Low Back Pain: Moving Back To Basics

Low back pain (LBP) affects many people and can be hard to treat. If LBP becomes chronic, psychological factors, such as fear-avoidance beliefs and catastrophising, can also become involved. There is an almost overwhelming amount of research about LBP and how best to treat it. This article discusses the evidence for and against different approaches and will allow you to make individually-tailored decisions for the best treatment for each of your LBP patients. Read this article online https://spxj.nl/3ADvWl9

By Kathryn Thomas BSc MPhil

As you know from your practice, lower back pain (LBP) affects so many individuals: young and old, athletic and sedentary. There are many opinions and dogma that gets attached to back pain, the dos and don'ts, and the preferred exercise type. Your patients will have researched on the internet and on social media about a possible self-diagnosis and the best quick fix, one magic exercise to relieve their pain. Sadly this often leads to confusion, frustration, fear and in some cases exacerbation of their symptoms. The fact is that in, most cases, chronic non-specific LBP need not be 'feared' – doing any serious damage through exercise and daily activities is rare. What patients fail to understand is the complexity of their condition, not just physically but that it has a psychosocial component too. Thus, based on the available evidence, what is the best exercise to prescribe to your back pain patients? Well, researchers within academia have blessed us with a plethora of studies to choose from, not just looking at the type of exercise most effective for LBP, but also comparison studies to find out which is superior to another. However, with all of this at our disposal, we (both practitioner and patient) feel less enlightened, even confused as to which exercise routine to prescribe. Or perhaps not? Maybe this excess of scientific evidence is sending a clinical message that patients should be less fearful, guided not to over-think or over-complicate the process and simply move more in any which way that appeals to them. The key to their recovery may be movement, which comes in many forms, and sticking to it!

Historically treatment for chronic LBP may have been ineffective, as a result of the unsubstantiated assumption that the problem is isolated to or originating from the lower back itself, and a specific functional deficit that now presents itself (although may have been present before the onset of pain) might be remedied by a specific exercise type. If there is low-level evidence or no evidence that specific exercises are superior to other forms of exercise or physical activity, then they represent an unnecessary drain on already limited healthcare resources.

If alterations in the periphery (such as increased movement asymmetry, decreased variability, reduced movement speed, increased muscle co-contraction as well as decreased back muscle endurance, strength and mobility) are compensatory rather than causative, then treatment needs to focus on new approaches. For example, these can include strategies to retrain the cortical function, alter patients' fears and beliefs, and incorporate a biopsychosocial model into rehabilitation.

The relationship between changes in physical performance as a consequence of exercise therapy and subsequent changes in clinical outcome has been reported as tenuous at best. It is conceivable that exercise therapy may elicit other changes that may be responsible for the improvements in pain and disability, for example:

- improvements in self-efficacy;
- coping strategies and fear-avoidance;
- modification of motor control patterns;
- changes in cortical organisation; and
- simply a positive relationship between patient and therapist (1).

●● THERE APPEARS TO BE NO CONSENSUS AGREEMENT THAT CORE STABILITY EXERCISE IS SUPERIOR TO GENERAL EXERCISE FOR CHRONIC LBP ●●

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This article aims to review the evidence available regarding different exercise types for LBP and question whether evidence exists for the philosophy of 'exercise that people enjoy and is easy for them to do will probably get done and hence have a positive effect'.

Comparing Exercise Types

1. Stabilisation or Core Stability Exercises

It is well documented that there is dysfunction in both the feed-forward and the voluntary activation of the deep-lying trunk muscles in recurrent and/or chronic LBP. Studies have shown that, in comparison to healthy controls, patients with LBP have a delayed onset of activation, particularly for the transversus abdominis (TrA) muscle during rapid movements of the arm or leg. This is an involuntary 'anticipatory' function of the TrA that is compromised. Not only this, but the ability to voluntarily activate the TrA during standardised exercises can be deficient in patients with chronic LBP. Specific spine stabilisation exercises, aimed at restoring these aspects of deep trunk muscle function have become popularised over the years, based on the hypothesis that these dysfunctions may pose a threat to spine stability and perhaps predispose to continuing or future episodes of pain.

