

Working With Musculoskeletal Disorders: Getting Back To Exercise Without Pain



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Introduction

Over the last nine years I have spent just under 10,000 hours helping people in their training, from those new to the gym to accomplished athletes, many of whom have come to me suffering with musculoskeletal pain or an existing injury. MSDs are pain in the body's joints, ligaments, muscles, bursas and tendons due to abnormal stress on the joints or surrounding structures (Page et al, 2010). MSDs can cause mild discomfort to debilitating pain. They commonly affect the lower back (Hildebrandt et al, 2000, Grimmer 2000), the neck, knee, feet or shoulder areas (Murphy, 2004, Holth et al, 2008).

Although some of these pains can be caused by age related degeneration (Machado de Rezende et al 2014), as certain activities can cause wear and tear over time, the underlying problem is often the accumulative overload of muscles through repetitive movements, inappropriate footwear and adopting a poor sitting posture every day (Grimmer, 2000, Murphy et al, 2004). Lack of stretching and regular muscle activation can worsen the effects. While some clients may cycle to work, go for a jog, swim or go to the gym after work they are often doing these activities with bad posture and joint alignment, and without stretching or warming-up, adding to the underlying problems that sometimes will not manifest until there is already a pain symptom (Figure 1).



Abstract: Most people today live a sedentary lifestyle, sitting for 10 to 12 hours a day. Consequently they become less and less conditioned and equipped to take part in recreational and sports activities in or outdoors. Technological advances mean we are required to move less and less, leading to postural deviations.

Some muscles have the tendency to become underactive and others to become overactive (Kendall et al, 2005, Page, 2010). Physical inactivity is increasing the risk of musculoskeletal disorders (MSDs) (Holth, 2008, Page, 2010, Davies, 2014). This means that working with today's typical client and athlete is becoming increasingly challenging for personal trainers and sports coaches.

The NASM Corrective Exercise Continuum (CEx) is a systematic, corrective programme that is based on deactivation and activation techniques of the neuromyofascial tissue. It is widely used in the USA and the UK. Its use has also been present in Hungary. Using this system with my clients has enabled them to eliminate minor MSDs and keep major MSDs under control. I use the CEx system in conjunction with body and postural awareness techniques that I will share over the course of the next four articles, in today's article I would like to introduce the system and the reasons behind its use. My overall aim in this series is to draw attention to some movement and range of motion (ROM) dysfunctions that are warning signs of potential MSDs. In line with the CEx system, I will suggest some easy to implement techniques and exercises to improve muscle quality and activity, thereby reducing the risk of injuries outdoors or in the gym that can be used safely by the clients as well.

Keywords: Sedentary lifestyle, musculoskeletal disorders, warm-up, injury prevention, the NASM Corrective Exercise Continuum

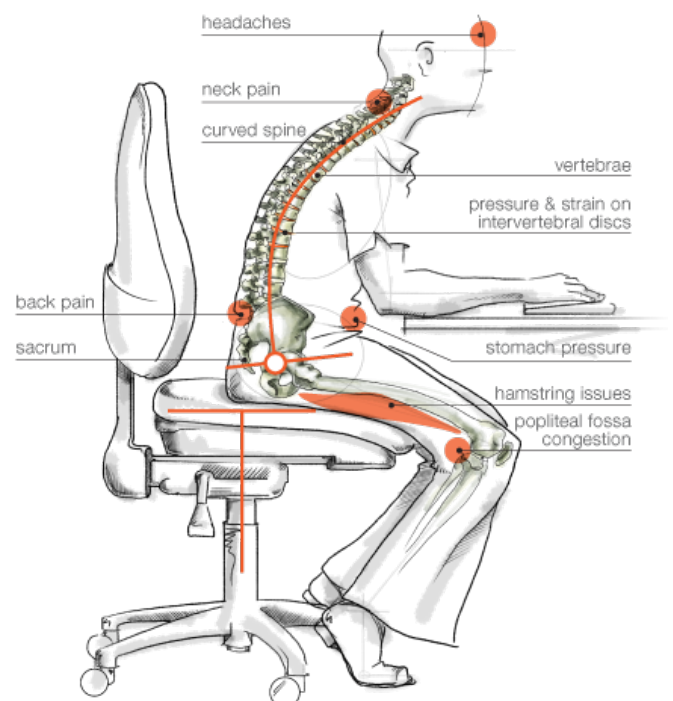


Figure 1. Problems that can arise from a poor sitting posture

Questions

The questions arise whether the NASM CEx is a safe corrective strategy that can be incorporated in to a warm-up routine that help prevent or improve existing muscular imbalances to give greater freedom of movement and also decrease injury risk while exercising and whether this strategy is clinically proven.

