



REVIEW OF MISTAKEN CLINICAL BELIEFS

Musculoskeletal myths

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Summary This paper discusses a number of common myths in the musculoskeletal pain management and rehabilitation/athletic development fields. The origins or rationale for these beliefs are reviewed. New scientific evidence disputing or refuting the myth is then presented followed by an explanation and evidence for an updated perspective.

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Introduction

Back pain affects over 85% of the population at some time in their lives (Spitzer et al., 1987). The disability problem associated with low back pain (LBP) has been termed an epidemic (Waddell and Burton, 2005). Even when not disabling, LBP is associated with frequent and persistent activity-limiting recurrences (Croft et al., 1998).

Waddell and Burton (2005) assert that modern medical management for LBP has proven to be a failure. The biomedical paradigm, by focusing on symptoms with cascading diagnostic and invasive medical interventions, aimed at frequently coincidental structural findings, has

failed to provide adequate solutions. While solutions to the back problem remain elusive, there are a number of myths that can be exposed, which shed light on a promising new direction for helping patients control their LBP. This new paradigm focuses on building activity tolerance, rather than merely providing symptomatic relief. It is patient-centered in that care seeks to aid patients in regaining independent function, return to work, and resumption of prior levels of social participation.

There are many sacred cows in the fields of musculoskeletal pain (MSP) management, and strength/conditioning practice. Such beliefs or practices are considered by some to be exempt from criticism or questioning, despite containing inaccurate dogmas, and this article will attempt to expose some of these myths, while proposing alternative, science-based, explanations.

Hackbarth and Boccuti (2011) writing a *Perspective* in the *New England Journal of Medicine* recently addressed

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the acute need to transform medical education in order to enhance health care value, "To manage this transition, physicians will need the requisite new perspectives and skills for evidence-based practice, effective use of information technology, quality measurement and improvement, cost awareness, care coordination, leadership of interdisciplinary teams, and shared decision making. Mastering the necessary skills and shifting one's perspective on what it means to be a good doctor will be a career-long endeavor that should begin during medical school and residency."

Myth #1 – low back pain is a benign, self-limiting condition

It has traditionally been taught that for the vast majority of individuals (75–90%) acute LBP episodes resolve within 4–6 weeks (see Fig. 1) (Hadler, 1986; Spitzer et al., 1987). This is based on insurance surveillance data which mostly tracked disability. Such an excellent natural history has led to the mistaken belief that acute LBP can be managed symptomatically (bed rest and medication) and left alone. However, there are two problems with this perspective. First, the view that most acute episodes resolve quickly and completely is disputed by a number of studies of primary care patients (Croft et al., 1998; Von Korff et al., 1993).

And, second there is a growing body of evidence that it is more cost-effective to attempt to prevent chronicity in those at risk for it, rather than waiting to treat only those in whom it manifests (Marhold et al., 2001; Pincus et al., 2002; Thomas et al., 1999). In fact, if the "decision to treat" is postponed until only the chronic minority are still suffering this would likely backfire since the 7.4% who develop chronic disability account for the majority of costs! (Hashemi et al., 1998; Spitzer et al., 1987).

A number of high-quality, prospective studies (Carey et al., 2000; Cherkin et al., 1996; Croft et al., 1998; van den Hoogen et al., 1998) have looked at the course of first-time acute LBP in non-occupational settings. These studies show that most acute episodes tend to improve rapidly, although not completely, and then run an intermittent, chronic course with less severe "flare-ups" (see Fig. 2). The original episode frequently lasts for as long as 3 months - not 4–6 weeks - before it can be said to have

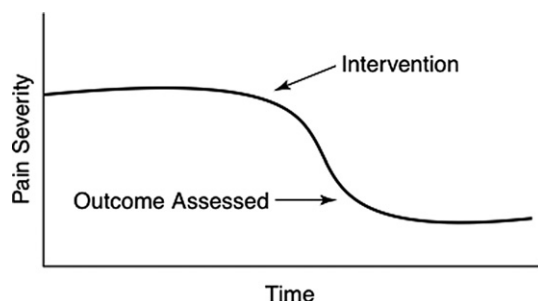


Figure 1 Presumed natural history of LBP Reproduced from Deyo RA. Practice variations, treatment fads, rising disability. Do we need a new clinical research paradigm? Spine 1993; 18, 2153–2162.

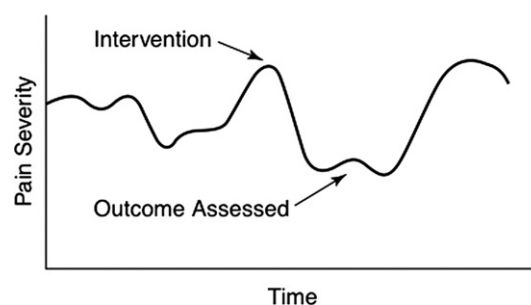


Figure 2 Actual course of LBP Reproduced from Deyo RA. Practice variations, treatment fads, rising disability. Do we need a new clinical research paradigm? Spine 1993; 18, 2153–2162.

remitted (Cherkin et al., 1996; Croft et al., 1998). The predictable "flare-ups" are mild to moderately activity-limiting and painful and lead to general dissatisfaction with the symptoms (Cherkin et al., 1996; Croft et al., 1998; van den Hoogen et al., 1998).

A systematic review of epidemiologic data on the natural history and course of LBP reported the following (Hestbaek et al., 2003):

- no evidence for the popular claim that 90% of back pain episodes resolve spontaneously in 1 month
- return to work does not equate with recovery since chronic patients may "move" in and out of employment or return to less demanding jobs
- patients may stop consulting with their medical physician, but this does not mean they are recovered

Hestbaek's study questions the value of short-term recovery as a valid outcome measure for a recurrent disorder such as back pain. The authors propose long-term prevention of recurrences as a more relevant measure of the success of a therapeutic intervention. According to Deyo and Weinstein (2001), "the emerging picture is that of a chronic problem with intermittent exacerbations, analogous to asthma, rather than an acute disease that can be cured."

Myth #2: the cause of musculoskeletal pain can be found on an X-Ray or MRI?

Structural evidence of a lumbar disc herniation in a patient with appropriate symptoms is present over 90% of the time (Boden et al., 1990a; Hitselberger and Witten, 1968; Rothman et al., 1984; Wiesel et al., 1984). Unfortunately, even when utilizing advanced imaging techniques such as myelography, CAT-scans, or magnetic resonance imaging (MRI) the same positive findings are also present in 28–50% of asymptomatic individuals (Boden et al., 1990a; Brandt-Zawadzki et al., 1995; Hitselberger and Witten, 1968; Jensch et al., 1994; Rothman et al., 1984; Wiesel et al., 1984). Similarly, in the neck the false positive rate with diagnostic imaging has been reported to be as high as 75% with an asymptomatic population (see Fig. 3) (Boden et al., 1990b; Teresi et al., 1987). Thus, imaging tests have high

sensitivity (few false negatives) but low specificity (high false positive rate) for identifying symptomatic disc problems.