Panjabi proposed the well-known model of spinal stability consisting of three subsystems: the passive subsystem (which includes bone, ligament and joint capsule), the active subsystem (which includes muscle and tendon), and the neural subsystem (which consists of the central nervous system and peripheral nervous system) (2). Control of spinal movement requires the three subsystems to work harmoniously together. Thus, core stability exercises should consider the motor and sensory components of the exercise and how they relate to these systems to promote optimal spinal stability (3). Core stability training should progress to include more intricate static, dynamic and functional exercises that involve coordinated contraction of local and superficial spinal muscles. Many studies and systematic reviews have been published showing the importance of core stability exercises in the rehabilitation of patients with LBP.

●● LBP PATIENTS SHOULD BE LESS FEARFUL AND SIMPLY MOVE MORE IN ANY WHICH WAY THAT APPEALS TO THEM ●●

Core stability training has a powerful theoretical foundation. It would be conceivable therefore that stabilisation exercises are superior to other forms of therapy for LBP patients. Studies have shown that stabilisation (or core) exercises are superior to usual medical care and education (or 'general practitioner treatment') (4*), but not to other forms of physical therapy/ exercise – there is limited evidence for any additional effect when stabilisation exercises are added to conventional physiotherapy programmes (4*,5,6,7*).

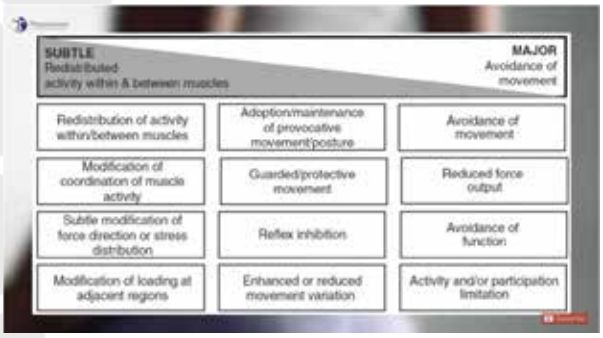
In comparison to general exercise (general trunk strengthening without a focus on maintaining a neutral spine, stretching and aerobic activities), core stability exercise may be more effective in relieving pain and improving back-specific function for patients with chronic LBP in the short term. This has been shown in studies where improvements in proprioception and balance follow a core strengthening programme (8*,9,10*,11*) However, when core stability exercises are compared to other exercise interventions both showed improvements in proprioception and balance (12*,13). No significant differences are observed between core stability exercise and general exercise in pain and functional status in the long term (14*).

It is not surprising that core stability exercises demonstrate significant improvements in the percentage change of muscle thickness on both sides of the TrA and lumbar multifidus (LM) (11*). A recent randomised clinical trial compared the McKenzie method of exercises with motor control exercises and found that both types of exercises similarly improved abdominal muscle thickness (15).

Stability exercises may significantly increase the ability to voluntarily activate TrA after therapy; however, neither the TrA-contraction ratio (TrA thickness contracted/TrA thickness at rest using ultrasound) recorded before treatment nor its improvement following treatment bore any significant relationship to clinical outcomes. Similarly, TrA anticipatory activation for rapid movements showed a non-significant effect on clinical outcomes following therapy (5).

There appears to be no consensus agreement that core stability exercise is superior to general exercise for chronic LBP. Seeing as positive effects are shown with different exercise forms (14*,16*), the application and underlying rationale for the use of stabilisation exercises are not endorsed unreservedly by all. Statistically significant differences in deep trunk muscle recruitment or activity levels between groups of chronic LBP patients and controls may be challenging to quantify, as is the diagnostic accuracy. More recent work has questioned the small but statistically significant group differences as being rather low and clinically non-relevant. There is also a paucity in the data directly correlating positive outcomes following a programme of stabilisation exercises contingent on improvements in deep trunk muscle function (5). Regardless of improvements in core muscle thickness or function with stability exercises, they are not superior to other exercise types in clinical outcomes such as pain, functional disability and fear-avoidance (11*,16*,17*,18).