Methodology

Collection of data was carried out at the 1st consultation with the clients from 2011 January to 2015 January. The majority, 96% of clients were working or studying full time, the remaining 4% consist of full time mums. 52% male and 48% of female clients, who were working in accounting, international business, marketing and finance, undertook the training. 50% of the participants were 29-39 years old, 21.4 % 39-49 years old, 10.7% 49-59 years old and 59+ respectively, while only 7.2% was 19-29 years old. Only 7% of them didn't have any pain syndromes, 93% of them experienced some kind of reoccurring pain in the past 12 months from the date being questioned by me. Body regions, which were most commonly reported for experiencing pain were the lower back (41.8%), neck and shoulder region (27.9%), knee (20.9%) and the foot and ankle (9.3%). 23.2% had both neck or shoulder and lower back pain.

Movement Assessments Prior Choosing the Corrective Exercises

What can a trainer do then when a client with potential musculoskeletal problems approaches them for the first time? I offer a free consultation to build trust, gather information and perform functional movement tests on the clients. As a first step, I will ask a series of questions about the client's work, their typical day, as well as their medical, pain and exercise history. Based on that information, I look for warning signs and 'red flags' that suggest that the client should not perform certain exercises or should be referred out to other professionals prior to commencing an exercise routine.

As a second step, I assess movement. I screen for abnormalities, particularly with the overhead squat (Hirth, 2007) and the single leg squat (Diamattia et al, 2005, Crossley et al, 2011)(Figure 2). Functional assessment should be incorporated into pre-participation screening in order to determine whether a client has the essential movement, mobility and strength to perform certain activities (Gray et al, 2010). Observation of movement can highlight common movement dysfunctions and can also be used to develop strategies for the prevention of injuries and enhancement of athletic performance (Ford et al, 2003, Clark et al., 2011, Yu et al, 2005, Gray et al, 2010).

Step three, if after the movement screen, I suspect weakness I test a muscle for strength (Kendall, 2006). Then based on what I have heard and seen I write an initial programme (step four) that incorporates corrective work for the observed movement dysfunction. I assess other dynamic movements such as pushing, pulling, rotation, mobility and stability within our first few sessions using the NASM (Clark, 2011) and Functional Movement Screen (FMS) tests and further refine the programme based on the results (Gray et al, 2010) to achieve maximum benefit. I also reassess clients' movement by repeating steps one to three from time to time.

Figure 2. Movement assessment - the overhead squat



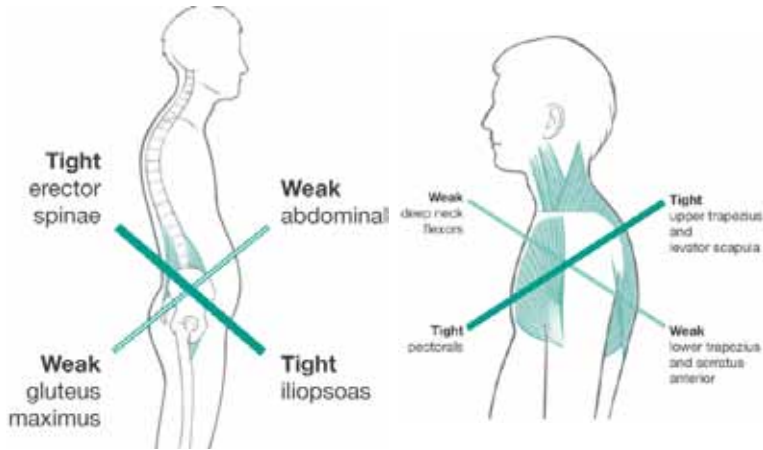
The two movement assessment programmes, NASM and FMS, are the first to provide functional evaluation standards and corrective solutions since 1987 and 1998, respectively. They are bridging the gap between fitness professionals and clinical practitioners such as physiotherapists. Both systems require a thorough understanding of the musculoskeletal system and so are designed for use by personal trainers and coaches only. When it comes to a corrective exercise prescription I find the NASM system easy to follow and learn, although I use exercises from both. After reeducation in movement a client can learn to understand what to feel while moving, over time the exercises can be learned and adapted into a client's everyday routine. Both systems are based on knowledge from renowned experts such as Vladimir Janda, Shirley Sharmann, Florence Peterson Kendall and Elizabeth Kendall McCreary. These specialists all agreed that due to occupational and postural strains, certain muscles get chronically lengthened and others chronically stretched therefore they develop weakness or overactivity. I won't go into further detail on the two movement assessment systems here but the relevant web addresses can be found in the reference section of this article if you would like further information.