Furthermore, the presence of structural pathology in an asymptomatic individual does not predict a greater likelihood of future problems (Borenstein et al., 2001; Carragee et al., 2004)! Borenstein et al. conducted MRI's on 67 asymptomatic people. 31% have abnormality of discs or the spinal canal (Borenstein et al., 2001). The MRI findings were not predictive of future LBP. Individuals with the longest duration of LBP were not those with the greatest anatomical abnormalities. Carragee et al. studied discograms and reported that a painful disc injection did not predict LBP on follow-up at 4 years (Carragee et al., 2004). While discograms have high sensitivity for identifying tears in asymptomatic patients, it was the psychometric profiles that were found to strongly predict future LBP and work loss.

More Imaging Centers A Good Thing?
Researchers at Stanford University found
(Baras et al., 2009):

- The more imaging centers
- The more MRI's ordered
- The more Surgeries Performed



Figure 3 Degenerative Joint Disease in an active person's neck.

Just as in the spine, MRIs have demonstrated high levels of structural pathology in the extremities of asymptomatic individuals. Fredericson et al. (2009) reported that "asymptomatic elite athletes demonstrate MRI changes of the shoulder (swimmers and volleyball players) and wrist (gymnasts) similar to those associated with abnormalities for which medical treatment and sometimes surgery are advised."

MRIs of the shoulders of ninety-six asymptomatic individuals were evaluated to determine the prevalence of findings consistent with a tear of the rotator cuff (Sher et al., 1995). The over-all prevalence of tears of the rotator cuff in all age-groups was 34%. There were fourteen full-thickness tears (15%) and nineteen partial-thickness tears (20%). These tears were increasingly frequent with advancing age and were compatible with normal, painless, functional activity.

Detailed MRIs of asymptomatic dominant and non-dominant shoulders of elite overhead athletes were obtained (Connor et al., 2003). A 5-year follow-up interview was performed to determine whether MRI abnormalities found in the initial stage of the study represented truly clinical false-positive findings or symptomatic shoulders in evolution. Eight of 20 (40%) dominant shoulders had findings consistent with partial- or full-thickness tears of the rotator cuff as compared with none (0%) of the non-dominant shoulders. Five of 20 (25%) dominant shoulders had MRI evidence of Bennett's lesions compared with none (0%) of the non-dominant shoulders. None of the athletes interviewed 5 years later had any subjective symptoms or had required any evaluation or treatment for shoulder-related problems during the study period. Thus, MRI alone should not be used as a basis for operative intervention in this patient population.

The same high false positive rate with MRIs has been shown in the knee of asymptomatic individuals. Beginning in one's 30's there is degeneration of the meniscus which increases with age even in asymptomatic people (Guten et al., 2002). According to De Smet et al. (2008) "False-positive MR diagnoses of medial meniscal tears are more common for longitudinal tears than other tear types and are also more common with MR abnormalities at either the superior surface or the meniscocapsular junction. Spontaneous healing of longitudinal tears accounts for some false-positive MR diagnoses."

The unfortunate result of using tests with high false positive rates in asymptomatic individuals in those with symptoms is that patients who may have coincidental findings are labeled as having pathology (Bogduk, 2000). The spinal column is not so vulnerable after all, and has much greater adaptive potential that it is often given credit for.

A more appropriate use of diagnostic imaging is in patients with a history or examination of red flags for tumor, infection, medical disease or fracture. Or, in patients with nerve root complaints which are unresponsive to conservative care and may require an invasive procedure such as an epidural.

Myth #3: all back pain patients are alike

85% of back pain patients have been given the label of non-specific back pain (Spitzer). At the 2nd International Forum

of Primary Care Researchers on LBP it was concluded that achieving a validated classification system for non-specific back pain was the top research priority (Borkan et al., 2002).

Laboeuf-Yde et al. (1997) and Laboeuf-Yde and Manniche (2001) suggested that viewing all LBP patients as homogenous is inaccurate. She went as far as to say that this would paint meaningful treatments for small, unique sub-groups of patients as ineffective (see Fig. 4). In fact, treatment matched to sub-group classification has been found to be superior to generic evidence-based treatment (see Fig. 5) (Fritz et al., 2003; Brennan et al., 2006). In particular, there are patients who will respond best to manipulation, directional preference exercise – e.g. McKenzie, or stabilization exercise. When patients are given the “matched” treatment they achieve better outcomes than if given the evidence-based standard of care – general reactivation advice.

Emerging evidence is showing that this classification system approach can be utilized in a hospital system to triage patients through multidisciplinary care pathways likely to improve outcome and reduce costs (Paskowski et al., 2011).

Myth #4: “let pain be your guide”

For over 100 years an acute pain or trauma perspective has “ruled” in the management of MSP. While the creed “if it hurts don’t do it” is effective for traumatic injuries it leads to a downward spiral of deconditioning in cases of chronic, persistent repetitive strain (see Fig. 6). It has been shown that attitudes and beliefs are important to recovery (Abenheim et al., 2000; Houben et al., 2005; Ostelo et al., 2003; Rainville et al., 2000; Vlaeyen and Linton, 2000) As Proust (Le Cote de Guermantes) said “For each ailment that doctors cure, they produce 10 others in healthy individuals by inoculating them with the pathogenic agent, 1000× more virulent than all microbes – the idea they are ill.”

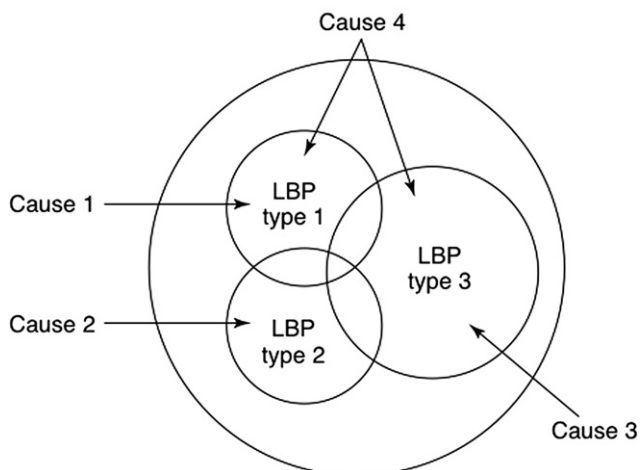


Figure 4 LBP population is heterogenous from Laboeuf-Yde C., Lauritsen JM, Lauritzen T. Why has the search for causes of low back pain largely been nonconclusive? Spine 1997; 22, 878.

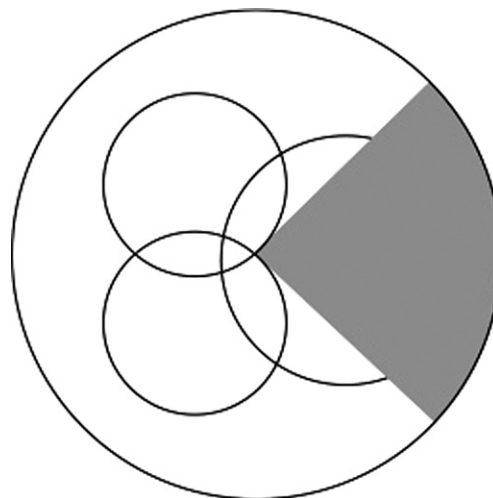


Figure 5 Intervention will only succeed if “matched” to correct sub-type From Laboeuf-Yde C., Lauritsen JM, Lauritzen T. Why has the search for causes of low back pain largely been nonconclusive? Spine 1997; 22, 878.

