DOI 10.1002/msc.1191

WILEY

CLINICAL UPDATE

Exercise for chronic musculoskeletal pain: A biopsychosocial approach

John Booth[1] | G. Lorimer Moseley[2] | Marcus Schiltenwolf[3] | Aidan Cashin[1] | Michael Davies[4] | Markus Hübscher[5,6]

[1] School of Medical Sciences, University of New South Wales, Sydney, Australia
[2] Sansom Institute for Health Research, University of South Australia, Adelaide, Australia
[3] Department of Orthopedics, Trauma Surgery and Paraplegiology, Heidelberg University Hospital, Germany
[4] Figtree Hospital, Figtree, Wollongong, Australia
[5] Neuroscience Research Australia, Sydney, Australia
[6] Prince of Wales Clinical School, University of New South Wales, Sydney, Australia

Correspondence
Dr John Booth, Department of Exercise Physiology, School of Medical Sciences, University of New South Wales, Sydney, NSW 2052, Australia.
Email: john.booth@unsw.edu.au

Abstract

Chronic musculoskeletal pain (CMP) refers to ongoing pain felt in the bones, joints and tissues of the body that persists longer than 3 months. For these conditions, it is widely accepted that secondary pathologies or the consequences of persistent pain, including fear of movement, pain catastrophizing, anxiety and nervous system sensitization appear to be the main contributors to pain and disability. While exercise is a primary treatment modality for CMP, the intent is often to improve physical function with less attention to secondary pathologies. Exercise interventions for CMP which address secondary pathologies align with contemporary pain rehabilitation practices and have greater potential to improve patient outcomes above exercise alone. Biopsychosocial treatment which acknowledges and addresses the biological, psychological and social contributions to pain and disability is currently seen as the most efficacious approach to chronic pain. This clinical update discusses key aspects of a biopsychosocial approach concerning exercise prescription for CMP and considers both patient needs and clinician competencies. There is consensus for individualized, supervised exercise based on patient presentation, goals and preference that is perceived as safe and non-threatening to avoid fostering unhelpful associations between physical activity and pain. The weight of evidence supporting exercise for CMP has been provided by aerobic and resistance exercise studies, although there is considerable uncertainty on how to best apply the findings to exercise prescription. In this clinical update, we also provide evidence-based guidance on exercise prescription for CMP through a synthesis of published work within the field of exercise and CMP rehabilitation.

KEYWORDS

biopsychosocial, chronic pain, exercise, musculoskeletal pain

1 | INTRODUCTION

The International Association for the Study of Pain (IASP) defines pain as 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage' (Merskey, 1979). Chronic musculoskeletal pain (CMP) refers to ongoing pain felt in the bones, joints and tissues of the body that persists longer than 3 months. CMP is the major cause for pain and disability in western society affecting up to 20% of adults (Woolf, Erwin, & March, 2012) and is predicted to increase by >50% by 2050 (Access Economics Pty Limited, 2007). CMP includes a diverse range of diagnoses, some of which imply a driving tissue pathology or structure (osteoarthritis, discogenic back pain) and some of unknown pathology ((spinal pain, fibromyalgia, chronic widespread pain); Woolf & Akesson, 2001). Independent of the primary pathology, the secondary pathology or consequences of persistent pain including fear of movement, pain catastrophizing, anxiety and nervous system sensitization appear to be the main contributors to pain and disability in these conditions (Gatchel, Peng, Peters, Fuchs, & Turk, 2007; Siddall & Cousins, 2004).

Traditionally pain has been viewed as a symptom and warning signal of an underlying disease process. This conceptualization has led to the belief that chronic pain treatments which address the primary pathology underlying the disease process ameliorate pain (Siddall & Cousins, 2004). However, for many chronic pain conditions it is often not possible to identify the underlying pathology or, more commonly, there is no treatment that can reverse the primary pathology. Modern conceptualizations of pain consider pain a protector rather than a marker of tissue state (Moseley & Butler, 2015a; Moseley & Vlaeyen, 2015) – a perceptual inference that reflects a 'best guess' that tissue is in danger and requires concerted protective action. As pain persists, the danger transmission system – nociceptive pathways – and the mechanisms that subserve pain itself become more sensitive (Moseley & Butler, 2015a). The relationship between pain and the true need to protect body tissue becomes more tenuous and the contribution to pain from biopsychosocial factors or secondary pathology can increase. Contemporary exercise interventions for CMP that address the secondary pathology of persistent pain have great potential to improve patient outcomes.