As has been suggested for other types of exercise or physical therapy, it is conceivable that the mechanism of action for this treatment does not concern trunk muscle function or segmental stabilisation per se. A high dose of most exercise treatments appears to reduce pain and functional limitation outcomes more than a low dose, and the addition of co-interventions appears to improve the effectiveness of most exercise types for pain and functional limitation outcomes (17*). The positive influence of the



Video 1. Motor Control Patterns in Low Back Pain (Courtesy of YouTube user Physiotutors)
https://spxj.nl/3TDVl6L

therapy may reside in improvements in self-efficacy, coping strategies, reduced catastrophising, fear-avoidance, changes in cortical organisation or simply a positive therapist–patient interaction/relationship (5,6,7*,19*,20*,21*,22*,23*).

Research has shown it may be difficult to attribute, with any confidence, the therapeutic results of core-based stabilisation exercises associated with improved or specific effects on abdominal muscle function (5). Likewise, a systematic review with meta-analysis concluded that "There is strong evidence stabilisation exercises are not more effective than any other form of active exercise in the long term" (24*). Results from the meta-analysis indicated a trend favouring core stability exercises which were not regarded as clinically significant, as any reduction in favour of stabilisation exercises fell below the minimal clinical important difference levels. Robust data from this meta-analysis considers that stabilisation exercises offer no benefit over alternative forms of exercises in the long term (24*). Outcomes from studies have found that there is a trend of worse fear-avoidance belief questionnaire (FABQ) scores with stabilisation exercises, compared with stationary bikes, sling exercises and general exercises. The rehabilitation strategy surrounding stabilisation exercises has been challenged with the suggestion that it could encourage unhealthy thoughts and beliefs about pain and movement (25). This will be discussed further towards the end of the article.

2. Motor Control Exercises

Motor control exercise (MCE) is founded on the principles of motor learning to integrate control and coordination of the spine muscles for functional activities (Video 1). The basis on which MCE may work follows the principles of spinal stability (2,3,6). Exercise should be individualised and tailored upon initial assessment of each patient's posture, muscle activation and coordination. Clinical assessment of this can be challenging as laboratory-based biomechanical and electromyographic measurements are traditionally used in motor control studies.

Muscles having poor control (commonly the deep trunk muscles including LM and TrA), may benefit from MCE as well as overactive muscles (commonly the large external trunk muscles including rectus abdominis and erector spinae muscles). The premise behind the MCE strategy is the assumption that motor control patterns are maladaptive, and that clinical benefit will be derived from 'correction'. Very low to moderate quality evidence shows that MCE is no more effective that other exercise types in reducing pain and disability in LBP patients (26*,27*).

3. Pilates

A popular exercise method touted to resolve chronic back pain is Pilates. Research showed that Pilates (specific trunk exercise), in comparison to a stationary bike programme, produced significant improvement in pain and disability at 8 weeks. FABQ scores were reduced in both groups. The results indicated that at 6 months, an important time point for assessing chronic pain, there were no between-group differences; both exercise programmes were effective in reducing pain, disability and catastrophising in the long term. If a patient with LBP adheres to either specific trunk exercises such as Pilates or a general exercise such as stationary cycling, it is reasonable to think that similar improvements will be achieved (28).

Interestingly the Pilates group was performing significantly better than the stationary bike group initially, but not at the 6-month follow-up. The short-term benefits may be due to patients' expectations being met (by receiving perceived relevant exercises), which in turn could activate the reward analgesia system (28).

4. Walking Programme

Conventional biomedical thinking may have you believe that a specific intervention, owing to its targeted nature, should outperform a more general exercise programme and not just a bit but significantly. When specific back strengthening exercises were compared to a walking programme (both performed twice weekly for 6 weeks), both groups improved. The walking programme was found to be as effective as the specific back strengthening programme for chronic LBP. All participants were sedentary at the start of the study, so possibly the take-home message is that physical activity is the most important factor, not necessarily the specifics of the activity (29).