Appropriate patient advice has been shown to be extremely valuable (Burton and Waddell, 1999). This is particularly evident when that advice is given in a biopsychosocial context, which reduces pain-related anxiety and encourages patients to gradually resume normal activities (Frost et al., 2000; Klaber Moffet et al., 1999; Lindstrom et al., 1992; Linton et al., 1993; Malmivaara et al., 1995). Biopsychosocial advice focuses on the consequences of pain – such as activity limitations, rather than the pain itself.

Myth #5 - acute & chronic pain are similar

Pain is an alarm, signaling tissue damage or threat (see Fig. 7). Withdrawing from a hot iron involves a stimulus from the periphery and a response. This is termed up-



Figure 6 Bed rest.

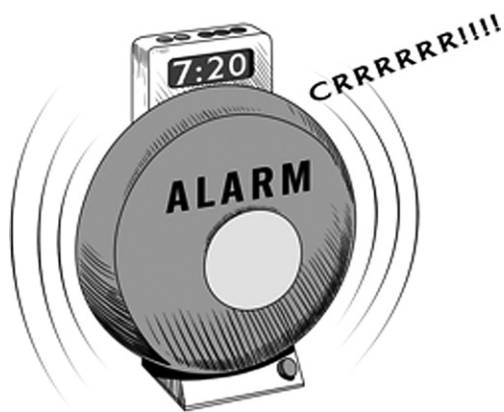


Figure 7 Alarm.

regulation from peripheral tissue to central nervous system (CNS). Acute pain can be understood in a Cartesian way (see Fig. 8). The body receives the input (thermal, mechanical, or chemical) signaling irritation/injury, etc. and a message is sent to the brain which receives it and responds. The brain and body are separate.

What is the problem with this brain/body split?

Pain is not usually proportional to tissue damage or threat. In chronic pain the injury is in the distant past and yet the pain persists. It has been said, "the hurt that you feel becomes the feeling that hurts". Pain thresholds shift downwards in chronic pain so that allodynia occurs – pain felt in response to non-noxious stimuli. This is mediated by glial cells undergoing functional and structural changes, a process that amplifies and distorts nociceptive signals (Gosselin et al., 2010). Melzack (2001) has described how neuro-signatures are transcribed in the CNS from



Figure 8 Descartes's view of up-regulation from the periphery to the CNS.

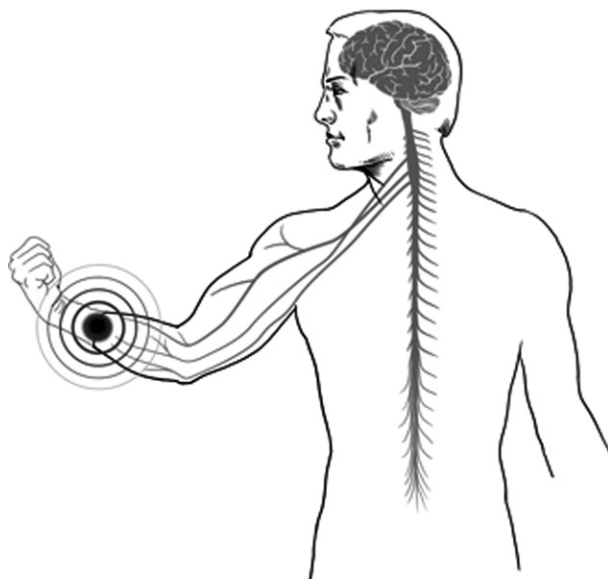


Figure 9 Amputee with phantom pain.

perceived threat which outlast the time it would take for an injured peripheral tissue to heal. A famous example in which pain persists without the tissue itself being involved occurs in phantom limb pain in an amputee (see Fig. 9). A novel treatment - for phantom limb pain or reflex sympathetic dystrophy - which works on down-regulation from the CNS to the periphery - is mirror box therapy (see Fig. 10).

A basic therapy for reducing the threat value of chronic pain is Graded Exposure Training (GET). This involves a combination of behavioral and physical reconditioning. Operant models were the first to be utilized and they emphasized rewarding well behaviors while ignoring illness behaviors as individuals exercised to a time-contingent quota, rather than to pain tolerance (Fordyce et al., 1986; Lindstrom et al., 1992).

GET starts with baseline testing to identify feared activities (perceptual activity intolerances) and pain tolerances. Then patients are gradually exposed to their feared stimuli so that they can experience that it is safe to perform the action. Discussing with people the nature of fear-avoidance beliefs is not as effective as providing direct evidence in this way (Bandura, 1987). "Graded exposures" should be specific to the feared activity (Vlaeyen et al., 2001). Goubert et al. (2002) showed this was necessary, because the effects of exposures to one movement don't necessarily translate to other, dissimilar, movements. In GET the patient should be involved in establishing their own goals for exposure to feared stimuli. Then quotas are agreed upon which are systematically increased until the goal is achieved. Initial quotas should be set to sub-threshold levels to assure success. They are time-contingent, rather than pain-contingent. This enhances motivation and is a form of positive reinforcement. Patient's progress is documented and audited at each treatment session.

Cognitive intervention plus exercise has superior functional outcome to lumbar fusion for chronic LBP patients (Keller et al., 2003)

Patients:

At least 1 year of low back pain.

Nearly ½ of them had prior lumbar surgery

Interventions:

Cognitive intervention plus stabilization exercises or lumbar fusion.

1 year outcomes:

- Sorensen trunk extensor endurance reduced from a mean of 68 s—48 s in the fusion group, unchanged in the exercise group.
- Isokinetic trunk muscle strength reduced nearly 25% in the fusion group and improved 30% in the exercise group.
- Density of back muscles decreased significantly in the fusion group and was unchanged in the exercise group

Myth #6: more is better

Traditional physical therapy rehabilitation or fitness training has taught the exercise mantra of “3 Sets of 10”. But, is more better?

Traditional bodybuilding culture has emphasized isolating individual muscles. But, physiologists say “the brain doesn’t think in terms of individual muscles. It thinks in terms of movement.”

For this reason quality of movement is essential, not quantity.

Janda was the first to show that what is important is not how much weight you can lift, but the skill or quality of the movement pattern that is used (Janda, 1978, 1983) Bigger isn’t necessarily better and the person who can “Lift a house” is typically not the best athlete (see Fig. 11).

In rehabilitation, stability is the objective and not strength. It has been demonstrated that the spinal column without muscles buckles at a load of 90 N (20 lbs). Typical loads in daily life are between 2000 and 4000N. Weight lifters can handle upwards of 20,000N. According to Panjabi (1992), “This large load carrying capacity is achieved by the participation of well-coordinated muscles surrounding the spinal column”.

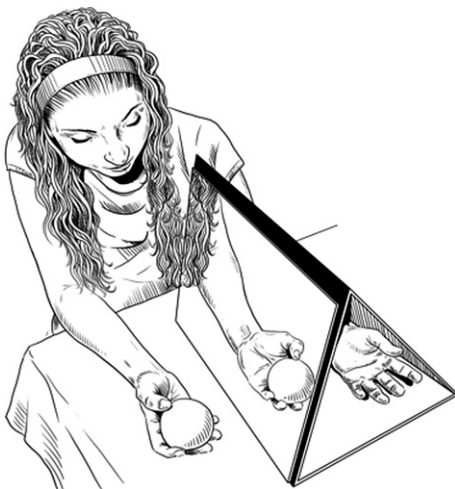


Figure 10 Mirror box therapy.

