3: Rehabilitation principles for treating chronic musculoskeletal injuries

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Abstract

- Evaluation of patients for rehabilitation after musculoskeletal injury involves identifying, grading and assessing the injury and its impact on the patient's normal activities.
- Management is guided by a multidisciplinary team, comprising the patient, doctor and physical therapist, with other health professionals recruited as required. Parallel interventions involving the various team members are specified in a customised management plan.
- The key component of the plan is active mobilisation utilising strengthening, flexibility and endurance exercise programs.
- Passive physical treatments (heat, ice, and manual therapy), as well as drug therapy and psychological interventions, are used as adjunctive therapy. Biomechanical devices or techniques (eg, orthotic devices) may also be helpful.
- Coexisting conditions such as depression and drug dependence are treated at the same time as the injury.
- Effective team communication, simulated environmental testing and, for those employed, contact with the employer facilitate a staged return to normal living, sports and occupational activities.

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MUSCULOSKELETAL INJURIES are common and the causes are multifactorial. Some are benign and self-limiting and little is required besides routine medical care and advice; others become chronic and present complex therapeutic challenges. Optimal management, especially for patients with associated comorbidities, requires a multidisciplinary team to simultaneously address the physical condition, the underlying psychological processes and the social milieu of the patient.

This review focuses on the rehabilitation principles guiding evaluation, management and return to activity after acute musculoskeletal injury, and briefly examines rehabilitation issues related to chronic musculoskeletal conditions. I have included two illustrative case histories — one of postacute rehabilitation of knee injury and one focusing on rehabilitation in chronic lower-back pain — one of the commonest musculoskeletal complaints in adults.[1]

Evaluation and management plan

The focus of evaluation is to identify the injury, grade its severity and formulate a multidisciplinary management plan to return the patient to normal activity as soon as possible.

- *Identifying* the injury involves taking a careful history, performing a thorough general and local examination and conducting relevant investigations.
- *Grading* the injury involves assessing the level of disability in relation to the patient's ability to return to normal activity levels, as well as his or her occupation and role in the community.
- *A multidisciplinary management plan* is developed with the patient, doctor and physical therapist as the core team members. Other health professionals such as an exercise physiologist, psychologist, occupational therapist, nurse, dietitian, podiatrist and orthotist are recruited as required.

Management options

Rest, ice, elevation and compression to minimise tissue damage after injury are the foundations of first aid. However, rest beyond the first 24–48 hours is contraindicated in most injuries, as inactive muscle rapidly atrophies, connective tissue contracts and detrimental changes occur in immobilised joints.[2]

In the postacute phase, optimal management of musculoskeletal injuries consists of multiple parallel interventions (Box 1; and Case histories 1 and 2, pages 240, 241)

Progressive active mobilisation

Progressive active mobilisation consists of strengthening and flexibility exercises, while maintaining or improving cardiovascular endurance. Proprioceptive retraining (balance and stability exercises) are used when such deficits are present. These exercises are then combined in progressive functional training in the context of relevant tasks in which they are used sequentially and in overlapping combinations. Initially, the exercises, described below, are supervised, usually by the physiotherapist.

Strengthening exercises are used to minimise disuse atrophy, increase circulation and maintain muscle condi-

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tion.[3] *Isometric* strengthening exercises, in which muscles are contracted without movement of an affected joint, are very useful in joint injury (eg, straight-leg raises in knee injury). *Isotonic* exercises, in which muscle contraction powers a joint through a range of motion, are used in a pain-free range of motion. They include daily progressive resistance exercises using weights or other resistance devices. Multiple repetitions varying in number and degree of resistance are employed.[3] Instruction and supervision are provided.

Flexibility exercises help restore normal joint motion. They may also play a role in prevention of injury. Graduated stretching over time increases the length of contractile and connective tissue within the muscle–tendon unit, and allows restoration of normal range of joint motion.[4] Stretching exercises after injury may be combined with passive modalities (eg, heat or ice) to reduce spasm induced by activity of the fusimotor system and provide both analgesia and increased range of motion. Flexibility exercises should be continued after recovery.

Endurance exercises at moderate levels of exertion should be performed most days of the week.[5] Most patients with chronic musculoskeletal injury and pain will not do this spontaneously. Benefits include cardiovascular improvements,[6] metabolic stimulation, maintenance of muscle bulk, immunological modulation and positive psychological effects.[4] The aim is to increase heart rate without aggravating the injury. Endurance exercises include:

- exercising in water and swimming;
- brisk walking or gentle jogging;
- circuit training using light weights in a sequence of exercises;
- calisthenics or aerobics; and
- use of exercise machines such as bicycles, steppers, rowers, treadmills and armcranks.