Biopsychosocial treatment that acknowledges and aims to address the physical, psychological and social factors underpinning pain and disability is currently accepted as the most effective approach to chronic pain (Gatchel et al., 2007; Meeus et al., 2016) and superior to stand-alone physical therapy such as exercise or physiotherapy (Kamper et al., 2014). The intention of this clinical update is to provide evidence-based guidance on exercise prescription using a biopsychosocial treatment approach and exercise recommendations valid across important CMP conditions that share common secondary pathology and mechanisms. Pain conditions associated with significant trauma or surgery or less prevalent conditions such as phantom limb pain and chronic regional pain syndrome are not considered.

2 | EVIDENCE FOR EXERCISE IN THE TREATMENT OF CMP

It is widely accepted that increased physical activity levels benefit individuals with CMP (Jordan, Holden, Mason, & Foster, 2010; Meeus et al., 2016; O'Connor et al., 2015). Exercise as a therapeutic modality to improve pain and disability has been widely investigated using randomized controlled trials (RCTs). Systematic reviews of RCTs have demonstrated that aerobic and resistance exercise were more effective than no intervention for improving physical function and pain in fibromyalgia (Bidonde et al., 2014; Busch et al., 2013) and knee osteoarthritis (Bennell & Hinman, 2011; Fransen et al., 2015). In patients with non-specific chronic low back pain (CLBP), the data support significantly reduced pain and disability, when compared to minimal care, no treatment or other conservative therapies (e.g. manual therapy, non-steroidal anti-inflammatory drugs; Hayden, van Tulder, & Tomlinson, 2005; van Middelkoop et al., 2011). For many chronic conditions, it is unclear if aerobic exercise, resistance exercise or what combination of these modalities might be superior. Aerobic exercise was more efficacious than resistance exercise for reducing pain in fibromyalgia (Busch, Barber, Overend, Peloso, & Schachter, 2007), but strengthening and/or stretching exercise was superior to aerobic exercise for non-specific CLBP (Hayden et al., 2005) and neck pain (O'Riordan, Clifford, Van De Ven, & Nelson, 2014). It appears that exercise can produce better pain and disability outcomes when combined with pain education (Moseley, 2002; Pires, Cruz, & Caeiro, 2015). While the majority of studies have utilized modalities including weights, floor exercise, walking, cycling and aquatic exercise, research into non-traditional movement modalities including pilates (Yamato et al., 2015), yoga and Tai Chi (Lee, Crawford,, & Schoomaker, 2014) is also increasing.

Several mechanisms might explain the beneficial effects of exercise on pain and disability in CMP. It is widely believed that exercise exerts its effects on pain and disability via improvements in physical function or performance (e.g. range of motion, strength, muscular endurance; Steiger, Wirth, de Bruin, & Mannion, 2012). However, the empirical evidence underpinning this belief is lacking and indeed there are contrasting results. In CLBP, improvements in pain and disability during an exercise programme were unrelated to changes in physical function (e.g. range of motion, strength, muscular endurance; Steiger et al., 2012). It follows then that other exercise-induced changes in secondary pathologies, improved psychological status and cognitions (e.g. reduction in fear, anxiety and catastrophization, increased pain self-efficacy), exercise-induced analgesia, and functional and structural adaptions in the brain (Moseley, Gallace, & Spence, 2012a; Wallwork, Butler, Wilson, & Moseley, 2015; Wand et al., 2011) may influence pain and disability more than physical function. This might also explain why research to date has not shown any specific exercise to be superior – it may be that psychological and/or neurophysiological factors that are common to all exercise approaches have the greatest mediating effects on pain and disability. If changes in pain and disability can occur without changes in strength, endurance or flexibility, then specific types and dosages that have been recommended to improve these parameters in healthy people (Garber et al., 2011) seem to be less relevant in CMP.

In summary, for CMP there is consistent evidence that exercise has clinically relevant effects on pain and function compared to no intervention, minimal care or other conservative therapies.