How does the body resist injury?

Antagonist muscle co-activation is necessary for aiding ligaments in maintaining joint stability during loaded tasks (see Fig. 12). Co-contractions increase spinal compressive load, as much as 12%–18% or 440N, but they increase spinal stability even more by 36%–64% or 2925N (Granata and Marras, 2000). They have been shown to occur during most daily activities (Marras and Mirka, 1990). This mechanism is present to such an extent that without co-contractions the spinal column is unstable even in upright postures! (Gardner-Morse and Stokes, 1998).

At the University of Waterloo Pr Stuart McGill (2002) has measured muscle activation vs spine load during a wide variety of different popular and novel exercises.

- Routine ADLs (Activities of Daily Living) -2000N
- NIOSH (National Institute of Occupational Safety and Health) limit 6400 N
- Acute/Subacute LBP - 3000N



Figure 11 Bigger is not better.



Figure 12 Spine stability requires agonist-antagonist co-activation.

The *sit-up* is a good example where information about spinal load is necessary for clinicians (McGill, 2002). The traditional sit-up involves 3350 N of force (see Fig. 13). If you are dealing with a low back pain patient then you would want to activate the abdominal wall with less strain on the lower back. The McGill curl-up is an excellent alternative with only 2000N of force on the lower back (see Fig. 14).

Trunk extension is another example where spinal load data can influence clinical decisions (McGill, 2002). The *prone superman* involves potentially harmful forces of 4300N (see Fig. 15). The quadruped position is a much better choice for extension training. The *bird-dog* exerts 3000N of force on the spine, while the *quadruped leg raise* between 2000 and 2300N of force (see Fig. 16).

Another popular gym exercise that places the spine in a dangerous position is the *hip press machine* (see Fig. 17). The lumbar spine is placed in kyphosis which adds strain to the posterior disc. One biomechanical modification that will reduce lower back strain is to perform the hip press with one foot on the ground.



Figure 13 Unsafe sit-up.

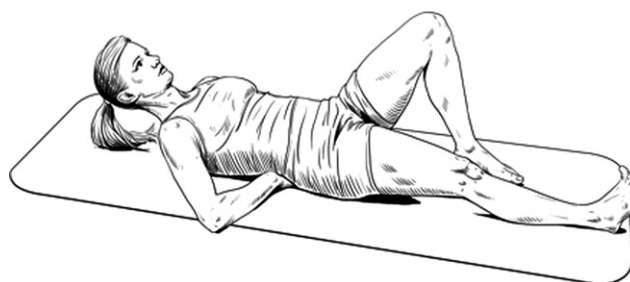


Figure 14 Safe modified curl-up from McGill.

Single leg squats are an example of a challenging exercise especially for the knee (see Fig. 18). Rear foot elevated split squats (popularly known as Bulgarian split squats) are a modification that facilitates better knee stability (see Fig. 19).

Squats are often performed with excessive weight before form is mastered (see Figs. 20 and 21). If the depth is too great given a person's posterior hip capsule or ankle dorsiflexion flexibility, lumbar kyphosis will occur. There are different ways to modify a squat so it can be performed safely. Hip hinging is one such key (see Fig. 22). Performing an arm rest or box squat is an automatic, reflex ("reactive") way to trigger healthful squat mechanics (see Fig. 23).

Myth #7 - the deep intrinsic muscles such as transverse abdominus are the keys to stability

Hodges and colleagues, from the University of Queensland, demonstrated that a specific motor control dysfunction was associated with low back pain (Hodges and Richardson, 1998, 1999). This involves a delayed activation of the transverse abdominus (TA) during arm or leg motions. This was found to be delayed in LBP patients when compared with asymptomatic individuals. Many physical therapy/rehabilitation programs were modified in light of this research to emphasize isolated training of the TA.

However the practical application of this research has been called into question by a spate of recent research papers (Gubler et al., 2010; Kavcic et al., 2004; Mannion et al., 2008, 2008a; Pulkovski et al., 2010; Rankin et al., 2006; Springer et al., 2006).

It has become clear that the lumbar spine is not stabilized by individual muscles, but by an orchestrated symphony of muscles with different muscles taking on greater or lesser roles depending on the movement challenge (Kavcic et al., 2004).



Figure 15 Prone superman.

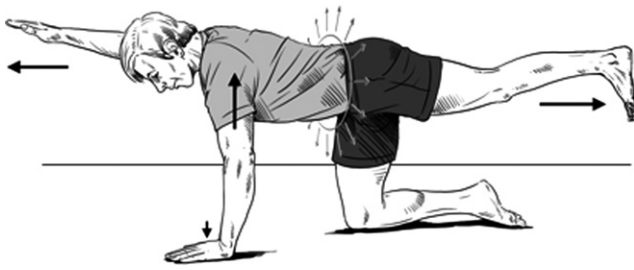


Figure 16 Bird dog.

Can we trust measures of TA activation?

According to Mannion et al. (2008, 2010) the TrA preferential activation ratio is too imprecise to be of clinical use. Of all the thickness measures and indices, the poor reliability of the “TrA preferential activation ratio” renders it the least reliable measure, hence questioning its use in clinical practice.

Can we trust measures of lateral abdominal wall thickness?

Side to side differences in lateral abdominal wall thickness at rest are present in asymptomatic individuals, therefore their presence in LBP patients may not be clinically

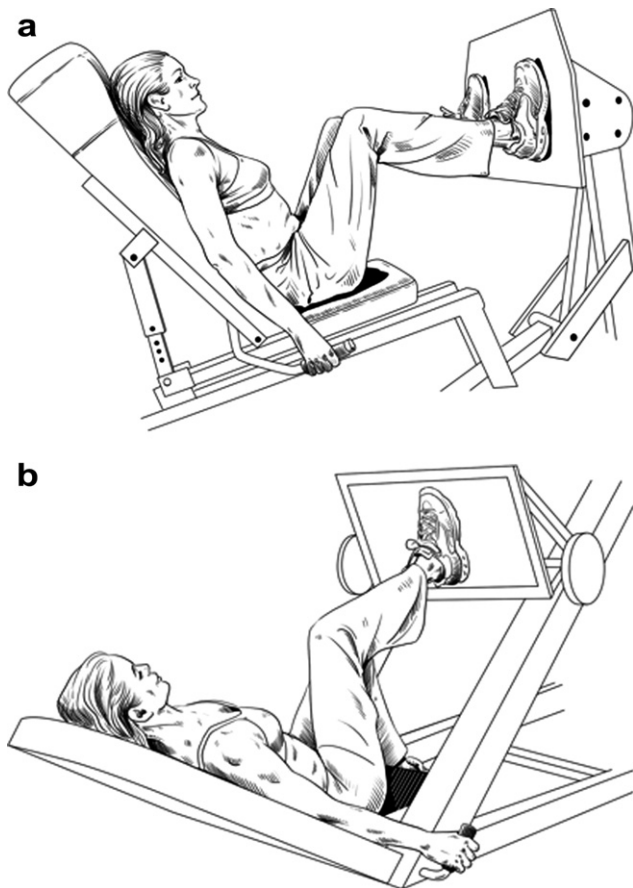


Figure 17 Hip press (a) Unsafe/(b) Safe.

relevant. In both an LBP patient group (Mannion et al., 2008) and an asymptomatic population (Rankin et al.) individual percentage side differences in the thickness of the lateral abdominal muscles were at times large, with group mean values ranging from around 11%–26%, with high standard deviations. If the thicknesses on each side were normalized, i.e. expressed relative to the whole lateral abdominal muscle thickness, side differences were still evident (10–20%). Thus, in clinical practice, caution should be exercised in over-interpreting asymmetries observed in the lateral abdominal muscles in individuals with LBP.