5. Loading or Strength and Resistance Exercises

A study by Aasa et al. directly compared low-load motor control (LMC) exercises with high-load lifting (HLL) in back pain patients (30*). Both exercise groups progressed over an 8-week period; the LMC group incorporated more dynamic and functional activities while maintaining a neutral spine, whereas the HLL group performed a deadlift with increasing weight. Both interventions resulted in significant within-group improvements in pain intensity, strength and endurance. Interestingly the LMC group showed significantly greater improvement in functional scores, although there were no

EXERCISE THERAPY SHOULD BE INTEGRATED INTO A PATIENT-TAILORED BIOPSYCHOSOCIAL REHABILITATION PROGRAMME RATHER THAN APPLIED AS A STAND-ALONE TREATMENT

between-group differences in pain, strength and endurance tests. Thus, LMC intervention may result in superior outcomes in activity and movement control compared to an HLL intervention, but not in pain intensity, strength or endurance (30*).

Although receiving two quite different exercise programmes, both groups made improvements. Interestingly, both groups received pain education – addressing a psychosocial component that may have balanced the playing fields. It may also be interpreted that the LMC group had greater movement variety in their activities compared to the HLL deadlift. There is data, that will be discussed later in this article, to suggest reduced variability may be a factor contributing to LBP, thus the LMC exercises may have had a positive effect on this underlying issue (30*).

Both strength/resistance exercise and coordination/stabilisation exercise programmes have a small but significant effect on LBP. A greater effect size has been shown in exercise programmes that incorporate whole-body strength/resistance activities. The evidence fails to conclusively show the superiority of one exercise type over the other (31). This suggests, therefore, that any exercise programme that is adhered to is probably the most effective (16*,17*).

6. Deconditioning and Reconditioning Exercises

This is a case of the chicken or the egg – which came first? Consensus is lacking on firstly, an initial decline in fitness and subsequent development of chronic LBP; secondly, development of chronic LBP resulting in subsequent deconditioning; and thirdly, the impact of restoration of physical activity and aerobic fitness in terms of recovery from chronic LBP. There is minimal evidence that chronic LBP patients suffer from disuse and physical deconditioning, before or after the onset of acute or chronic LBP (32,33). The relation between the level of activity and back pain may in fact be a U-shaped curve. Both inactivity or sedentary lifestyle and excessive activities (physically strenuous back activities or sports) present an increased risk for back pain (34).

7. High-Intensity Interval Training

High-intensity interval training (HIIT) is one of the most popular fitness trends worldwide, involving short bursts of very intense activity interspersed with short periods of rest or low-intensity exercises. HIIT offers an alternative to moderate-intensity continuous training (MICT). Whereas continuous exercise at high intensity leads to exhaustion quickly, alternating bursts of high and low intensity (or rest) allows patients to easily achieve high-intensity levels. HIIT is also a time-efficient form of exercise that may overcome motivational barriers for some patients (35*).

A study comparing HIIT to MICT for chronic LBP proved it to be a feasible, well-tolerated, and effective therapeutic modality. It showed greater improvements in disability and exercise capacity than MICT. The HIIT protocol consisted of bouts of cardiorespiratory training using a cycle ergometer, general resistance training exercises and core muscle training (36*); essentially a combination of multiple exercise types discussed above.

In a further study using HIIT protocols on chronic LBP patients, participants were randomly assigned to one of four groups performing high-intensity cardiorespiratory interval training coupled with (i) general resistance training; (ii) core strength training; (iii) combined general resistance and a core strength programme; or (iv) mobility exercises, which involved six exercises aimed to improve the mobility of the trunk and hip complex. Results showed that all four groups had clinically relevant improvements, which suggests that HIIT can be combined with other modalities when setting up exercise therapy for chronic LBP (37*).