3 | APPLYING A BIOPSYCHOSOCIAL APPROACH TO EXERCISE TREATMENT

Patients with CMP can have remarkably similar pathology but dissimilar clinical presentations encompassing different thoughts, beliefs, behaviours and expectations which require different exercise treatment approaches. Tailoring exercise to individual patients has been recommended for CMP (Bennell & Hinman, 2011; Meeus et al., 2016; O'Riordan et al., 2014), which requires an initial assessment to understand the biological, psychological and social factors contributing to pain and disability.

3.1 | Initial assessment

While comprehensive biopsychosocial assessment is beyond the scope of this position paper and detailed elsewhere (Turk & Melzack, 2011), several aspects most relevant to exercise prescription are discussed. The initial assessment provides an opportunity to lay the foundation for a positive clinician–patient therapeutic alliance, which refers to a sense of collaboration, understanding and support between the clinician and the patient and is a key factor in determining rehabilitation outcomes (Ferreira et al., 2013; Lion, Mangione-Smith, & Britto, 2014). Patient-centred communication engages the patient and strengthens the therapeutic alliance (Ferreira et al., 2013; Lion et al.,

2014) and should commence in the initial assessment and be ongoing throughout treatment. All initial assessments require a comprehensive pain assessment because aspects of the pain itself, including intensity, location, and aggravating and relieving factors (e.g. posture, movements) will influence exercise prescription. Understanding the patient's thoughts, beliefs and behaviours concerning physical activity and pain assists clinicians in implementing combined patient-tailored exercise and targeted education (for review see Moseley & Butler, 2015a; for the key text and patient-targeted workbook for 'explaining pain' see Butler & Moseley, 2013 and Moseley & Butler, 2015b).

Yellow flags traditionally refer to psychological distress in patients with low back pain and suggest an increased risk of progression to long-term distress, disability and pain. In principle these risk factors, including fear avoidance behaviour, catastrophization and low mood, can be applied more broadly to CMP and are critical treatment targets for exercise prescription. Supplementing the patient interview with screening questionnaires (e.g. distress and risk assessment method questionnaire (DRAM), pain self-efficacy questionnaire, fear avoidance questionnaire; see Yeomans, 2000) allows some quantification of the patient's beliefs, thoughts and behaviours and informs treatment. For a fear avoidant, inactive patient with low pain self-efficacy, higher levels of supervision and graded exposure exercise to fearful activities is preferred above a self-managed aerobic and resistance exercise programme prescribed for an active patient not displaying fear avoidance behaviour or low pain self-efficacy. As yellow flags become more prevalent and/or other significant factors impact on rehabilitation (e.g. substance misuse, diagnosed psychopathology), exercise invention alone is unlikely to be beneficial and requires a move towards multi or inter/disciplinary treatment. For example, the DRAM comprises two short questionnaires, the Modified Zung Depression Index (modified Zung) and Modified Somatic Perceptions Questionnaire (MSPQ), validated in patients with chronic musculoskeletal pain (Main, Woods, Hollis, Spanswick, & Waddell, 1999) which take about 5–10 min to complete. The DRAM does not require specialist training to administer or interpret and uses a scoring system that permits patients to be classified as normal (modified Zung <17), at risk (modified Zung 17–33 and MSPQ <12), distressed depressive (modified Zung >33) or distressed somatic (modified Zung 17–33 and MSPQ >12) (Main et al., 1999; Yeomans, 2000). The DRAM provides the clinician with a more objective method than clinical impression for deciding if a patient would benefit from a multi- or inter-disciplinary treatment approach. A patient classified 'at risk' according to the DRAM should respond to an exercise intervention implemented solely by a clinician competent with biopsychosocial treatment. In contrast, for a patient classified as 'distressed' according to the DRAM, combining exercise and a psychological assessment/intervention provided by a Clinical Psychologist is recommended above exercise alone.