For lower-limb injuries and arthropathies, swimming and water exercises are particularly useful, allowing all limb muscles to provide the work of exercise, with an 80%–90% reduction in weight-bearing forces (Box 2).

1: Management options after musculoskeletal injury

Progressive active mobilisation
- Strengthening, flexibility and endurance exercises
- Proprioceptive retraining
- Functional training

Passive physical treatment
- Heat, ice
- Manual therapy

Drug therapy
- *See text*

Psychological treatment
- Education/explanation
- Counselling, reassurance
- Cognitive behavioural therapy

Biomechanical techniques and devices
- Taping/orthotics
- Altered technique/equipment

Relevant specialist opinion

2: Exercising without weight-bearing

96-year-old man with bilateral hip and knee osteoarthritis doing water-based exercise.

Proprioceptive retraining

Ligament, tendon and joint injuries are often accompanied by proprioceptive impairments, which persist after the acute injury phase.[7] This retraining aims to increase speed and efficiency of muscular control to prevent reinjury.

The components of proprioceptive retraining are:

- taping or bracing to aid joint alignment and increase sensory input;
- progressive static balance exercises (eg, in ankle injury, standing on one leg and graduating from firm surfaces to foam to a "wobble board"); and
- increasing the difficulty of balance and control exercises sequentially (eg, using a blindfold or increasing the required speed to complete a task).

Functional training

Functional training combines the previous components of strength, flexibility, endurance and proprioceptive exercises. Muscle groups are exercised in tandem to allow coordinated, purposeful movement. Training is progressive (eg, walk–jog–run) as healing progresses. It forms the basis of graduated return-to-work programs. Functional training has been shown to decrease time off work, and speed return to sporting activities.[8]

Passive physical treatments

These should only be used as part of a structured program and not as a substitute for more active participation. A preference for and reliance on passive treatment modalities should be discouraged. Ultrasound, laser, magnets and acupuncture have very little, if anything, to offer, and there is a dearth of scientific evidence to support their use.

Cooling has beneficial effects in both the acute and subsequent phases of injury. Ice packs are cheap and easy to employ. Cooling provides analgesia, vasoconstriction and oedema reduction and may be used in combination with active exercises.[9]

Heat causes vasodilatation, increased metabolic rate, analgesia, increased collagen extensibility and reduces spasm.[9] It is used most often in chronic painful conditions with associated muscle spasm (eg, whiplash).

Manual therapy is one of the oldest treatments in medicine and encompasses all forms of massage, mobilisation, manipulation and traction. Benefits include reduction in oedema and spasm, and improved flexibility and range of joint motion, as well as psychological effects. Referral for this purpose should be made to physical therapists who have appropriate scientific training and experience and who are willing to work as part of a team. There is some evidence that manual therapy, in combination with exercise and education, is beneficial.[10]

Drug therapy

Several classes of drugs have a role to play in musculoskeletal injury management.

Case history 1 — a woman with anterior knee pain

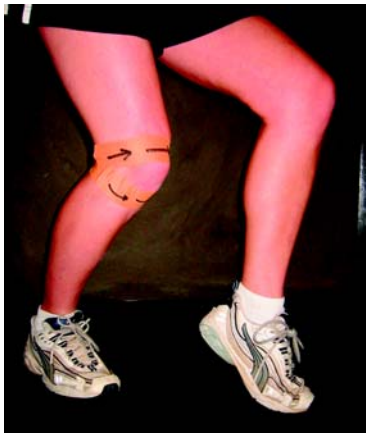
Patient: A 29-year-old woman with anterior right knee pain. She is a real estate agent, and plays competition netball.

History: She has had progressive nagging pain at the front of her right knee associated with activity for 3 months, and has occasional sharp retropatella pain on walking and anterior pain when descending stairs. The pain is worse after netball. She is otherwise fit and well, and she has had no previous knee injury.

Examination: Pain free at rest. Slim build. Wasted right vastus medialis muscle. Right patella situated more laterally than the left. Very small effusion, tender to palpate on the medial border of the right patella. Normal range of motion. Single leg squat reproduces pain, as does quadriceps contraction against resistance at 30 degrees. Mild weakness of right gluteal muscle group. Running shoes in poor repair.

Investigations: Radiography shows no abnormality. The results of an MRI scan would not alter management.

Diagnosis: Patellofemoral syndrome (*differential diagnosis* — loose body, osteochondritis dissecans, patella tendinitis.[21]



Patient with patellofemoral syndrome, performing strengthening exercises for right gluteal and quadriceps muscles, with taping to aid patella alignment (arrows indicate direction in which tape is tensioned). Note appropriate new running shoes.

