in the exercise programs, patients who participated in the strengthening group demonstrated greater improvements than the flexibility group. The authors suggest that this study provides compelling support for the benefits of strengthening, as well as flexibility exercises in fibromyalgia, with muscle strengthening exercise producing a greater magnitude of improvement than flexibility training alone.

Tai Chi

In recent decades, Tai Chi has become increasingly popular in the general public as a means of managing chronic health conditions. Overall, research has suggested that individuals who participate in the practice of Tai Chi show improvements in pain, quality of life, and function. In fact, the Arthritis Foundation directly supports Tai Chi as a means of managing osteoarthritis. Despite the general consensus that Tai Chi improves health-related outcomes, the empirical literature has not provided convincing support in terms of the extent of its effectiveness. In the first review of Tai Chi in musculoskeletal pain, Hall et al. [50•] aimed to determine the effectiveness of Tai Chi in chronic musculoskeletal pain conditions. The authors identified seven RCTs for inclusion in their review, with a total of 321 participants. Six trials studied patients with arthritis, while the seventh studied patients with chronic tension headaches. Across the studies, various styles of Tai Chi were used, with the range of duration being between 6 and 15 weeks for 40–60 min. All trials included outcome measures for pain. The majority also included measures for disability and quality of life. Generally, the quality of the studies included was described to be poor, with most utilizing small sample sizes. Pooled estimates from the meta-analysis generally supported a small and short-term positive impact of Tai Chi on both pain and function. Due to marked variability among the quality-of-life measures used across the studies, a pooled estimate was not able to be calculated in this meta-analysis. Thus, the impact of Tai Chi on psychological variables, including quality of life, remains unclear.

Interdisciplinary Approaches to Pain Management

Interdisciplinary chronic pain rehabilitation programs (IPRPs) are designed to help patients with disabling chronic pain restore function and quality of life. They all include

some form of exercise and/or structured physical therapy program. Interdisciplinary care (as opposed to multidisciplinary) is a team approach in which all the members of the team, including the patient, work together toward common goals. Patients who participate in such programs are exposed to many different approaches for managing and relieving their pain. Thus, it is not possible to determine which aspect of the program is responsible for changes in pain, mood, and function reported by patients completing such programs. This being said, these programs have been shown to be more effective than non-interdisciplinary rehabilitation for both chronic and sub-acute low back pain [51, 52, 53••, 54, 55••, 56••]. Disciplines commonly involved in these programs include physical and occupational therapy, nursing, psychology, medicine, vocational rehabilitation, and chemical dependency counseling when needed. Some programs are intensive, 3–4 weeks long, and include day-long

schedules that include active physical therapy and reconditioning, occupational therapy with an emphasis on body mechanics, group and individual psychotherapy (often cognitive-behavioral therapy), and medication management.

Patients in need of intensive pain rehabilitation are frequently profoundly deconditioned when they enter the program, and this has occurred, often in large part, because of psychological factors that drive sedentary behavior. Several studies have looked at the effects of pain catastrophizing on pain perception and behavior [57–61]. Thibault et al. [60], in a study with 72 patients with musculoskeletal pain performing a lifting task, found that pain catastrophizing was associated with increased pain behaviors and overt signs of pain such as grimacing and such protective behaviors as decreased lifting, which in turn leads to a decreased ability to lift, secondary to deconditioning. In 192 patients with chronic pain, Shelby et al. [61] found that catastrophizing contributed to both pain and

Table 1 Summary and clinical recommendations

Therapy	Summary of empirical findings	Clinical recommendations
Aerobic exercise	<ul style="list-style-type: none"> • Long-term benefits include improved mood, decreased pain perception and improved cardiovascular fitness • Immediate decreases in anxiety and/or depression may be obtained after brief bouts of aerobic exercise 	<ul style="list-style-type: none"> • Set small, progressive goals of exercise duration and intensity to help increase self-efficacy as immediate mood-enhancing and pain-reducing benefits are experienced • Use of aerobic exercise may have particular importance in chronic pain patients with depression or anxiety
Anaerobic exercise	<ul style="list-style-type: none"> • Literature supports the use of core strengthening and stabilizing exercise in chronic and subacute low back pain, but not acute pain • Benefits include reduced work absenteeism, enhanced personal engagement in physical rehabilitation, and improved overall functioning • In patients with subacute pain, anaerobic exercise may prevent profound deconditioning, kinesiophobia, and the development of chronic pain syndromes • No current evidence of one particular strengthening method or technique as being the most effective • Individualized programs may offer the best rates of success 	<ul style="list-style-type: none"> • Utilize core strengthening and stabilization exercises in chronic and subacute low back pain • Use anaerobic exercises to reduce the likelihood of profound deconditioning and/or disability • Develop an individualized exercise program to involve patients in their own recovery and address the unique needs of each patient
Yoga/Pilates/Tai Chi	<ul style="list-style-type: none"> • Benefits include pain reduction, improved function, and enhanced spinal mobility • Benefits obtained are greater than those obtained through educational interventions and equal to those obtained through participation in conventional exercise programs • Evidence that exercises targeting stretching and flexibility show slightly less impact on pain reduction and function than anaerobic exercises 	<ul style="list-style-type: none"> • Recommended as a suitable form of exercise therapy for chronic pain patients who are interested in or receptive to alternative exercise therapies and who might benefit from engaging in a regular “practice” of techniques that emphasize the connection between the mind and the body • Future research is needed to explore impact on psychological variables
IPRP	<ul style="list-style-type: none"> • IPRPs offer a unique and intensive treatment intervention, emphasizing physical reconditioning, in addition to psychological contributors to increased disability and pain • Substantial empirical evidence for the efficacy of IPRPs in chronic pain 	<ul style="list-style-type: none"> • IPRPs may offer the best platform to offer exercise therapy for patients with severe, persistent, and disabling pain • Patients with persistent pain may reap greater benefits from exercise therapy while doing so in the context of an interdisciplinary program