Patients usually expect a thorough physical assessment and although specific to each patient's presentation, several variables should be explored in all assessments due to their influence on exercise prescription. A thorough assessment can also serve as a compelling mechanism to provide reassurance that the tissues are structurally sound – such reassurance has established beneficial effects (Traeger et al., 2015). Extra variables that should be considered include understanding the impact that pain and injury is having on the patient's function, daily activity and movement. This information is garnered through the patient interview, self-report questionnaires of function and disability (e.g. Roland Morris disability questionnaire (Roland & Morris, 1983), neck pain and disability scale (Wheeler, Goolkasian, Baird, & Darden, 1999)) and the physical tests undertaken. The rationale for the tests selected is to provide information on activity, functional tolerances and movement from which the commencing exercise baseline is formulated. The patient's pain behaviour, confidence with movement and activity, and their movement quality should also be noted during the physical assessment.

3.2 | Commencing treatment and explaining pain

Several practices known to improve treatment outcomes can be implemented in the first supervised exercise session. It is imperative that clinicians understand contemporary pain biology concepts so they can engage in meaningful and positive pain dialogue and 'explain pain' to patients (Butler & Moseley, 2013; Moseley & Butler, 2015a). Explaining pain refers to a range of educational techniques that aim to change how the patient makes sense of their pain (Moseley & Butler, 2015a; see also Moseley, Butler, Beams, & Giles, 2012b for the integration of explaining pain with a graded activity-based rehabilitation approach). The targeted conceptual change is from 'pain as a sign of structural damage or pathology' to 'pain as a protective mechanism modulated by all credible evidence of tissue damage and safety' (Moseley & Butler, 2015a). Explaining pain should commence immediately, remain ongoing and be reviewed throughout rehabilitation. Associating exercise and movement with pain and injury can heighten anxiety and increase pain. A guiding principle is that all exercise and activity be perceived as safe and meaningful by the patient (Lotze & Moseley, 2015). It is imperative that patients understand and believe it is safe to exercise with discomfort that: plateaus and does not continue to rise significantly; they can cope with and feel is manageable; and gradually decreases after they have finished exercise. Exercises can be performed as tolerated by the patient and stopped temporarily/modified with intolerance. Exercise prescription should be time contingent as opposed to pain contingent (Meeus et al., 2016), as it is not possible to dose exercise proportional to pain threshold. Assessment of pain intensity using a numerical rating scale or visual analogue scale is recommended throughout treatment to monitor progress from baseline. It is not necessary to assess pain intensity during every exercise session as this does not provide any additional benefit beyond a tolerable/not tolerable dichotomy. Pain-intensity ratings do not accurately reflect tissue damage or nociception in patients with chronic pain. Over time, pain intensity ratings are less influenced by nociception and more by emotional and psychosocial factors (Ballantyne & Sullivan, 2015). Frequent attention to the patient's pain intensity as a marker of potential tissue damage or tissue/exercise safety bears potential risk of increasing the patient's vigilance to pain, thereby facilitating unhelpful cognitions such as fear avoidance behaviour or pain catastrophizing. Frequent reassurance is required throughout treatment that despite persisting symptoms, it is safe to gradually become active. Principles of graded exposure are critical and should be implemented with a sound understanding of biological adaptations that are likely to be present in people with CMP.

3.3 | Treatment expectation and goal setting

Evidence suggests that pre-treatment expectations significantly influence treatment outcomes including pain and disability (Cormier, Lavigne, Choinière, & Rainville, 2016). If a patient's primary treatment expectation is pain abolition, failure to achieve this can increase frustration and anxiety and contribute to pain and disability (Colloca & Benedetti, 2007). This can be avoided by fostering treatment expectations around improving function, quality of life and reducing the impact of pain on the patient's life. This is not to say that the patient should not expect pain relief with exercise. A better approach is for pain relief to become a secondary goal supported by suggestions such as 'when people with chronic pain slowly pace up and become more active pain often reduces'. Goal setting should also be completed before commencing exercise and involve a collaborative approach with the clinician assisting the patient to identify meaningful goals not only related to exercise, physical activity and function but other biopsychosocial aspects (Gardner et al., 2015). Patient-centred goal setting promotes informed, individualized exercise interventions that are more meaningful and engaging to the patient. Clinicians should emphasize that exercising in itself is not the final treatment goal but regular exercise can help patients to enhance life quality through improvements in physical function and performance of activities of daily living. Critically, the patient should be reminded that the biological adaptations that occur as pain persists are difficult to reverse and will take time – they should be embarking on a journey of recovery and mastery of their situation, not a quick fix solution.