Treatment plan

Days 1–5

- *Relative rest* — avoid activities producing knee pain.
- *Ice* — 15 minutes twice daily.
- *Strengthening exercises* — 80 straight leg raises per day to strengthen quadriceps. *Flexibility exercises* — hamstrings and tensor muscle of fascia lata/gluteal muscles. *Endurance exercises* — swimming (no breaststroke to avoid knee flexion).
- *Passive treatment* — manual mobilisation to aid patella tracking.
- *Biomechanical treatment* — taping to aid patella alignment (Figure). New, appropriate running shoes with pronation control.
- *Psychological treatment* — reassurance and education.
- *Drug treatment* — short-acting anti-inflammatory drugs for 5 days.

Days 6–14

- *Strengthening exercises* — progressive resistance exercises for quadriceps and gluteal muscles (Figure). *Flexibility exercises* — continued as above. *Endurance exercises* — using exercise bicycle.
- *Biomechanical treatment* — taping patella for activity (Figure), and full-foot, flexible, heat-moulded orthoses to help prevent excess foot pronation.
- *Functional training* — brisk walking for 20–30 minutes daily, followed by ice packs.

Days 14–28

- *Exercises* — continued as above.
- *Functional training* — progression to light jogging and running three times per week for 30 minutes, taping patella and wearing orthoses in running shoes.
- *Return to activity* — netball training, then return to competition.

Discussion: Patellofemoral syndrome is associated with predisposing biomechanical factors such as a large "Q" angle (relative genu valgum), reduced mass and control of quadriceps muscle, torsion of tibia, laterally placed or tilted patella.[21] Most patients respond to conservative measures, which should be tried first before expensive investigations. This patient was easily managed with two visits to the doctor and five physiotherapy sessions. She returned to full activity, with a self-maintenance program to prevent recurrence.

Analgesics (paracetamol or combinations of paracetamol and aspirin plus codeine) can be used to provide sufficient pain reduction to allow an increase in activity levels.

Opiates (codeine, tramadol, oxycodone) tend to be overused for analgesia in post-injury rehabilitation. Longer-acting agents (eg, Tramal SR; CSL), taken orally, are preferable, but their use should be closely monitored because of the risk of dependence and abuse.

Non-steroidal anti-inflammatory drugs (NSAIDs) (short-acting indomethacin, diclofenac with a medium action time, and long-acting piroxicam), taken orally, are particularly useful, providing a combination of analgesic and anti-inflammatory effects. In conditions with ongoing inflammation (eg, enthesopathies, arthropathies and ligamentous strains), duration of use of NSAIDs may vary from days to weeks.

Selective COX-2 inhibitors provide anti-inflammatory and analgesic effects with lower gastric side-effect profiles than traditional NSAIDs, and are most useful in chronic arthropathy.[11]

Local corticosteroid injections are useful for some conditions (eg, rotator cuff injuries). However, the benefits may only last for weeks to months,[12] and training is required in administration techniques. There is limited evidence to support the use of parenteral corticosteroids in plantar fasciitis and finger flexor tendinopathy.[13,14]

Tricyclic antidepressants (eg, amitriptyline, dothiepin) are often helpful in relatively low doses for chronic pain and also provide nocturnal sedation.[15]

Benzodiazepines act centrally as sedatives, but tend to be overused and should only be viewed as a short-term adjunctive treatment. Co-existing anxiety states and depression should be treated separately.

Anticonvulsants (carbamazepine, gabapentin, valproate) can be prescribed as adjunctive therapy in patients with neuropathic pain. Of these, gabapentin has been advocated for its favourable side-effect profile.[16]

Muscle relaxants (eg, baclofen) may be helpful in patients with severe muscle spasm.

Psychological treatment

Patients may respond to a chronic injury and pain with mood disturbances, including depression, lowered self-esteem, anxiety, anger and maladaptive behaviour.[17] Calm explanation, reassurance and involvement in the rehabilitation plan can counteract these psychological disturbances,

as can cognitive behavioural therapy and family and social support.[18] Occasionally, medication, supportive psychotherapy and referral to a psychiatrist are required. Many studies have found general exercise programs to have positive psychological benefits.[19,20]

Biomechanical devices and techniques

The trauma leading to musculoskeletal injury may be acute or involve chronic repetitive forces. A subtle and diverse combination of body type, physical factors and work requirements, as well as individual technique, can be the aetiological factors producing or maintaining an injury. Protective devices (eg, knee pads for workers who are required to kneel) can protect an existing injury and prevent new occurrences. Techniques used during activity may require alteration, and exercise equipment used should be in a good state of repair. Orthotic devices help biomechanical alignment and reduce stress on joints (Case history 1) and can be an effective part of a treatment plan.[22] They have been shown to help prevent ankle injuries.[23]

Specialist referral

Specialist surgical, rehabilitation and psychiatric interventions may be required in particular cases in which the condition is resistant to the management options outlined above.

