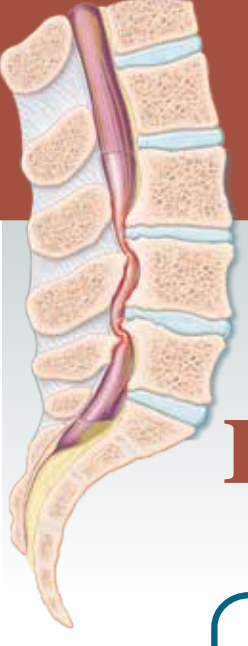

Exercise Prescription for Back Pain

ABSTRACT

Exercise is one of the most effective and simplest evidence-based recommendations to manage acute and chronic back pain. This paper discusses the physiology and evidence to support exercise as effective treatment. We will provide guidance on how to assess and prescribe exercise and offer methods to educate and encourage physical activity for patients with back pain.

KEYWORDS: Back Pain, Physical Activity, Exercise Prescription, Motivational Interviewing.

CME Pre-test Quiz

Clinical Case

Kevin is a 43 year-old software engineer who presents to your office with a new complaint of low back pain that he first noticed 5 days ago when reaching for his slippers. His pain rapidly increased and began to spread to his left leg. He is severely limited with his ability to sit comfortably. Currently, his back pain radiates down the left leg to the lateral aspect of the foot. The leg pain is worse than the pain in the back. He denies bowel or bladder difficulties. He is otherwise healthy.

Kevin has had occasional episodes of low back pain since he was in his 20s, when he was a college football player. Since starting his career in software engineering, he has not maintained his previous fitness levels and his job requires pro-

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longed sitting without breaks. His Exercise Vital Sign (See below in How to Assess) is currently 0.1

On examination, he has bilateral iliolumbar muscle spasms. His lumbar active range of movement is markedly limited. Flexion reproduces his leg pain. He has a positive left straight leg test with reproduction of his typical leg dominant pain. There is mild weakness with left ankle plantar flexion and decreased left ankle reflex. The rest of his physical exam is non-contributory.

Clinically, you suspect an S1 radiculopathy. You are aware of the TOP guidelines that recommend no MRI imaging be performed in the acute phase even in the presence of radiculopathy unless there are clinical red flags.[2] You are also aware of the TOP recommendations for patient education and promotion of exercise.

What exercise recommendations would you give to Kevin?

Introduction

Back pain is one of the most common reasons patients visit a family doctor, with a prevalence of approximately 80% in the adult population. Fortunately, this condition tends to resolve over time, however, studies show the prevalence of chronic back pain is growing, leading to significant health care and societal costs.[3,4] Numerous factors, including negative labelling of patients, over medicalization, dependency on passive care, increasing obesity and sedentary lifestyles have been identified as factors leading to this increase.

Evidence and Clinical Practice Guidelines for Back Pain

A detailed walking program written by Hippocrates in the fourth century BC is credited as the first physician initiated medical prescription for exercise.[5] Today, the American College of Physicians evidence-based clinical practice guidelines for back pain specifically recommends the traditional practices of Tai Chi and Yoga.[6] A recent Cochrane review in 2017 summarized 21 systematic reviews of 264 randomized controlled trials, involving 19,642 participants. This review compared interventions against placebo, no exercise / minimal interventions.[7] Exercise consistently demonstrated mainly favourable effects in the reduction of pain severity, improved physical function, increased psychological function and overall better quality of life. In general, the effect sizes for exercise are relatively similar to other interventions, including medications and surgery. This large base of evidence suggests that many types of exercise and physical activity are beneficial in managing back pain.[7]

There is no evidence that exercise or physical activity are significantly harmful in back pain, beyond the temporary aggravation

of pain.[7] The combination of the potential for pain reduction and improved quality of life, general health benefits, and low risk and side effect profile should mandate that an exercise prescription be included as an intervention in the management of back pain. More