3.4 | Baseline activity and pacing up

As previously mentioned, it has been well established that cognitions such as fear, anxiety and pain catastrophization are strongly correlated with pain and disability (Meeus, Nijs, Van Oosterwijck, Van Alsenoy, & Truijen, 2010; Moseley, 2004; Vlaeyen, Kole-Snijders, Boeren, & van Eek, 1995). It is imperative that before commencing exercise, clinicians have identified the altered cognitions contributing to each patient's pain and disability. This permits individualized treatment combining exercise and education which addresses maladaptive thoughts and beliefs with the intention of decreasing pain and disability. An objective of the first supervised exercise session is to establish a baseline of activity that can be completed without causing a significant increase in symptoms. Unadventurous exercise prescription in the first session will be less likely to cause a marked increase in pain during and after exercise, as factors including altered cognitions and disuse through inactivity can result in a seemingly innocuous exercise session evoking a marked increase in pain. Activity pacing is a widely accepted pain management strategy and refers to dividing the patient's daily activities/exercise into manageable portions that do not exacerbate their symptoms (Andrews, Strong, & Meredith, 2012). Effective pacing, i.e. finding the appropriate amount and intensity of physical activity, promotes confidence and reassurance that it is safe to engage in activity and provides the foundation for progressive overload or pacing up throughout treatment. Clinicians should endeavour to avoid pacing up (increasing physical activity/exercise) too quickly and exacerbating the patient's symptoms. Significantly increasing the patient's pain during and following the first exercise session has the potential to: further erode confidence with movement and exercise; strengthen the relationship between movement and pain; and decrease patient motivation to engage in exercise treatment. In instances where the therapist is unsure about exercise prescription, patients should be allowed to self-select exercise dosage (Jones, Adams, Winters-Stone, & Burckhardt, 2006). Helping patients understand pain and the factors that can modulate pain reduces the likelihood and intensity of flare-ups. Having ready-made responses to unexpected flare-ups should also reduce their intensity, duration and impact. For example, patients can be reminded that a flare-up reflects a protective strategy, not a sign of damage, and that one can repeat the previous dose (which they know was safe) and halve the increment of progression. This simple rule can have profoundly reassuring effects (Traeger et al., 2015). Furthermore, it is important to frequently provide positive reinforcement for the efforts and achievements of patients. This is important for the clinician–patient relationship and patients are more likely to trust a clinician who is genuinely supportive and engaged.

3.5 | Exercise type

There is little evidence supporting one particular type of exercise over another for CMP (Bennell & Hinman, 2011; Fransen et al., 2015; Jones et al., 2006). Exercise modalities that patients enjoy and associate with achieving their goals improve treatment adherence (Jordan et al., 2010). Other factors influencing modality choice include the patient's level of function, aggravating and relieving postures and movements, and the ability to self-manage the exercise. It is important that clinicians demonstrate exercise accompanied by explanation of what muscles it engages and how the exercise can be helpful, observe and monitor exercise practice, provide feedback and correct poor technique (Slade, Patel, Underwood, & Keating, 2014). As stated earlier, aerobic and/or resistance exercise can be beneficial for CMP (Bennell & Hinman, 2011; Bidonde et al., 2014; Busch et al., 2013; Fransen et al., 2015) and should thus be considered for exercise prescription.

3.6 | Aerobic exercise

Aerobic exercise performed between 20 and 60 min, ≥2 days/week for 6 weeks or longer can be sufficient to positively impact on symptoms and function (Busch et al., 2011; O'Connor et al., 2015). The benefits of aerobic training also include improved psychological well-being and better cognitive and metabolic function, which holds promise for CMP patients who often have co-morbidities. Aerobic exercise has also been shown to decrease pain perception and pain sensitivity in healthy individuals and CMP cohorts (Naugle, Fillingim, & Riley, 2012). Performed at an intensity to improve cardiovascular fitness, aerobic training might also augment pain tolerance (Soriano-Maldonado, Ortega, & Munguía-Izquierdo, 2015). Explaining to patients that aerobic activity such as walking, swimming and cycling has the potential to 'turn down the pain volume or dampen the pain response' can be reassuring and motivating to patients. Given the potential benefits of aerobic exercise to pain, function, health and wellbeing, an aerobic component will be an integral component of most exercise programmes for CMP.