Mannion et al. (2008a) found body mass was the most significant positive predictor of absolute muscle thickness, for all muscles at rest and during abdominal hollowing, accounting for 30–44% variance. Body mass index explained 20–30% variance in TA contraction ratio. Therefore, asymmetries in patients should be interpreted with caution, since they are also common in healthy subjects.

Has abdominal hollowing been shown to stabilize the spine?

Whereas abdominal hollowing has not been shown to stabilize the spine, abdominal bracing has (see Fig. 24). Abdominal bracing increases lumbar axial rotation stiffness during the Active Straight Leg Raise Test of Mens (Liebenson et al., 2009). Abdominal bracing reduces lumbar axial rotation during the Active Straight Leg Raise test (Liebenson et al., 2009).

Myth #8: we should breathe out with exertion - right?

In nearly every gym or boot camp people are encouraged to breathe out with exertion (see Fig. 25). Exhale during a sit-up is a typical example. A reasonable question to ask is whether there a difference between heavy exercise and light to moderate exercise? For example, a person engaged in power lifting or Olympic weight lifting actually is actually taught to inhale prior to the squat in order to increase intra-abdominal pressure (IAP). Then, to hold their breathe in or “sip” air to maintain the high intra-abdominal pressure so they can lift more weight (see Fig. 26).

During low-load training should we entrain exertion with exhalation? If so how will this enhance stability when joints are fatiguing during a sport such as basketball, or an activity such as snow shoveling? When “winded” what is sacrificed - breathing or stability? McGill et al. (1995) show that when a spinal stabilization and respiratory challenge is simultaneously encountered, the nervous system will naturally select maintenance of respiration over spinal stability. An example of this occurs when during repetitive bending or lifting activities the back becomes vulnerable due to poor aerobic fitness, even if the motor control system is well trained (see Fig. 27).

Even when there is good abdominal strength, unless there is proper coordination between the abdominals and the diaphragm, spinal instability will be present during challenging aerobic activities (O’Sullivan et al., 2002; Hodges et al., 2000). Normally during exhalation the abdominals increase their activity while the diaphragm

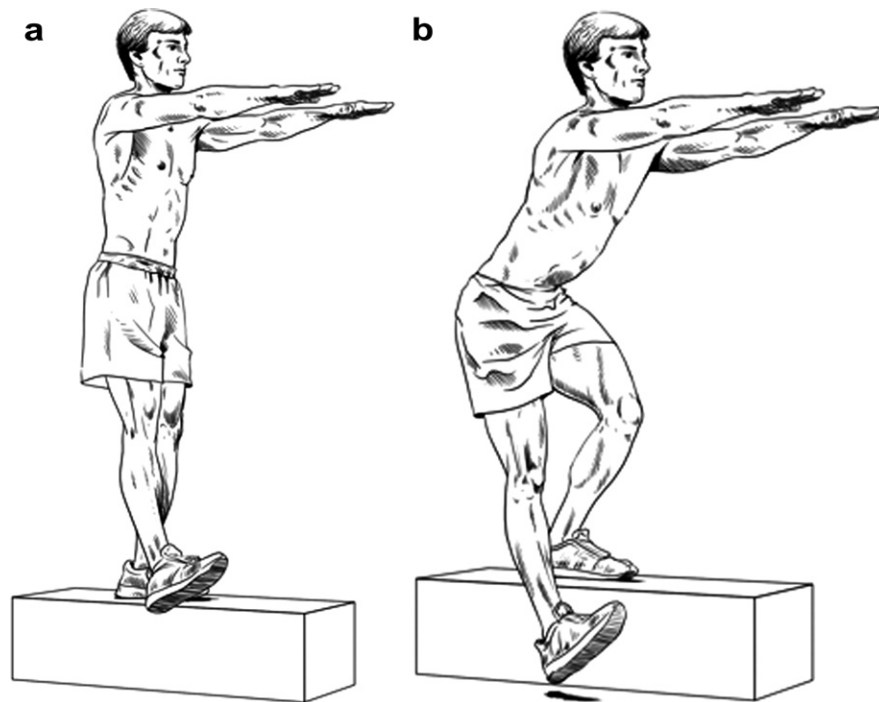


Figure 18 Single leg squats.

decreases its activity. It has been demonstrated that this reciprocal relationship can become dysfunctional if respiratory dysfunction is present, or aerobic demand is too great (Hodges et al., 2000).

It is possible to train improved coordination between the abdominal wall and diaphragm (see Fig. 28). Hodges and Gandevia (2000, 2000a) have shown during a mildly aerobic challenge, involving repetitive limb movements, that tonic activity of the diaphragm and transverse abdominus muscles can be maintained.

Myth #9: why does my back hurt - I do 100 sit-ups every morning?

As mentioned above disc load is high during sit-ups. There are better, low load abdominal exercises such as McGill's partial curl-up, side bridges on the knees, planks, and dying bugs (McGill, 2002).

Another feature of sit-ups relates less to the exercise choice itself, but to its timing. When is the disc most vulnerable? Morning is recognized as a dangerous time for

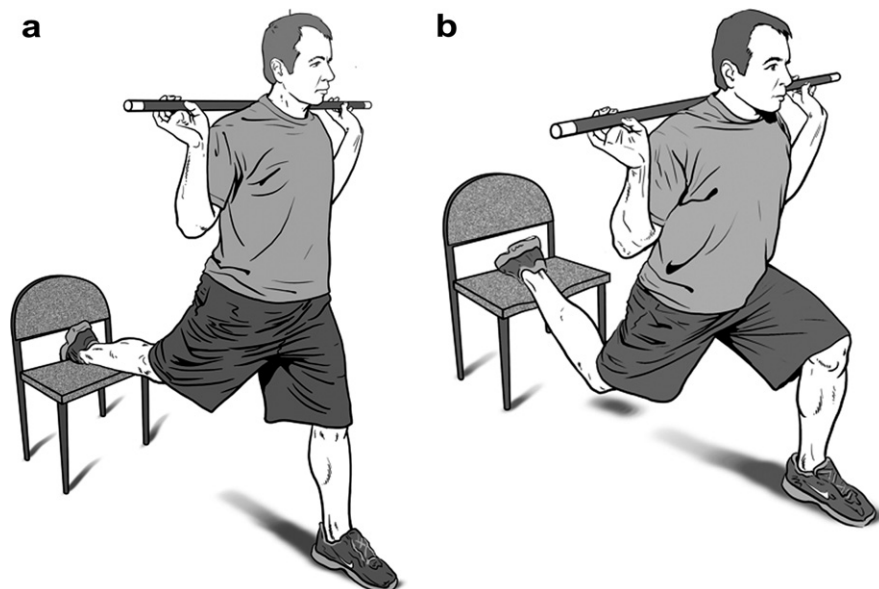


Figure 19 Rear foot elevated split squats.