Chronic musculoskeletal conditions

Chronic conditions, in particular back pain, are difficult to treat, and, despite being given optimal care, a proportion of patients do not improve and exhibit abnormal illness behaviour (see Case history 2). There is often coexisting depression and anxiety, especially in the elderly.[24,25] There may be "secondary gain" inhibiting improvements in function (eg, compensation payments, increased family or social attention, and work avoidance). Drug dependence should be recognised, if present.

In such patients a problem list helps identify and prioritise issues to be addressed, and pain and activity diaries can give the clinician a clearer idea of the patient's physical capabilities. Again, a coordinated multidisciplinary approach is desirable.[26]

In chronic back pain, there is little evidence to support the effectiveness of manipulation, soft-tissue injections, acupuncture or back orthoses.

A functional restoration approach to the management of patients with chronic back pain, combining quantification of back strength, flexibility and aerobic fitness with an occupational and goal-oriented strengthening program, an aerobic conditioning program and cognitive behavioural therapy, has shown some promise.[27] A meta-analysis of the results of intensive biopsychosocial rehabilitation supports its efficacy.[28] There is Australian evidence that media campaigns can positively alter community perceptions of back pain.[29]

Case history 2 — a man with chronic back pain

Patient: A 46-year-old man, divorced, and an invalid pensioner, with chronic lower-back pain.

History: He sustained the original injury pushing a car, and has had 3 years of progressive back pain. He has pain on a daily basis, is uncomfortable sitting and driving, and has difficulty sleeping. He is unable to work (builder's labourer) and is socially isolated, with feelings of worthlessness. He has poor exercise tolerance, and is dependent on 6–8 tablets of Panadeine forte (codeine phosphate–paracetamol) daily and diazepam 5 mg three times a day.

Medical history: Gastro-oesophageal reflux, left knee arthroscopy.

Examination: Limited range of motion in the lumbar spine, stiff and slow gait, no neurological deficits. Weakness of the abdominal and gluteal muscles, lack of flexibility in the hamstring and psoas muscle groups, and tenderness to palpation over the right L4/5 transverse process and L4 and L5 supraspinous processes. He is depressed and overweight.

Investigations: Multiple doctors have been consulted and numerous investigations performed. An MRI scan showed L4/5 disc annular protrusion, multilevel disc desiccation, and multilevel facet joint spondylosis.

Diagnosis and problem list: Spondylosis of the lumbar spine; chronic pain syndrome; depression; drug dependence; social isolation; physically deconditioned.

Management: Pain and activity diaries; customised multidisciplinary management plan.

- *Strengthening exercises* — physiotherapist-supervised strengthening program for gluteal and abdominal muscles at the local public hospital, progressing to home-based daily exercise routine. *Flexibility exercises* — hamstrings, gluteal and psoas muscle stretching twice daily. *Endurance exercises* — encouraged to go to the local pool for self-managed program.
- *Passive treatment* — heat packs applied for 20 minutes to lower back to reduce spasm daily; gentle mobilisation by the physiotherapist.
- *Psychological treatment* — education and supportive counselling; given literature explaining the condition; cognitive behavioural therapy conducted by a psychologist at the community mental health centre.
- *Referral* — to Commonwealth Rehabilitation Service.
- *Drug treatment* — celecoxib 200 mg daily, dothiepin 25 mg at night for three nights then 50 mg at night; substitute paracetamol for Panadeine forte; discontinue diazepam progressively.

Outcome (at 6 months): Pain is still present on a daily basis, but there are improvements in self-reported pain, sleep patterns and mood. His exercise tolerance and activity levels have improved, and he has completed an introductory course in basic computing skills. Substantial reduction in codeine use, and diazepam is no longer used. He is still unemployed and socially isolated.

Evidence-based recommendations

Musculoskeletal injury – In most patients with chronic musculoskeletal injury increasing exercise levels has multisystem benefits (E1).[6,19]

Chronic back pain – Intensive biopsychosocial rehabilitation is useful in the management of chronic back pain (E1).[26-28]

Chronic pain – For chronic pain, tricyclic antidepressants and anticonvulsants are often effective at relatively low doses (E2).[15]

Musculoskeletal conditions – In chronic musculoskeletal conditions there is often coexisting depression and anxiety, especially in the elderly ($E3_2$).[24,25]

Return to activity

Progressive, staged return to activity is encouraged after the achievement of full range of movement, adequate strength and control. Simulated environmental testing and effective team communication facilitate this. In returning patients to employment tasks that require physical activity, contact with the employer is helpful to prescribe which job roles can be safely undertaken. The decision to return to full activity should be made by the whole treatment team, including the patient.

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