3.7 | Resistance exercise

In contrast to aerobic exercise, resistance training generally involves a smaller muscle mass with increased local tissue and joint loading. For some patients, this can be an unfamiliar and worrisome sensation with the potential to evoke a protective pain response. The likelihood of this occurring can be reduced through adapted exercise prescription at the commencement of treatment, with the purpose of familiarizing the patient to the exercise and providing reassurance that it is safe to perform. Exercise using weights has been widely investigated and is a commonly prescribed resistance exercise that is easily quantified and progressively upgraded in clinic and home exercise programmes. Resistance training that engages non-painful body parts can have a positive global impact on pain (Burrows, Booth, Sturnieks, & Barry, 2014; Vaegter, Handberg, & Graven-Nielsen, 2014) offering alternative exercise strategies for patients experiencing flare-ups.

3.8 | Land versus aquatic exercise

Pain changes movement, and patients with CMP often present with abnormal movement patterns and tissue loading (Sterling, Jull, & Wright, 2001). A primary objective of exercise treatment is restoring movement and normalizing tissue loading, which might also be more responsive to land as opposed to aquatic exercise. Positive outcomes for CMP have been demonstrated with supervised land-based exercise programmes that either simulate or duplicate work and/or functional tasks (Schonstein, Kenny, Keating, & Koes, 2003). While resistance aquatic exercise can also improve pain and function in CMP conditions (Barker et al., 2014), muscle function may be more responsive to land-based exercise (Bidonde et al., 2014). Exercise specificity also dictates that a patient's tolerance for their normal daily activities and movements might be more amenable to land rather than aquatic exercise. While clinicians will mostly prescribe land-based exercise for CMP, aquatic exercise might be preferred for individuals with very poor functional tolerances and/or heightened levels of pain and distress (Busch et al., 2011). In this instance, the treatment goals can include a gradual transition to land-based exercise as function and pain improves. Ultimately the choice of exercise modality will be strongly influenced by the patient's preference.

3.9 | Level of supervision

Exercise programmes that are individualized and supervised have been recommended for CMP (Jones et al., 2006; Jordan et al., 2010; Meeus et al., 2016). However, the optimal type and level of supervision is unclear as one-on-one supervision, group supervision and a home exercise programme with review have all been shown to improve pain and function (Jordan et al., 2010). Supervised exercise promotes treatment adherence and supplementing supervised sessions with home exercise, educational worksheets and materials can further improve adherence (Jordan et al., 2010). Patients should be encouraged to keep daily/weekly recordings of their physical/exercise activities. Ongoing self-monitoring can be helpful to identify barriers and facilitators to exercise participation, motivate positive exercise behaviour and increase participation (Moseley, 2006). Monitoring can be performed with activity diaries/log books and instrumented activity trackers. There is no minimum number of supervised exercise sessions before progressing to self-managed home exercise. As for all facets of treatment, the level of supervision chosen by the clinician will depend on patient presentation, preferences and goals. For traits such as low pain or low exercise self-efficacy, fear avoidant behaviour, heightened anxiety and poor functional tolerances, higher levels of supervision should be considered.