Table 1: Evidence Based Guidelines for Exercise in Back Pain

"Consider a group exercise programme (biomechanical, aerobic, mind–body or a combination of approaches) within the NHS for people with a specific episode or flare-up of low back pain with or without sciatica. Take people's specific needs, preferences and capabilities into account when choosing the type of exercise." [NICE]
"Clinicians should advise patients with acute, subacute, or chronic low back pain to remain active as tolerated" [ACP]
"For patients with chronic low back pain, clinicians and patients should initially select nonpharmacologic treatment with exercise, multidisciplinary rehabilitation, acupuncture, mindfulness-based stress reduction (moderate-quality evidence), tai chi, yoga, motor control exercise, progressive relaxation, electromyography biofeedback, low-level laser therapy, operant therapy, cognitive behavioral therapy, or spinal manipulation" [ACP]
"… no serious harms were reported for any of the recommended interventions. Muscle soreness was reported for exercise" [ACP]
"Continuation of usual activities as tolerated" for acute LBP [TOP]
"Prescribe exercise or therapeutic exercise" for acute and chronic LBP [TOP]
"Encourage patient to initiate gentle exercise and to gradually increase the exercise level within his/her pain tolerance. Sophisticated equipment is not necessary. Other options may include unsupervised walking and group exercise programs, such as those offered by chronic disease management programs. The peer support of group exercise is likely to result in better outcomes, giving patients improved confidence and empowering them to manage with less medical intervention." [TOP]
"Advise patients who are recovering from an episode of acute low back pain that recurrence episodes are common and that remaining physically active and participating in regular exercise may reduce the likelihood of recurrence" [TOP]
"To achieve health benefits, adults aged 18-64 and aged 65 years and older should accumulate at least 150 minutes of moderate to vigorous intensity aerobic physical activity per week, in bouts of 10 minutes or more" [CSEP]

NICE. National Institute for Health and Care Excellence.[28]
ACP. American College of Physicians.[6]
TOP. Toward Optimized Practice Low Back Pain Working Group.[2]
CSEP. Canadian Society for Exercise Physiology.[22]

importantly, because most adults will have an episode of back pain, it may be beneficial to introduce regular exercise as a lifestyle change to improve overall health.

Unfortunately, despite numerous published clinical practice guidelines, observational studies of actual practice have demonstrated that this is not the case.[8,9] Table 1 lists a summary of the specific recommendations for exercise from recent clinical practice guidelines.

How Does Exercise Reduce Pain?

The mechanisms by which exercise improves quality of life and reduces pain severity are multifactorial, influencing the musculoskeletal, cardiovascular and central nervous systems. An understanding of these mechanisms may help the clinician educate and further engage patients towards increasing their physical activity.

The spinal motor control model suggests that there is equilibrium between the structural (vertebrae, ligaments, discs), muscular and neurological biofeedback components.[10,11] Disruption of at least one of these elements may lead to increased instability and painful irritation. Intuitively, spinal motor control exercises that strengthen the muscles surrounding the spinal column should address the muscular component, but activation and subsequent endurance require neurological input, which in turn necessitates training. To address both the muscular and neurological biofeedback systems, building and maintaining physical capacity over the course of a patient's desired activities, requires progressive and ongoing exercise. Ergonomic education can help reduce stresses on the structural components.

The high prevalence of degeneration on routine MRI scans of the spine in the population demonstrates that the structural components are subject to age-related changes.[12] Not only does exercise reduce the effects of aging at a cardiovascular, neurological, and musculoskeletal systems level, basic science has demonstrated an effect on the cellular components of aging as well.[13] This is mediated by the release of anti-aging cytokines mitochondrial biogenesis, cytoprotection, hypertrophy, anti-oxidant defense, activation of stem cells and improved proteostasis during exercise.

In addition to having biomechanical effects, pain is a complex process involving nociceptive stimuli and neuro-modulatory processes that includes a number of facilitating and inhibiting neurotransmitters. For example, animal and human studies have demonstrated that exercise and aerobic fitness increase the number of endorphins acting through the opiate pathways to reduce levels of substance P and other inflammatory cytokines.[14] This exercise-induced modulation of

neurotransmitters leads to higher pain tolerance and reduced sensitivity to nociceptive stimuli.

From a biological perspective exercise increases cerebral blood flow, improves oxygenation of cerebral tissue, reduces muscle tension and activates beneficial neurotransmitters including serotonin and endorphins. Exercise has also been demonstrated to have a beneficial effect on psychological well-being.[28,29] Psychological factors have a large impact on pain. Exercise is a well described evidence-based treatment for anxiety and depression and can improve confidence, internal locus of control and self-efficacy, improved body image and social support. The ability of exercise to modulate both biological and psychological components contributes to its ability to effectively manage pain.