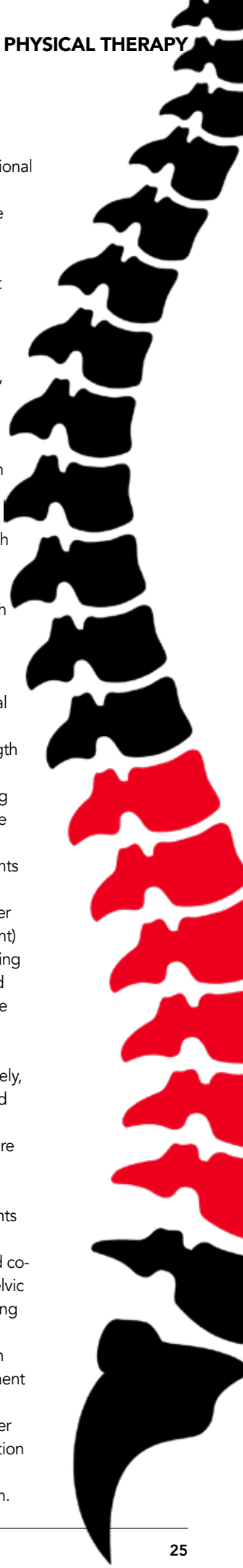
Postural and Movement Characteristics or Deficits

A common belief held by clinicians is that identifying and correcting movement or postural aberrations can result in improved pain and activity. In order to 'normalise' dysfunctional movement, clinicians would need an empirical basis for (i) differentiating between normal and dysfunctional movement, and (ii) determining whether correction of the dysfunctional movement might reduce pain and activity limitation. And here lies the problem with excessive heterogeneity across studies.

A systematic review by Laird et al. assessed 43 studies of lumbopelvic kinematics in patients with and without back pain (38*). In comparison to those not in pain, reduced proprioception, slower movement and reduced range of motion (lumbar flexion, lateral flexion and rotation) were common across back pain patients. The implications of reduced proprioception are that people with LBP are less 'movement-aware' with potentially reduced postural control. Key questions remain, such as Are these deficits a result of or a cause of LBP? And, potentially, Were these deficits present before the development of LBP? Structural factors including the size of the lumbar lordosis, pelvic tilt, leg-length discrepancy, and the length of abdominal, iliopsoas and hamstring muscles are not associated with the occurrence of LBP (39*).

Research has shown that patients with LBP experience 26% greater spine compression and 75% greater lateral shear (normalised to moment) than asymptomatic individuals during controlled exertions. The increased spinal loading resulted from muscle coactivation measured across 10 muscles using electromyography data. When permitted to move freely, the patients with LBP compensated kinematically in an attempt to minimise external moment exposure (40). Likewise, fear of movement, kinesiophobia, is associated with greater trunk stiffness in LBP patients (41*). Therefore patients with LBP have greater muscle activation and co-contraction with reduced lumbopelvic movement. This is reasonable seeing as the muscular response to pain or the threat of pain is protective in nature, aiming to minimise movement (42).

So, one might question whether exercises that promote co-contraction and increased core stiffness could potentially perpetuate the problem.



Video 2. Graded Exposure Exercises for Low Back Pain (Courtesy of YouTube user Physiotutors) https://spxj.nl/3q5SRRf

Video 3. The BEST Exercise for Low Back Pain according to Research (Courtesy of YouTube user Physiotutors) https://spxj.nl/3ej0NMa

As with the pelvic floor, it has been shown that hypertonic muscles (more common than initially perceived), contribute to pelvic pain and dysfunction in the area. Relaxation and lengthening, rather than generic Kegel strengthening is a treatment goal for some of these patients. Similarly 'turning off' some muscles to allow for freedom of movement may be necessary for LBP patients. Reduced movement may not be due to weakness but rather increased activation of a muscle, stiffening the joint and restricting movement. Thus freedom of movement, both physically and psychologically, should be a goal during treatment (Video 2).

Research shows that LBP individuals present with reduced gait speed and reduced stride length compared to individuals without back pain. It is possible that individuals with LBP use a strategy of slower walking velocity and slightly reduced stride length to minimise the kinematic and kinetic demands of walking. Strong evidence highlights altered phase relations between motion in the pelvis and thorax during walking in individuals with persistent LBP. The pattern of coordination, or relative motion, between the upper trunk and pelvis in the axial plane is speed-dependent in healthy controls. Becoming more anti-phase as speed increases. Contrary to this, LBP individuals exhibit greater in-phase movement patterns. There is an inability to dissociate the trunk and pelvis. During fast walking, anti-phase coordination helps to generate elastic recoil between the thorax and the pelvis. This may explain why individuals with LBP, presenting with reduced anti-phase coordination, walk slower and with a shorter stride length (43*).