3.10 | Treatment dosage

There is considerable uncertainty regarding exercise dosage for CMP (Fransen et al., 2015; Hayden et al., 2005; Jones et al., 2006). Establishing definitive guidelines is further complicated by the need to individualize treatment so that even within seemingly specific subgroups (e.g. CLBP, fibromyalgia) exercise prescription can vary greatly between patients. In contrast to the American College of Sports Medicine guidelines to improve musculoskeletal fitness and health in healthy individuals (Garber et al., 2011), people with CMP appear responsive to lower exercise dosage. In the clinic, exercise intensity is best monitored using a Borg 6–20 scale rating of perceived exertion (RPE) or combined RPE and heart rate (Demoulin, Verbunt, Winkens, Knottnerus, & Smeets, 2010). Higher scores on the Borg scale indicate increasing perceived exertion with physical activity/exercise, from 6 – no exertion – to 20 – maximal exertion (Borg, 1998; see Table 1). RPE can also be monitored in instances where one repetition maximum (1RM) is not applicable such as fear avoidant and deconditioned patients and non-weight-training resistance modalities including floor, body weight and functional exercise. Low- to moderate-intensity aerobic exercise (40 < 70% of maximum heart rate (HR_{max})) can improve pain and function in CMP (Bennell & Hinman, 2011; Häuser et al., 2010; O'Connor et al., 2015). Likewise, low- to moderate-intensity resistance exercise (40–60% 1RM) has shown to be sufficient to evoke positive changes (Bennell & Hinman, 2011; Busch et al., 2013; Kristensen & Franklyn-Miller, 2012). While most exercise interventions for CMP will involve low- to moderate-intensity exercise, higher intensity training (≥70% HR_{max}/1RM) can improve pain and function without adverse effects (Bennell & Hinman, 2011; Kristensen & Franklyn-Miller, 2012; Limke, Rainville, Peña, & Childs, 2008) and should be prescribed when the goal is a return to more physically demanding work, sport or recreation. While clinicians should aim to gradually increase exercise intensity and apply the principles of progressive overload as the patient's confidence and exercise tolerance improve, it is important not to lose sight of the fact that simply assisting patients to become more active and setting goals around increasing their activity levels can be beneficial. We have thus taken a practical, evidence-based approach to aerobic and resistance exercise prescription for CMP using the FITT principle (frequency, intensity, time, type), with suggestions based on findings from pertinent systematic reviews and established

TABLE 1 General guidelines for aerobic and resistance exercise prescriptions using the FITT principle (frequency, intensity, time, type) for people with chronic musculoskeletal pain

Aerobic exercise	Intensity HR equivalents: low intensity: 40 < 55% HRmax; moderate intensity: 55 < 70% HRmax; high intensity: 70 < 90% HRmax
Frequency	≥ 2 times/week; ≥ 6 weeks
Intensity	Low intensity (RPE 8–10) to moderate intensity (RPE 11–13). Higher intensity (RPE 14–16) for goals involving more demanding work, sport or recreation where tolerated
Time	20–60 min and <20 min with exercise intolerance. Consider shorter intervals interspersed with other exercise modalities (e.g. 3 × 7 min walking separated by resistance exercise)
Type	Modalities involving continuous and rhythmic exercises that engage major muscle groups but do not exacerbate symptoms (walking, jogging, swimming, dancing, etc.)
Progression	Commence RPE 8–10 grading to RPE 11–13 as tolerance increases; RPE ≥14 for high-intensity training. Increase duration before intensity (e.g. for treadmill walking increase duration and walking speed before incline)
Resistance exercise	Intensity 1RM equivalents: low intensity: 40 < 60% 1RM; moderate intensity: 60–70% 1RM; high intensity: ≥70% 1RM
Frequency	2–3 times/week; ≥ 6 weeks
Intensity	Low-intensity (RPE 8–10) to moderate-intensity exercise (RPE 11–13). For more demanding work, sport or recreation consider high-intensity training (RPE 14–16)
Time	For low- to moderate-intensity exercise 1–2 sets of 15–20 reps reduced/adapted for exercise intolerance. For high-intensity exercise 1–2 sets of 8–12 reps
Type	Modalities that engage muscles of affected body part(s) and/or major muscle groups (weight-bearing activity, free weights, floor exercise; machines, resistance bands, motor control exercise, etc.) that do not exacerbate symptoms
Progression	Commence RPE 8–10 grading to 11–13 as tolerance and function increases; RPE ≥14 for higher intensity training. Increase reps before load; commence floor exercise with short holds and higher reps and increase hold duration before exercise difficulty. For functional exercise commence at a level specific to patient's presentation and increase reps before load

ex, exercise; HR_{max}, age-predicted heart rate maximum; 1RM, 1 repetition maximum; RPE, rating of perceived exertion assessed using Borg 6–20 RPE scale; reps, repetitions.

exercise guidelines for healthy individuals presented in Table 1. A summary of key points concerning exercise prescription for CMP is provided in Table 2.