Evaluation of a Patient with Back Pain for Exercise

In addition to the standard back assessment,[15] clinicians should consider incorporating the Exercise Vital Sign into their practice.[1,16] This screen involves simply asking and recording:

(i.) How many days per week a patient engages in moderate to strenuous exercise (such as a brisk walk), and

(ii.) The average time spent each day doing so.

Besides serving as a baseline for comparison, the simple act of asking these questions may stimulate patients to engage in exercise. A recent large observational study of over 1.5 million patient visits at Kaiser Permanente Health Care Centers demonstrated that patients in centres that implemented the Exercise Vital Sign, had greater weight loss and improved diabetic parameters compared to centres that did not record it.[1]

Patients frequently note a preference for either extension or flexion activities based on their pattern of back pain.[17] This directional preference for exercise should be determined during the initial assessment because the pattern of back pain provides the basis for the appropriate treatment direction. When assessing the range of motion clinicians should note which directions aggravate or relieve the typical pain. Flexion activities include sitting and bending forward; extension activities include standing, walking and arching backwards.

The chronic back pain population presents not only with biomechanical pain but often with excessive deconditioning, fear-avoidance, depression, anxiety, centrally mediated pain, loss of role in family and society and other barriers to participation in treatment. These negative factors, along with positive facilitators such as previous experiences with sport or a network of social sup-

port, need to be considered when evaluating patients for exercise. These issues may not be apparent at initial assessment; ongoing follow-up visits may be required to successfully engage patients in exercise therapy.

A brief assessment for risk of cardiovascular complications or falls can be done using common clinical sense, although more standardized tools include the PAR-Q+ and the Fall Risk Questionnaire.[18,19]

What to Prescribe

The most important consideration in an exercise prescription is to encourage patients to be active each day. The practitioner's uncertainty over which exercise is "best" may interfere with that practical advice. The best exercise recommendation has to be something that a patient will do and something in line with current interests and preferences. If there a willingness to participate, the exercise prescription must include a few other considerations.

The three components of physical fitness are aerobic endurance, strength and flexibility. An ideal exercise program should include all three. Although, traditionally, clinicians have focused on core stabilization exercises, the most recent evidence suggests that any form of exercise is effective.[20] This is likely due to the multifactorial benefits of general physical fitness as previously discussed. Anecdotally, patients appear to be more focused on stretching with few realizing the importance of core strengthening and aerobic conditioning. This oversight emphasizes the importance of education about all three aspects.

Certain factors should be considered when prescribing exercises. Foremost among these are the patient's personal preferences, previous experiences with any exercise program and socioeconomic factors limiting participation. A clinician's active listening at this step is a critical component of patient engagement.

The principle of "start low and go slow" should be emphasized to avoid hyperalgesia of muscle fatigue. Commonly, patients stop doing exercises because of pain and fear of causing harm. Proper education about "hurt" versus "harm" and emphasis on a very gradual increase in intensity and duration should be used to keep the patient moving. For severely deconditioned patients, this process can take several months. The actual exercise prescription should specify the Frequency, Intensity, Time, and Type (F.I.T.T.) to address these issues.[21]

Regarding the specific type of exercise the directionality of pain relief and the comfortable range of motion should be considered. For patients with acute (< 6-12 weeks) back pain, the emphasis should be

on encouraging activity and gradual return to daily activities with modifications dictated by their pain tolerance and directional preference. As patients improve, recommendations for increasing physical activity as part of a change in lifestyle may be the best way to reduce risk of recurrence and improve overall health. Based on Canadian Physical Activity Guidelines, the eventual goal should be 150 minutes per week of brisk, moderate or vigorous physical activity in bouts of 10 minutes or more. Strengthening exercises should be incorporated at least twice a week.[22]

For patients with chronic pain, the inflammatory component of the back injury has likely subsided. These patients should be reassured appropriate exercises that temporarily aggravate pain are not harmful; performance will improve with gradual reconditioning. Any slight increase in pain during exercise should be temporary and not persist after the exercise session. If irritability is high and the increase in pain is prolonged, the F.I.T.T. principle of exercise still applies but the components should be reassessed. Most exercises can be performed with an emphasis on a "neutral trunk". Techniques and devices that support the back, such as aqua-fitness, treadmill walking with arms on the bars, Nordic walking (see Box 1) and stationary cycling are recommended to improve patients' aerobic conditioning without adding stress on the structural elements of the spine.