Need for the deactivation-activation steps: Typical weak and overactive muscles

Some muscles have a tendency to get tight or overactive - these muscles generally have one third greater strength than those which tend to get weakened (Page, 2010). Through a mechanism called reciprocal inhibition, Sherrington's Law, tight or overactive muscles will inhibit the antagonist muscles, on the opposite side of the joint, which in turn can appear to be weak when tested.

Typical weakness and underactivity that can be found in the lower extremity are - for example the bottom's muscles (the gluteus maximus, the gluteus medius), the abdominals (TVA) and core muscles - while the hip flexors (iliopsoas, rectus femoris) and

the lower back's erector spinae show tightness. In the upper extremity, the posterior deltoid (rear shoulder), and the middle and lower trapezius, rhomboids and serratus anterior prone to becoming lengthened and weak, while the upper trapezius and levator scapulae along the chest muscles become tight. These muscle imbalance patterns has been classified as Upper-crossed and lower-crossed syndrome (Janda, 1987)(Figure 3).



3.a 3.b
Figure 3. Impairment syndromes of the lower (a) and the upper (b) body

Once a muscle imbalance exists, shortened or overactive muscles will force the joint out of alignment, causing joint dysfunction, poor movement patterns and compensation elsewhere. This cascade of events will start an underlying pathology well before the pain presents itself (Janda 1987, 1993). When compensation occurs, certain muscles will take over as the prime movers, which under normal circumstances should only assist the prime movers. For example, consider the hip flexor muscles, the psoas. When someone spends long hours sitting, this muscle remains in a shortened position for too long and eventually it remains that way if it is not stretched properly. This tight muscle will reciprocally inhibit the gluteus maximus muscle (Figure 3.a) The gluteus maximus will have altered force production - it will be delayed acting as a prime mover for hip extension (straightening the hip) which will lead to a substitution of its role by the upper thigh and the lower back muscles. If this imbalance and altered recruitment continues over a prolonged period of time, hamstring pain and lower back pain will develop.

Corrective Strategy: NASM CEx

Most people who train recreationally assume that a general warm-up only includes stretching and raising the heart rate. This will confer the following benefits: reduced muscle stiffness, greater oxygen flow to the working muscles, increased body temperature, decreased muscle viscosity, increased muscle contraction times and increased lubrication of the joints. However, an effective warm-up also needs to negate the effects of lifestyle, by deactivating muscles that are overactive and activating those that are inhibited/underactive.

The NASM CEx system (Figure 4) recognises this and puts forward a warm-up model that includes the following four steps for muscle function: 1) Inhibit 2) Stretch 3) Activate 4) Integrate. The first three steps should precede any other warm-up component as they aim to correct muscle dysfunctions before other activity takes place. As research shows that ROM can be

improved by application of both heat and ice, warming up tissues prior to stretching may not be necessary (Brodowicz et al, 1996, Peres et al, 2002). The fourth step can be incorporated into the workout itself.

1) Inhibitory Techniques (Figure 5.a) – These techniques release tension or decrease overactivity, not just in the muscle but in the neuromyofascial (nerve-muscle-fascia) tissues of the body. They include Self-Myofascial Release (SMR) which is a self-massage therapy, releasing the trigger points of overworked, tender muscles and fascia (Page, 2010). SMR can be performed using foam rollers, sacrosse balls or tennis balls.

2) Lengthening Techniques (5.b) – Static stretching (SS) and proprioceptive neuromuscular facilitation (PNF) are used to increase the length of the neuromyofascial tissues.

3) Activation Techniques (5.c) – Once the release and lengthening of tight muscles has been achieved, activation can be done through isolation exercises. These involve only one joint and a limited number of muscle groups, so that more attention can be paid to ensuring the muscle's sufficient contraction – thereby avoiding using the overactive, 'cheating' muscles. Isolation exercises are slow and controlled motions.

4) Integration Techniques (5.d) – These are how a client can relearn movement with the correct order of muscles firing. Integration techniques retrain the activated muscles through functional movements such as weighted total-body exercises, mainly as part of the work out.



Figure 4. The Corrective Exercise Continuum (Clark, 2011).