Figure 20 Unsafe squat.

the spine. Reilly et al showed that 54% of the loss of disc height (water content) occurs in the first 30 min after rising (Reilly et al., 1984). Disc-bending stresses are increased by 300% and ligaments by 80% in the morning (Adams et al., 1987). Avoidance of early morning flexion has been shown to be a wise strategy when recovering from acute LBP (Snook et al., 1998) (see Figs. 29 and 30). Therefore, avoidance of high risk activities such as bending, lifting, twist (BLT), early in the morning, after sitting, or stooping in full flexion, is important in injury prevention.



Figure 21 Safe squat.

Myth #10: no pain no gain

Successful athletes can tell the difference between pain from an injury and that from hard work. If they couldn't they would not last long in their sport. Whereas, some people feel that every hurt equals harm, and then adopt illness behavior, others ignore pain and push beyond their limit, resulting in injury after injury. Learning how to walk this fine line between training or straining is a key to successful pain management, rehabilitation and performance enhancement.

To build capacity the individual needs to work at the edge of his/her capabilities. Therefore, building up will always entail a risk of breaking down. There are different populations to consider - *acute pain from injury*, *recurrent pain not associated with trauma*, *chronic persistent pain*, and those who are *healthy*.

Acute pain from injury

"Let pain be your guide" is a famous adage following trauma. It is perfectly sensible. Especially when there is ligament damage (i.e. sprained ankle), fracture, or similar diagnosis. But, as swelling subsides early, active mobilization is required to prevent poor resolution of the healing tissues.

Recurrent or chronic pain

In recurrent (e.g. weekend warriors) or chronic pain patients, reactivation should be gradual. *Pain is not a good guide* since appropriate activities may be necessarily uncomfortable. Allowing pain to be a guide leads to activity avoidance and deconditioning.

"No pain no gain" is also inappropriate and will lead to overstrain. Many patients who have trouble recovering, either avoid activity entirely or try to return to normal activities too aggressively, leading to a "boom or bust" cycle (see Fig. 31) (Butler and Moseley, 2003).

Whereas some people catastrophize pain, and avoid activities - others, perhaps more stoically may try to ignore pain and overexert (Hasenbring, 2000). People use different "stop rules" with activities. The "as many as can" (AMAC) approach leads to persistence until the task is completed (Vlaeyen and Morley, 2004). The "feel like discontinuing" (FLD) approach leads to termination when the task is not enjoyable. Negative mood has different effects depending on a persons stop-rules. If AMAC is the attitude, then negative mood leads to continuation, but if FLD is the mood - it leads to stopping.

Instead of AMAC or FLD the preferred approach incorporates pacing (Harding and Williams, 1995; Linton, 2000). This is a "quota-based" or "graded exposure" approach (Harding and Williams, 1995; Harding et al., 1998; Linton, 2000). 'Quota-based' consists of the patient's activity levels being gradually increased, in a step-wise manner limited by quota not pain (see Fig. 32).

Healthy

In an athlete "no pain no gain" is true to a degree. Only hard work, sweat and pain will help build the necessary capacity to enhance performance traits. However, pain in

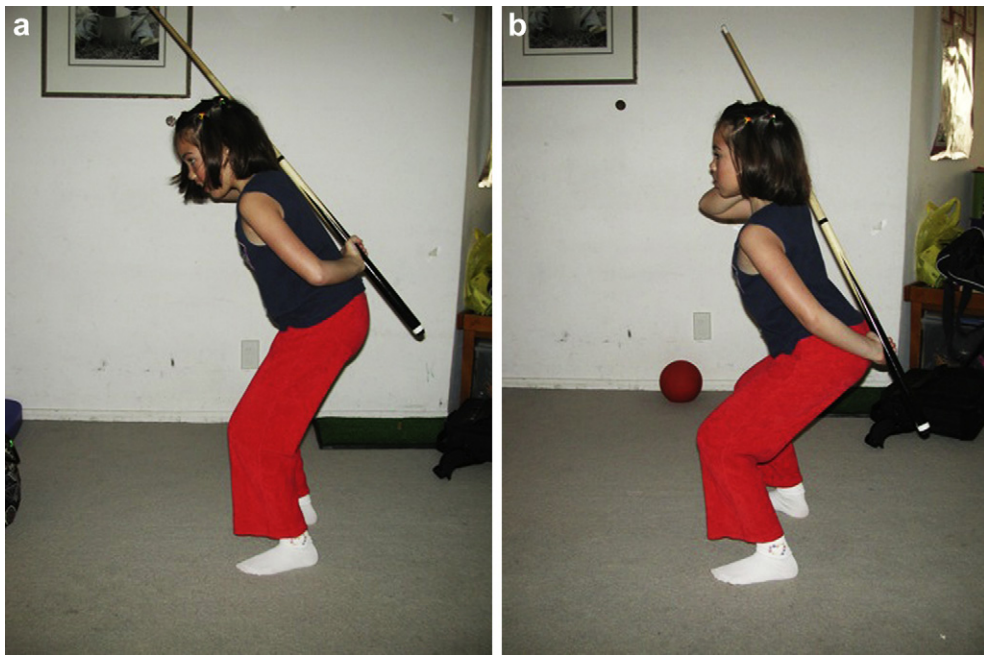


Figure 22 a/b – Hip hinge training with dowel.

joints should be distinguished from pain in muscles. Knee pain, especially medial or lateral joint-line pain, should be seen as a warning sign. Quadriceps or gluteal “burn” would of course be the goal!

A new paradigm

In looking at these ten myths a clear theme emerges. Both “too little too late” and “too much too soon” should be avoided. It is the responsibility of the rehabilitation provider to know the patient or client’s health-injury status, past history, activity goals, and current functional status. The modern approach follows a very simple yet systematic approach. After ruling out sinister “red flags” of serious disease perform a functional assessment.

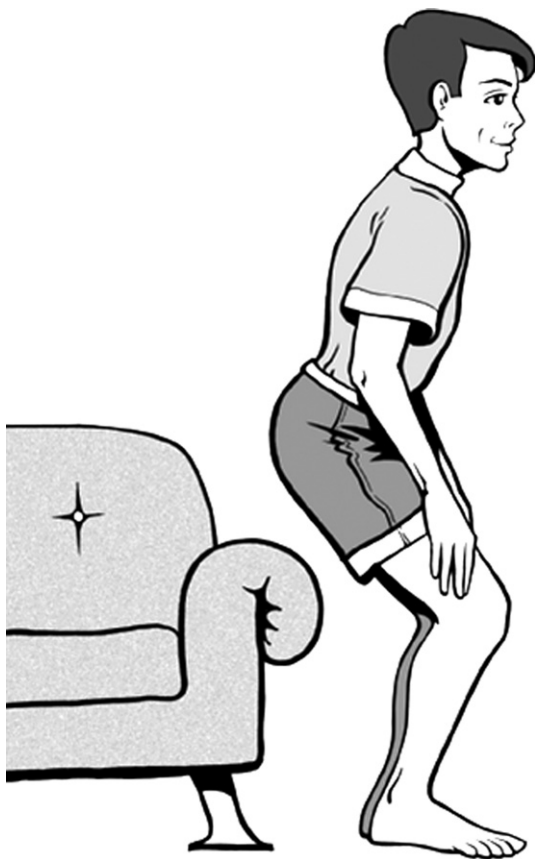


Figure 23 Box or arm rest squat.