For those whose pain is increased with flexion suitable exercises including walking, Nordic walking, swimming, Tai Chi, and Pilates, can all be performed while avoiding a forward bent posture. For those who find extension painful, consider stationary bicycle, or modifying the above exercises to keep the back slightly flexed. Despite its reputation for extreme poses, many yoga instructors are comfortable recommending gentler yoga routines for patients with back problems.

A common misconception is that back exercises consist of only doing sit ups. In reality the focus should be on exercises that engage the core muscles surrounding the spine (flexors, extensors, obliques). Many exercises can accomplish this, while maintaining a neutral trunk that minimizes stress on the structural elements. Dr. Stuart McGill, a Canadian kinesiologist popularized the McGill "Big 3": modified curl ups, side bridges and "bird-dog" exercises.[23] Severely deconditioned patients may require an even simpler exercise approach, including any upright activity, such as rapid walking, that engages the core muscles.

In summary, while acute patients should select exercises based on their directional preference for pain control, the chronic

Box 1: Walking Programs and Nordic Walking

Walking is a safe, effective, enjoyable and accessible exercise program. It may be the easiest exercise to start, even for deconditioned patients. Patients should be encouraged to keep a diary, use a mobile App, or pedometer (available on most cell phones) and schedule "a daily walk". They should start at a comfortable pace and duration, even if it means only 5-10 minutes. Progression should be at a rate of 10% duration per week. Once the patient can do 20-30 minutes, (it may take months), then they can increase intensity to a brisk pace.

For patients, in which balance or weight bearing pain in their joints or back are an issue, Nordic walking poles may help overcome these barriers. Nordic walking is becoming increasingly popular, and is relatively easy to access. Nordic walking can: improve posture, increase upper body and core strength, provide an enhanced aerobic workout, offload impact on lower back and lower extremity joints, and provide increased stability and confidence.

Nordic walking is easy to learn but knowledgeable instruction can maximize success. Most Nordic walking poles will provide sizing instructions using height markings on the poles; elbows should be bent slightly greater than 90 degrees when gripped. Start with first dragging the poles and developing a natural arm swing, then gradually progress to planting, and finally pushing the poles. Clinicians may wish to inform themselves about the basic technique or add a qualified local instructor to their compilation of community resources.

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Table 2: Online Resources:	
Towards Optimized Practice Clinical Practice Guidelines for Back Pain	http://www.topalbertadoctors.org/cpgs/885801
Centre for Effective Practice – Clinically Organized Relevant Exam (CORE) Back Tool	https://www.thewellhealth.ca/wp-content/uploads/2016/04/CEP_CoreBackTool_2016-1.pdf
Canadian Physical Activity Guidelines	http://csepguidelines.ca/
Patient Tips and Back Exercise Videos	http://www.isaec.org/
Patient Back Exercise Sheets Based on Pattern of Pain	http://www.sasksurgery.ca/patient/spine.html
Exercise is Medicine Prescription Tool and Other Resources	https://www.exerciseismedicine.org/support_page.php/healthcare-providers/
Brief Action Planning Guide Tool (5A's)	https://centrecmi.ca/wp-content/uploads/2018/05/BAP_guide_2016-08-08.pdf

pain exercise prescription should focus on simply getting patients moving. Regardless of the pain duration, exercise prescriptions should follow the F.I.T.T. principle.

How to Prescribe

"The art of medicine" not only requires an understanding of basic physiological principles but also engagement of the patient. Inattention to the latter is probably a notable reason for the failure of an exercise prescription and must be addressed. The five major steps (5 A's) to intervention, initially developed for smoking cessation, have been recommended to initiate exercise.[24] A health care provider should: 1) Ask about the patient's physical activity level; 2) Advise on the importance and benefits of exercise; 3) Assess the patient's willingness to change; 4) Assist willing patients with an exercise prescription; 5) Arrange follow-up to ensure compliance. In a busy clinical practice this can require frequent visits with brief discussions.