IPRP interdisciplinary chronic pain rehabilitation program

disability. Failure to address these issues in treatment of chronic back pain often leads to continued disability. Pain tolerance is reduced by thoughts emphasizing the averseness of the situation, the inadequacy of the person to bear it, or the physical harm that could occur. Such beliefs as “I will have a life again only after I am cured,” “I can’t go out to dinner if I am in pain,” and “I shouldn’t exercise if it hurts” have obvious impacts upon adaptation.

Many patients with chronic pain develop a fear of movement, so-called kinesiophobia. Having become deconditioned due to rest following the onset of their pain, they hurt more whenever they attempt activities. This in turn leads to even more rest. Breaking this cycle is critical for rehabilitation to take place. Many studies have addressed kinesiophobia [62–66]. Patients who rate high on scales of kinesiophobia report more pain and disability and engage in more self-protective behaviors [65].

Education may be one of the most critical of the “therapies” provided in IPRPs. It is often crucial because a patient’s behavior and their families’ reaction to their disease may be based on faulty information or misconceptions. Education can clarify the problem and indicate the best response. For example, it can be useful to interpret chronic pain as “real,” but a “false alarm” that needn’t dictate activity.

There are no studies looking at different types of exercise or their efficacy within the context of an IPRP. As discussed previously, a study by Sullivan et al. [23••] did attempt to examine the role of physical reconditioning within a pain rehabilitation program on pain, mood, function, and perceived exertion. A conditioning effect in addition to immediate antidepressant and anxiolytic effects were demonstrated. Longer-term antidepressant and anxiolytic effects that occurred over the 3-week program were likely a result of multiple pharmacological and nonpharmacological factors. Brief exercise did not have an acute analgesic effect. However, the change from admission to 3 weeks proved statistically and clinically significant. This data suggests that exercise in the context of an IPRP may provide longer-term pain relief; however, again, multiple treatment factors make it impossible to conclusively attribute the pain reduction to exercises/reconditioning. The lack of immediate pain relief may demonstrate why pain patients often become deconditioned and discontinue their exercise programs.

It has been noted that when treating chronic pain syndrome disorders, treatment in an IPRP is considered the premier treatment due to patients’ high psychological comorbidities. Dufour et al. [29] found a slightly more favorable difference in regards to improvement in pain and disability between an IPRP and an intense individual physical therapy–assisted exercise program. Dufour et al. [29] studied a group of 286 patients with CLBP in a stratified,

randomized, single-blinded trial. Both groups demonstrated improvements, but the IPRP group demonstrated more favorable response in global assessment of pain management. Both groups had similar findings regarding pain, disability, and return to work. The authors note that their findings are similar to Bendix et al. [30]

Conclusions

There is a dearth of well-designed studies that clearly demonstrate the efficacy of a specific exercise program over another in the treatment of chronic pain. This review clearly points to methodologically questionable and sometimes contradictory empirical evidence (please see Table 1 for a summary of the common findings from the available literature and brief recommendations based on the empirical findings and clinical experience). However, the consensus in the field continues to be that there is at least a modest benefit of exercise, and leading organizations in the field continue to recommend that it be included as a component of treatment. In other words, there is agreement that exercise “helps” in the treatment of chronic pain, but it is still not clear exactly which factors or particular types of exercises may be attributed to such improvements. At best, the literature suggests that the benefits of exercise are non-specific. Undeniably, further outcome studies are needed to clarify the specific benefits of each of the exercise modalities reviewed in this paper.

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