Individuals with LBP also have greater lumbar paraspinal activation during walking. Over time, this increased activation in individuals with LBP may contribute to recurrence due to increased compressive spinal loading. Increased paraspinal activation may also be the cause of the reduced anti-phase coordination as a result of increased axial stiffness limiting dissociation of motion between the upper trunk and the pelvis (43*).

Decreasing trunk stiffness may automatically increase movement variability in LBP patients. Focusing on decreasing stiffness through more relaxed movements across a variety of tasks or activities, such as gait, could be a treatment strategy for LBP sufferers.

Final Thoughts

Exercise therapy has been shown to alter a number of psychological factors correlating with the change in self-rated disability. It is impossible to say whether the psychological changes followed the improvement in symptoms and function after exercise therapy or vice versa. Even in cases where cognitive-behavioural therapy has not been addressed, physical activity has decreased the level of pain catastrophising. This may be due to 'enforced' exposure to activities that challenge the notion of movement being a threat, allowing the patient to enjoy the positive experience of completing the given exercises without undue harm (5).

There is an argument that performing (any) exercise is more important than the type or the targeted physical aspect of the exercise. The biological mechanisms explaining the positive effects of exercise therapy are not yet fully understood. Improvements in clinical outcomes do not correlate to local (muscle or joint strength, length or endurance) changes. Other explanations that the derived benefit is from more central effects include:

1. perhaps a correction of a distorted 'body schema';
2. altered cortical representation of the back;
3. modification of motor control patterns as a consequence of a reweighting of sensory input; and
4. a positive therapist–patient interaction/relationship (44*).

Studies have reported a correlation between psychological status and LBP or pain tolerance. However, the efficacy of treatments that solely focus on psychological factors has been shown to be small (45*). In addition to providing physical benefits, exercise therapy seems to positively influence psychological variables such as fear-avoidance beliefs, catastrophising and self-efficacy regarding pain control. This may result from patients not receiving harm while completing exercises, regaining trust and confidence in their back function, thereby adjusting irrational thoughts and beliefs about their back pain (44*).

If a treatment is effective, then the establishment of its active ingredient is immaterial. Basically, if an exercise activity improves a patient's clinical outcome then don't over-think the biomedical reasoning behind it. Accepting that chronic LBP may be a problem of cortical reorganisation and degeneration, it is also possible that exercise therapy may have served to normalise this. There appears to be a significant dose–effect relationship between adherence to the exercise and outcome. Thus choosing an exercise that is relevant, enjoyable, accessible, cost-effective and preferred by the patient will facilitate adherence to therapy.

As therapists, we should be aware of the potential danger of applying pain-contingent stabilisation exercises

only. Focusing on nothing else but stabilisation exercises contradicts the current understanding of pain and neuromuscular interactions, and thus does not comply with a biopsychosocial approach to treatment. Stabilisation exercises prescribed to patients who have a moderate or high fear of movement might trigger or exacerbate their kinesiophobia (eg. "I have to keep my back always stable and I am therefore not allowed to move my back") and catastrophic thoughts (eg. "If I do not continuously activate my stabilisation muscles, my back will be prone to severe injuries"). Stabilisation exercises can be integrated with other exercise types and in a biopsychosocial treatment programme, comprising various components such as stress management, education and activity self-management (23*,25).

Exercise therapy should be integrated into a patient-tailored biopsychosocial rehabilitation programme rather than applied as a stand-alone treatment (eg. a time-contingent approach to exercise therapy should be applied). There is consensus for individualised, 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 (46,47). Thus, education should play a key role, with supervised exercise and behavioural therapy as other first-line therapeutic options (48). Interventions such as supervised or individualised exercise therapy and self-management techniques enhance exercise adherence and improve self-efficacy, which is one of the main predictors of treatment outcomes for patients with chronic pain. It is unlikely that one kind of exercise training is the single best approach to treating chronic LBP. Studies provide evidence that 'active therapies' are the most effective, including Pilates, resistance, stabilisation/motor control and aerobic exercise training, where the patient is guided and actively encouraged to move and exercise in a progressive fashion (Video 3) (16*,47). These modes of exercise training also appear to be more effective than therapist hands-on and hands-off treatments (49).