Although a physiotherapy referral might accomplish these goals there may be barriers to accessing this approach. The primary care provider may be the only available source to guide patients' incorporation of exercise into their lifestyle. Appropriate level fitness classes and community exercise groups that provide motivation, social support and reassurance may be helpful in engaging patients

Table 3: Suggestions to Overcome Common Barriers to Exercise

Pain	• Start low & go slow – 10 minutes a day if very deconditioned and increase only 10%/ week • Consider exercises that support the back to improve aerobic fitness and endurance: aqua-fitness, treadmill walking with arms on the bars, Nordic walking (see Box 1) and stationary cycling • Consider directional preference and posture of the recommended exercise • Educate that exercise reduces pain in the long run • Take pain medication 30-60 minutes prior to activity • Ice after activity
Weather	• Walk at Wal-Mart, shopping mall, indoor soccer building • Gym • Treadmill, Stationary Bike, YouTube, DVDs at Home • Winter sports: snow shoeing, Nordic skiing, ice skating, hockey
Financial	• Walking is free • Assist patient with local Parks and Recreation Department financial assistance programs for exercise classes • Community exercise classes • YouTube, DVDs, www.isaec.org • Used Nordic poles or stationary bike
Patient's Lack of Time	• Walking meetings and work breaks • Incorporate physical activity into daily living (e.g. take stairs, park further away) • Take up a physically active hobby (e.g. dance, gardening)
Clinician's Lack of Time	• Simply ask / Exercise Vital Sign • Counsel over multiple visits • Offer praise and reassurance • Consistent messaging • Set a good example yourself • Familiarize and utilize community resources and allied health professionals

towards exercise. Clinicians should maintain a database of local community exercise resources. Online resources are listed in Table 2

Often patients believe that their back pain represents a harmful process. This fear-avoidance belief can greatly affect their ability to become active and is a major factor in the development of chronicity.[25] Clinicians must educate patients about the difference between hurt and harm and consistently emphasize that inactivity is detrimental. Strategies to address other barriers are listed in Table 3

SUMMARY OF KEY POINTS

1. Exercise is one of the most effective and simplest evidence-based recommendations to manage acute and chronic back pain
2. For chronic back pain the most important exercise is the one the patient will actually do.
3. For acute back pain the exercise prescriptions should take into account the patient's directional preference of exercise (Pattern of Pain) and the patient's unique situation.
4. Exercise Prescriptions should include the F.I.T.T. principle (Frequency, Intensity, Time and Type).

The technique of Motivational Interviewing is a systematic method to empathetically engage a reluctant patient to improve their health and has been shown to be effective at improving physical activity levels across a variety of chronic diseases.[26,27] The main components of Motivational Interviewing are use of empathetic/reflective listening to understand the patient's perspective about changing their behaviour and the emphasis on evoking the patient's motivation for change. Essentially, it is a collaboration that allows patients to produce their own arguments for change. Clinicians can use the acronym O.A.R.S. (Open-ended questions, Affirmation, Reflective listening and Summation) to recall the technique.

Kevin's Exercise Prescription

After listening to Kevin's concerns, you recognize that he is interested in beginning an exercise program.

CLINICAL PEARLS

Simply asking the patient about exercise has been shown to be effective in improving health outcomes. Consistent messaging about the positive role of physical activity is important.

Most forms of physical activity are usually beneficial. The exercise prescription should take in to account what the patient is actually prepared to do.

Patients often require reassurance that pain associated with exercising does not lead to physical harm.

Motivational interviewing is a structured, empathetic method to engage resistant patients.

Walking is free.

CME

Post-test Quiz

Members of the College of Family Physicians of Canada may claim MAINPRO-M2 Credits for this unaccredited educational program.

His level of radicular leg dominant pain initially makes strenuous activity impossible and may require frequent periods of scheduled rest. However, the F.I.T.T. approach allows you to start a suitable routine as soon as possible. You prescribe the following exercise:

- Frequency – once daily
- Intensity – very mild and gradually progress the pace.
- Time – 5 minutes: slowly increase duration by 1-2 minutes per week as symptoms permit
- Type – walking

Conclusion

The consistent message to remain active each day is an important evidence-based principle in the management of back pain that should be consistently promoted. In chronic cases, the most important exercise is the one the patient is prepared to do. For acute patients the exercise prescriptions should consider both the pattern of back pain and the patient's unique situation. Patients may need to be reminded that even if they experience a temporary increase in discomfort appropriate movement and activity will not cause harm. When patients are resistant to change and non-compliant with therapeutic exercise recommendations, motivational interviewing principles may identify and manage barriers to change.

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