4 | SPECIAL CONSIDERATIONS

Health screening before commencing exercise is mandatory for all patients, with the physical activity readiness questionnaire being the minimal standard screening tool (American College of Sports Medicine, 1995). Relative contraindications include red flags such as acute injury or trauma, history of cancer, systemic steroids and drug misuse. In addition, the relative and absolute contraindications of exercise apply (American College of Sports Medicine, 1995). When exercise is poorly tolerated and continues to increase symptoms despite several revisions, shift the focus from structured exercise to gradually pacing up daily activities. When an exercise intervention continues to worsen the patient's symptoms and/or function, cease or suspend treatment and encourage the patient to remain as active as their symptoms permit.

5 | FUTURE RESEARCH TO ADVANCE EXERCISE TREATMENT FOR CMP RESEARCH

Clinical trials with a rigorous analysis of causal mechanisms are required. Innovative methods for causal mediation analysis allow identification of the intermediate factors through which physical activity/exercise exert their effects on pain and/or disability (treatment effect modifiers). A better understanding of the biological (e.g. increased muscle strength, greater range of motion, normalized pain processing) psychological (e.g. reduced fear of movement, improved mood) and social (e.g. earlier return to work) mechanisms of exercise will help refine exercise interventions. As the response to increased physical activity/exercise can vary considerably between patients, it is important to understand the individual factors that are associated with favourable patient outcomes (e.g. which subgroup(s) of patients is/are more likely to respond to an increase in physical activity/exercise intervention – 'what works for whom?'). A better understanding of strategies to improve treatment adherence such as goal setting, self-monitoring and professional feedback is required.

TABLE 2 Key points concerning exercise prescription for CMP

- Understanding contemporary pain biology and 'explaining pain' are key competencies required for biopsychosocial treatment
- Frequently reassure patients that it is safe to move/pace up despite their symptoms
- Exercise prescription should be time, as opposed to pain, contingent using a tolerable/not tolerable dichotomy
- Have ready-made responses to flare-ups can reduce severity
- Exercise should be individualized, enjoyable, related to patient goals and with a level of supervision specific to the patient
- Many patients with CMP will respond to lower exercise dosage than recommended for healthy individuals (i.e. graded low to moderate intensity)
- Closely observe and monitor exercise practice, seek and provide feedback and correct poor technique
- Encourage patients to self-monitor exercise (diaries, activity trackers, etc.)
- Place emphasis on developing/restoring movement confidence and quality

Research to identify the optimal exercise intensity, frequency, duration and modality is also warranted.

6 | SUMMARY

Exercise can improve symptoms, decrease disability and improve function and wellbeing in a range of CMP conditions. No one exercise modality has proven superior with considerable uncertainty regarding exercise modality and dosage. The weight of evidence is for aerobic and resistance exercise modalities. However, if patients prefer, non-traditional forms such as pilates, yoga and tai chi should not be excluded. There is consensus for individualized, supervised exercise based on patient presentation, goals and preferences, and exercise that patients perceive as safe and non-threatening. To align with contemporary pain rehabilitation practice, clinician competency is required with implementing exercise interventions using a biopsychosocial treatment approach. It is also important for clinicians to understand that in some instances, irrespective of exercise, simply engaging with the patient, developing their confidence with movement, assisting them to become more active and pace up their daily activities has the potential to reduce the impact of pain and improve quality of life. Finally, the clinician needs to understand mechanisms and contemporary conceptualization of pain and be able to impart this understanding to their patients – failure to do so will leave the patient confused as to why a biopsychosocial approach is required for a structural–pathology-based problem.

CONFLICT OF INTEREST

In the last five years, G. Lorimer Moseley has received support from Pfizer, Workers' Compensation boards in Australia and Europe, Kaiser Permanente, Agile Physiotherapy, Results Physiotherapy, the International Olympic Committee and Port Adelaide Football Club. He receives speaker fees for lectures on pain and rehabilitation and royalties for several books about pain and rehabilitation.

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How to cite this article: Booth J, Moseley GL, Schiltenwolf M, Cashin A, Davies M, Hübscher M. Exercise for chronic musculoskeletal pain: A biopsychosocial approach. *Musculoskeletal Care*. 2017. https://doi.org/10.1002/msc.1191