5.a

5.b



5.c



5.d

5.a Inhibit 5.b Lengthen 5.c Activate 5.d Integrate
Figure 5. The NASM CEx system warm-up model

Stretching pre-exercise: Good or bad

Stretching is a controversial topic among performance coaches. There is little, if any, evidence that SS and PNF pre-participation prevents injury, as was previously thought (Paradis 2014, Gergley 2013). Also, growing evidence suggests that SS has no or a detrimental effect on subsequent performance as it has been shown to lead to a decrease in force production, power performance, running speed, reaction and strength endurance in athletes (Marek, 2005, Haag, 2010, Gergley, 2013, Haddad, 2014, Paradis, 2014). However, the average recreational athlete needs to increase ROM around several joints to avoid accumulative injuries. Research shows that decreased flexibility, below normal ranges, can lead to 2.5x increased injury risk (Pope 1998). Also it is important to note that long-term studies on static stretching protocols show that SS leads to decreased chronic injury rates (Pope, 1998, Amako, 2003, Wilson, 2010).

Dynamic stretching (DS), on the other hand, has been shown to improve subsequent running performance in both acute and chronic cases (Ramachandran, 2014, Judge, 2009) and can help decrease the effects of performance decline caused by SS. DS is not part of the CEx as it can cause injury if it is used incorrectly and needs to be supervised by a professional. However, further examination of the literature suggests that low volume (1-2 sets), short duration (10-25s), moderate intensity SS methods (SS, PNF), with an adequately long time gap between SS and the main activity itself (10-15 minutes) may not be detrimental on performance (Haag, 2010, Guidetti, 2009, Torres, 2008).

Furthermore, if SS is conducted prior to subsequent higher intensity dynamic warm-up elements, it is likely that its detrimental effects will be diminished. In a CEx programme, SS should only be applied to muscles that have been determined to be overactive or tight.

The reason why trigger points need to be eliminated

Symptoms such as weakness, decreased ROM and early fatigue in the muscles can also be caused by trigger points (TrPs) (Page, 2010, Mense and Simons, 2001), which develop as the bands of muscle fibres get overstimulated. One way to overload a muscle is by placing it in a shortened or lengthened position again and again over a period of time. This can happen after an injury as a person tries to avoid pain, or it can happen due to degenerative postural overload when a person is constantly

hunching over their desk causing the head to fall forward, the shoulders to round and the back to hunch.

TrPs can be palpated as hypersensitive nodules of muscle fibres. Pressure on the TrP will cause pain in the affected area or the pain can radiate to other areas. In my experience, clients typically have significant pain on palpation in the muscles that maintain body posture, such as in the neck, shoulders and pelvic girdle, due to repetitive overload at work, in the car or at home. TrPs may also manifest as a tension headache, or as neck, calf and lower back pain (Alvarez, 2002). (Figure 6). I will revisit common TrPs due to postural deviation later on in this series of articles, focusing on particular body parts and where they refer pain.

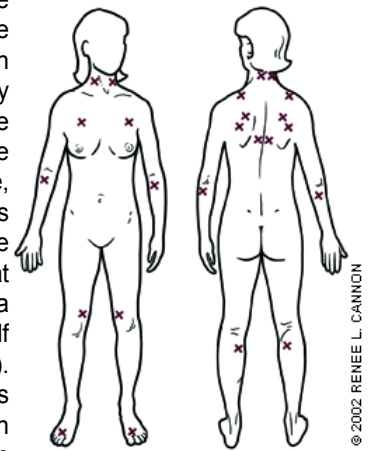


Figure 6. Most frequent location of trigger points.

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Conclusions

Aims were to investigate and explore whether the NASM CEx is a safe corrective strategy to use before exercising. In accordance with the literature, there is a need to deactivate muscles, before the antagonist muscles that they reciprocally inhibit, can get activated. An inhibited, weak muscle can't fulfill its function eventually will cause permanent muscle imbalances and structural changes to occur such as the lower-crossed and upper-crossed syndromes. It was established that static stretching is needed with the general population, the performance decreasing effects will dissipate with time or dynamic stretching can be used to eliminate any negative effects. Trigger points further weaken the muscle and fascia therefore the use of self-myofascial release is recommended. The activation and integration of muscles is a pre-requisite to any exercise routine. From my own experience with clients, I know that these techniques can be learnt and used by any client regardless of age.

Summary

The tools and solutions put forward by the NASM CEx address muscular imbalances, tightness and weakness. They provide an innovative, research-based and systematic approach that builds effectively on previous techniques and appears to tackle problematic areas. In my experience, NASM CEx works best and has greater carry-over effect to everyday life when clients are educated about posture and correct movement during daily activities such as sitting, walking and sleeping. Look out for my next article in the next issue, in which I will discuss common movement dysfunctions of the knee, how to spot them and how to apply the four steps of CEx to improve knee function.

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