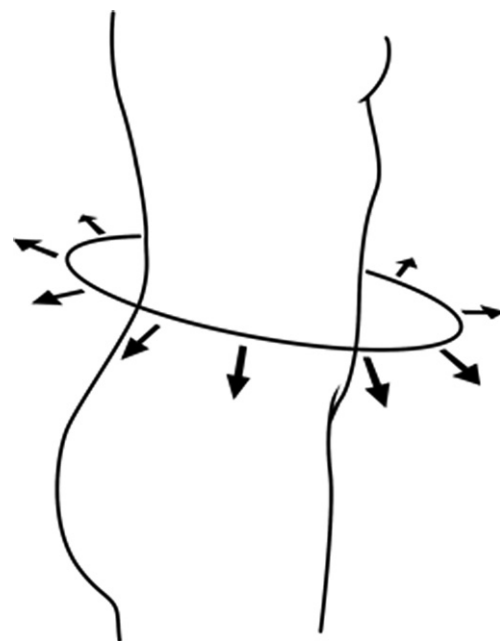


Figure 24 Abdominal bracing.



Figure 25 Exhale with exertion.

Janda (1978) said, "Time spent in assessment will save time in treatment". The functional assessment is the key to distinguishing the site from the source of pain

Site vs Source of pain

Site

- Pain Generator
- Segmental
- Isolated

Source

- Repetitive strain
- Insufficient capacity
- Central Sensitization

When a person is suffering from persistent pain, guarding is an expected yet potentially deleterious response. Janet G Travell (White House Physician to John F Kennedy) said,



Figure 26 Olympic weight lifter holding breathe in.



Figure 27 Snow shoveling.

"after an injury tissues heal, but muscles learn, they readily develop habits of guarding that outlast the injury."

Similarly, in the sports medicine world, according to Stanley Herring (1990) (team physician N.F.L. Seattle Seahawks), *"signs and symptoms of injury abate, but these functional deficits persist.... adaptive patterns develop secondary to the remaining functional deficits."*

Clearly, if guarded movements are memorized and persist even in the absence of pain, then faulty movement patterns will be reinforced over time. As Aristotle said, *"Practice doesn't make perfect, it makes permanent"*. The key is to reassure patients and to find individualized therapies that reduce painful movements. It has been shown that this type of empirical approach leads to predictable between-session improvement (Hahne et al., 2004; Tuttle, 2005, 2009). This patient-centered approach is in stark contrast to traditional approaches which follow pre-determined protocols, based on a specific diagnosis.

Treating the biomechanical source of pain instead of the site of symptoms is based on a concept called regional interdependence, Mascal et al., 2003; McGill et al., 2003; Powers, 2010; Sciascia and Kibler, 2006; Wainner et al., 2007). This is the theory that dysfunction of one region is responsible for dysfunction in another.

Functional assessment is a "missing link" in the traditional medical-orthopedic assessment of musculoskeletal

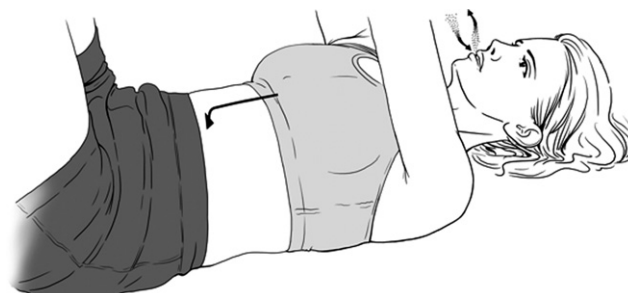


Figure 28 Breathing and bracing.

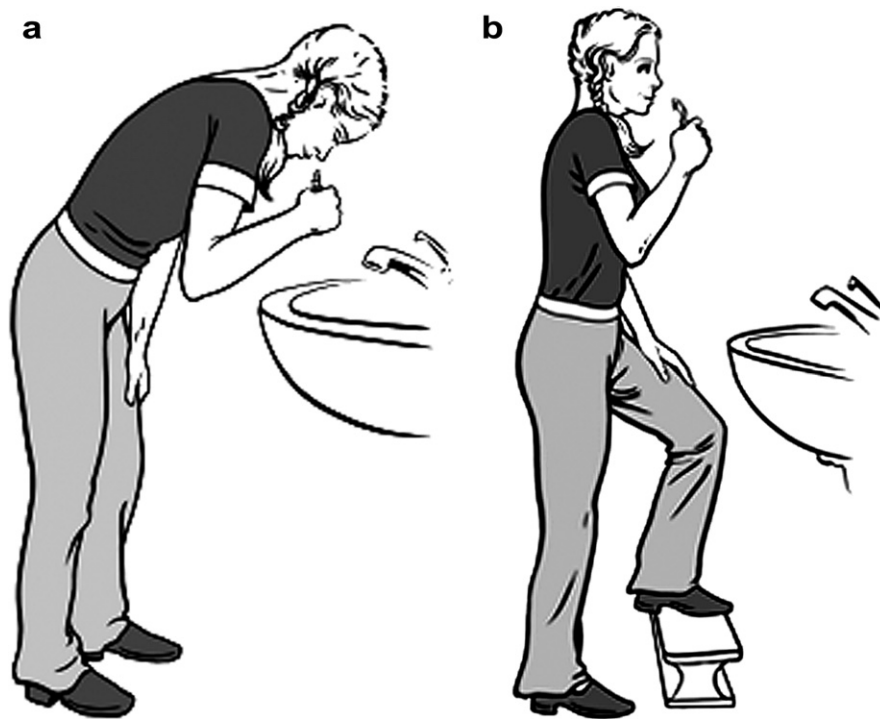


Figure 29 Brushing teeth a) unsafe b) safe with foot stool.

pain (MSP). Janda et al. (2007), Cook et al. (2010) and others have called for the functional assessment of movement patterns to become a “gold standard” for individuals with MSP. The overhead squat and single squat are two such

examples (see Figs. 33 and 34). The overhead squat is invaluable because it screens mobility of the upper (thoracic spine, anterior chest wall, latissimus dorsi) & lower kinetic chains (posterior hip capsule and ankle