Indeed, if the main aim of exercise therapy in chronic LBP is to get patients moving again and be able to confront their fears about physical activity and movement, then the method used to do this may be immaterial. This has a fortuitous side-effect that it would open up the array of potential options for the type of exercise to be carried out, allowing consideration of the all-important issues of cost, access to facilities and patient preference. The focus should be placed on the human being doing the exercise rather than just their back!

References

Owing to space limitations in the print version, the references that accompany this article are available at the following link at the following link https://spxj.nl/3ADvWl9

KEY POINTS

- There are many different types of exercise that have a positive effect on LBP.
- No one exercise type is superior to another in clinical outcomes.
- Positive clinical effects from exercise for LBP are not directly attributed to physiological changes in muscle thickness, strength, mobility or endurance.
- Stabilisation exercises that re-enforce a patient's beliefs in their pain, 'instability,' and catastrophising will negatively impact their recovery.
- Deconditioning is not clearly associated with LBP.
- Increased trunk stiffness, decreased ROM and speed of lumbar movement are associated with LBP.
- Kinematic and intramuscular reduction in variability is associated with LBP.
- An exercise or physical activity that allows patients to safely confront their movement fears and anxieties will be most beneficial.
- There is a significant dose–effect relationship between adherence to the exercises and positive outcomes.
- Choosing an exercise that is relevant, enjoyable, accessible, cost-effective and a patient preference will facilitate adherence to therapy.
- Consider a rehabilitation programme combining different exercise variables (high and low load) and different exercise types giving greater variability and freedom of movement.

DISCUSSIONS

- What do you believe is a key underlying element of a successful exercise programme in LBP patients?
- What exercises do you traditionally use for LBP, and why?
- Would you allow your LBP patients to choose their preferred exercise or activity?

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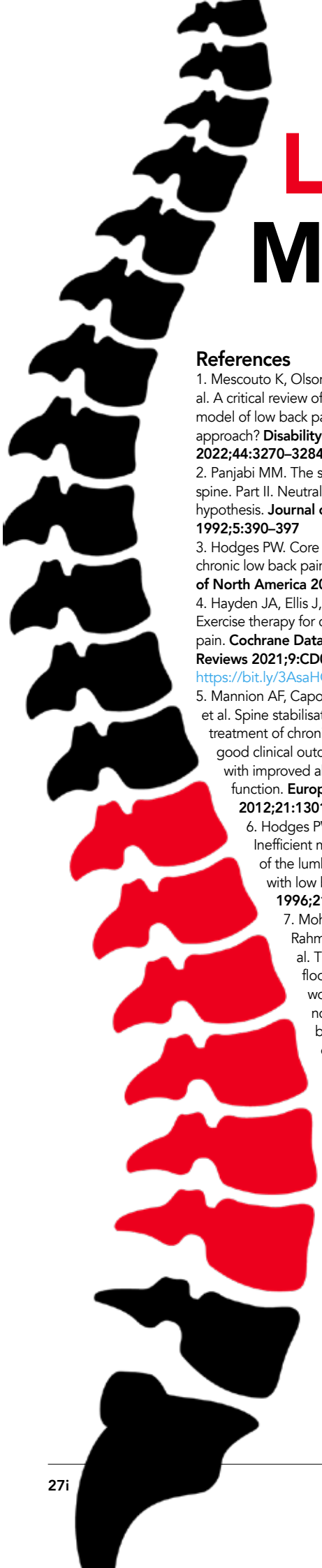

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●● MANY PATIENTS WITH LBP HAVE GREATER MUSCLE ACTIVATION AND CO-CONTRACTION WITH REDUCED LUMBOPELVIC MOVEMENT ●●

STABILISATION EXERCISES PRESCRIBED TO PATIENTS WHO HAVE A MODERATE OR HIGH FEAR OF MOVEMENT MIGHT TRIGGER OR EXACERBATE THEIR KINESIOPHOBIA

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