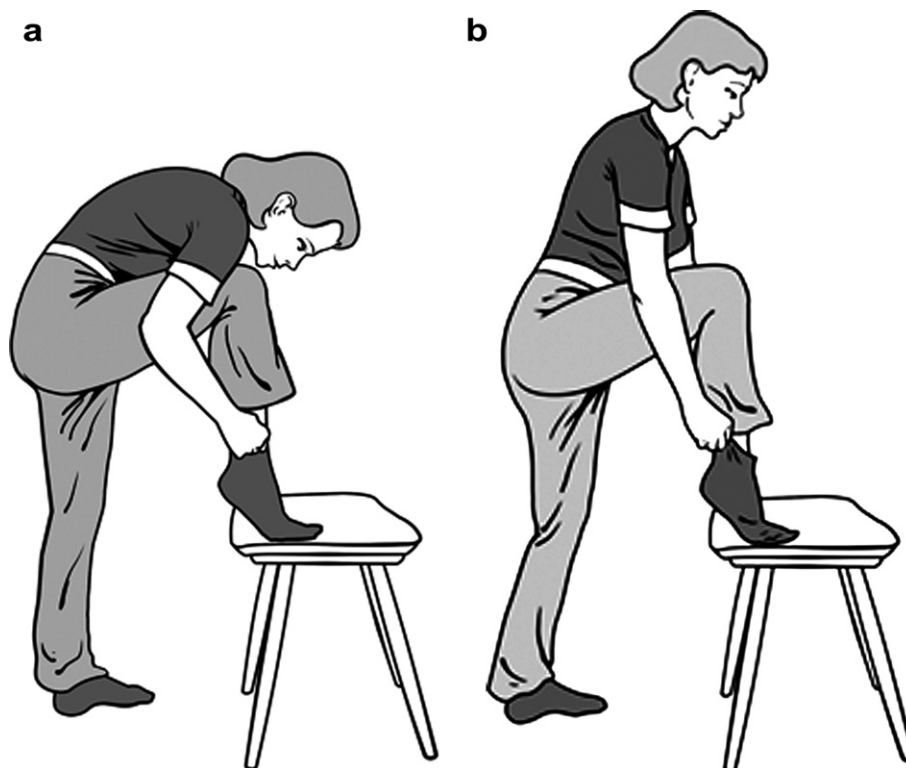


Figure 30 Putting on socks a) unsafe b) safe.

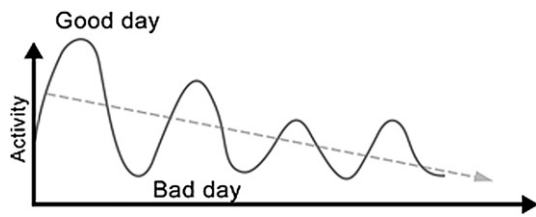


Figure 31 Boom and bust cycle.

dorsiflexion) as well as lumbo-pelvic and knee stability. Single leg squat is an essential test for most people since it reveals frontal plane issues in the lower quarter kinetic chain, as well as poor core control and posterior chain strength/skill.

Regional interdependence : specific evidence

Mobility deficits of the thoracic spine and hip, and stability deficits of the lateral hip/pelvis and core deserve to be highlighted for their influence throughout the locomotor system:

1/Thoracic influences:

- Thoracic spinal manipulation has been shown to be helpful for patients with shoulder impingement syndrome (Bang and Deyle, 2000; Bergman et al., 2004).
- In one controlled study it was shown effective by itself (Boyles et al., 2009).
- It has been demonstrated that a significant association exists between decreased mobility of the thoracic spine



Figure 32 Pacing.



Figure 33 Overhead Squat test

and the presence of patient-reported complaints associated with neck pain (Norlander and Nordgren, 1998).

- Cleland et al. (2005, 2007) showed that in selected patients manipulation of the thoracic spine was a successful treatment for patients with neck pain.

2/Hip influences:

- Lateral hip instability and hip mobility deficits are functional problems that influence areas above and below it. For example the active hip abduction test can predict individuals who are at risk for low back pain development during prolonged standing (Nelson-Wong et al., 2009).
- Whitman et al. (2006) found that treatment of the hip was successful in management of spinal stenosis.



Figure 34 Single leg squat frontal plane assessment.



Figure 35 Plyometric squat.

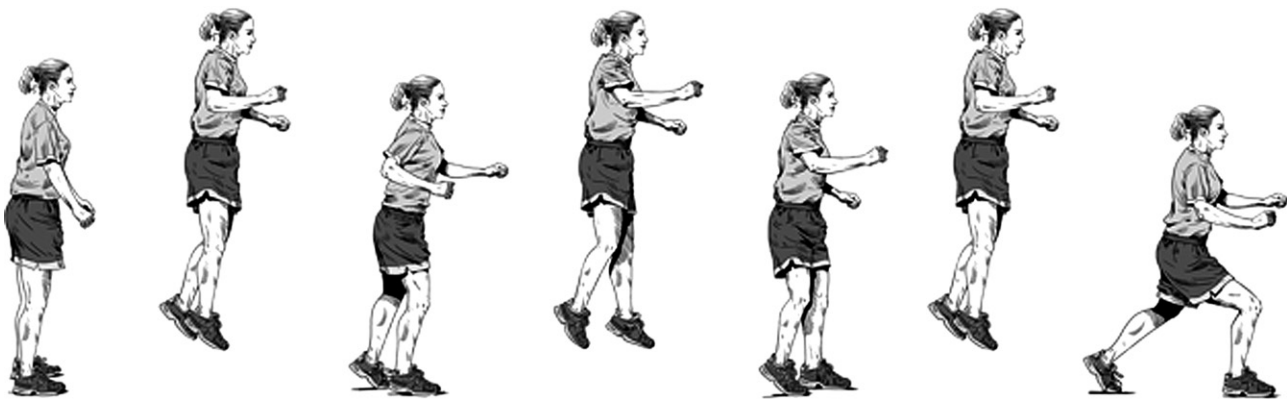


Figure 36 Plyometric lunge.

- Cibulka et al. (1998) reported that unilateral deficits in hip range of motion were associated with sacro-iliac pain syndromes.
- Cliborne et al. (2004) found that hip dysfunction was correlated with knee pain associated with arthritis, and that hip mobilization was beneficial in these patients.
- Improvements in hip flexion strength, combined with increased iliotibial band and iliopsoas flexibility, were associated with excellent results in patients with patellofemoral pain syndrome (Tyler et al., 2006).

3/Core influences

- Core stability is a third function which has been found to effect areas throughout the locomotor system. Athletes with decreased neuromuscular control of the body's core, measured during sudden force release tasks and trunk repositioning, are at increased risk of knee injury (Zazulak et al., 2007a, 2007b).
- Specifically impaired trunk proprioception and deficits in trunk control have been shown to be predictors of knee injury (Zazulak et al., 2007a, 2007b).
- A rehabilitation program consisting of progressive agility and trunk stabilization exercises was found to be

more effective than a program emphasizing isolated hamstring stretching and strengthening, in promoting return to sports and preventing injury recurrence in athletes suffering an acute hamstring strain (see Figs. 35 and 36) (Sherry and Best, 2004).

Conclusion

The World Health Organization (WHO) has placed independent functioning as the overarching goal of treatment of disabling musculoskeletal pain (Waddell and Burton, 2005).

The functional Independence WHO Paradigm (Waddell and Burton, 2005):

1. *Participation*: This involves the social activities that a person deems essential to their lifestyle. It may encompass household activities such as cleaning, cooking, carrying groceries, etc. as well as recreational activities such as walking, running, tennis, soccer, golf, etc.
2. *Disability*: This refers directly to the ability to work or satisfy the demands of employment.

3. *Impairments* ("weak link"): This involves such things as radiologic issues such as degenerative disc disease or arthritis. Also, isolated range of motion impairments, strength deficits, or motor control issues.

Promoting restoration of function rather than a symptomatic approach, or one which is focused mainly on addressing structural pathology, is a key step in making this transition. This new paradigm requires a reevaluation of a number of current tenets of care. If this happens a more patient-centered approach which is designed to help patients safely return to activities which are important to them will result.

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