Chapter

myoActivation: A Structured Process for Chronic Pain Resolution

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"The good physician treats the disease; the great physician treats the patient who has the disease".

Sir William Osler, 1849–1919

Abstract

Chronic pain is a significant burden in all societies. The myofascial origins of chronic pain are often unrecognized but play a major role in chronic pain generation. Myofascial release has been shown to be effective and can augment the limited number of therapeutic tools available to manage chronic pain. However, there is no standardized approach that allows for comparative analysis of this technique. *myoActivation*® is a unique therapeutic system, which targets active myofascial trigger points, fascia in tension, and scars in patients with chronic pain. Targets for intervention are determined through obtaining a history of lifetime trauma and a structured, reproducible posture, and movement assessment. Catenated cycles of movement tests, palpation, and needling are used to achieve the goal of pain resolution through restoration of soft tissue integrity. This chapter describes the distinctive features of *myoActivation* from the important key elements of the patient's clinical history, through to the aftercare instructions. Relevant evidence for each component will be presented. Case studies will be used to illustrate some important concepts and the effectiveness of *myoActivation*. This chapter is relevant to all clinicians that manage people living with chronic pain.

Keywords: pain, chronic pain, paediatric pain, mobility dysfunction, fascia, myofascial trigger points, timeline of lifetime trauma, physical trauma, scars, palpation, catenated cycles, structured assessment, non-pharmaceutical, pain management

1. Introduction

Pain is defined by the International Association for the Study of Pain (IASP) as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" [1]. Pain is a highly subjective sensation influenced by: degree of tissue damage, response to medications, diet, age, sex, genetics, cultural background, and psychosocial factors including attention, emotion, cognition, beliefs, expectations, and socioeconomic status (**Figure 1**).

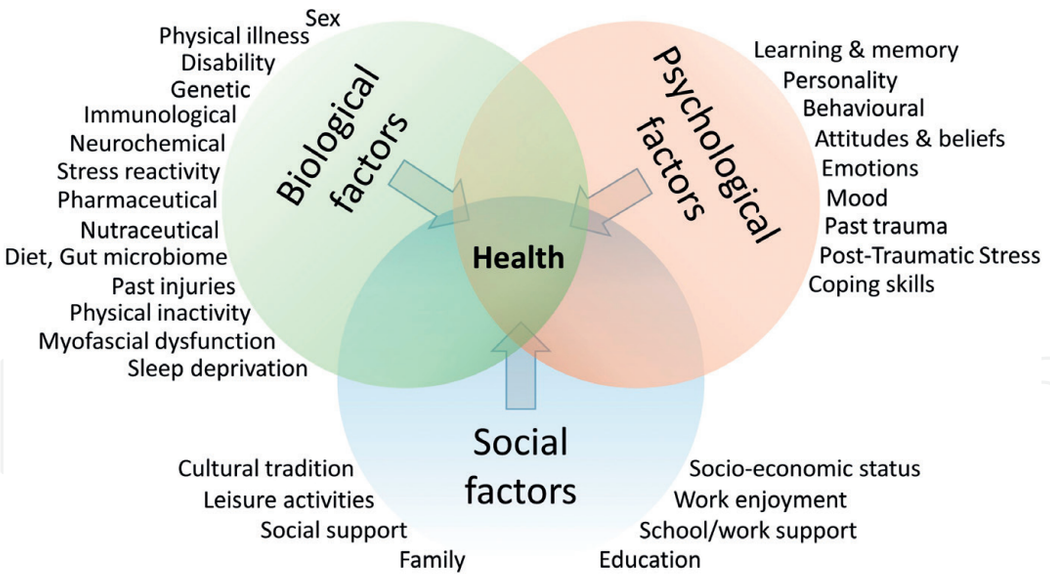

Figure 1.
The biopsychosocial contributors to chronic pain.

Pain is a sensory output from the brain when the brain is on alert. In acute pain, this sensory output is important to protect the organism from further harm during the healing phase, and, is usually associated with a nociceptive stimulus.

Chronic pain is quite different; although it is typically considered to refer to pain lasting longer than 3 months, such a time limit seems to be reductive, and it more properly refers to "pain that extends beyond the expected period of healing" [2]. The overall prevalence of chronic pain conditions is estimated to be in the order of 35–51% of the adult population [3] and the incidence of widespread chronic pain estimated to be 10–15% [4]. Chronic pain occurs across the lifespan, including children [5] and the elderly [6]. The frequency of visits to physicians, emergency departments, and other healthcare providers is significantly increased in the presence of chronic pain [7]. Currently, the burden of chronic pain has a huge impact on quality of life in the lives of people with chronic pain [8, 9]. The economic burden of chronic pain in terms of healthcare costs is substantial, but pales in significance compared to the costs of lost productivity due to job redundancy and sick days [9].

1.1 Background

Chronic pain is a complex biopsychosocial phenomenon that requires a multidisciplinary approach to management. This usually includes return to physical function [10], graded return to work/school, medications to help with pain, mood and sleep, as well as non-pharmacological techniques to address the psychosocial components of pain [9, 11, 12]. The weakest link in this therapeutic process is the pharmacological approach, especially the overreliance on the use of *opioid* medications. The prescription of opioids for chronic non-cancer pain increased fourfold in USA from the early 1990s up to 2011 [13, 14]. Opioids contribute only modest relief of chronic pain. They have limited effects on improvement in function but cause significant opioid side effects [15]. Opioid substance abuse and opioid-related death are major issues associated with prescription of opioids for chronic pain. Review of opioid-related deaths demonstrates that the majority had a diagnosis of chronic pain in their last year of life [16]. Prescription of opioid medications has gradually decreased since 2011, but the opioid-related overdose death rate continues to rise exponentially [17]. This current opioid crisis constitutes a critical public health issue in USA and Canada [13]. Even though the prescription of opioid drugs does not appear to be causally

related to overdose deaths, it is clear that their prescription is one pathway to long-term use: 5.3% of opioid naïve adults prescribed opioids will still be on opioids 1 year later [18]. Increased numbers of opioids prescribed on the first prescription predicts a lower likelihood of opioid discontinuation [18]. It is notable that 20% of children with chronic musculoskeletal pain are prescribed opioids [19].

Up to 22.5% of chronic pain patients develop their chronic pain condition after surgery [20]. *Persistent postsurgical pain* (*PPSP*) represents a significant clinical problem, occurring after 10–50% of surgeries and resulting in severe chronic pain in 2–10% of these patients [21]. PPSP is considered to be primarily neuropathic (nerve damage during surgery) where the incidence depends on various perioperative factors, including genetic predisposition, preoperative anxiety, depression, preoperative pain, the extent of the surgical insult, surgical technique, length of surgery, and the quality of acute postoperative pain management [21, 22]. In 27% of patients receiving chronic opioid therapy, treatment for pain after surgery was the reason for opioid initiation [23]. There is 5.9–6.5% incidence of new persistent opioid use after surgery, not only after major surgery but also after minor surgical procedures [24].

Multiple traumas have a cumulative effect on chronic pain [25], independent of post-traumatic distress disorder symptoms [26]. Increased risk of physical ill-health is associated with exposure to a single traumatic event but accrues as more events are experienced [27]. It is not clear what characteristics of past traumatic experiences (type, duration, severity, earlier onset) influence the strength of the relationship between accumulative traumatic events and subsequent medical conditions [28]. Contemporary clinical history taking often neglects distant trauma as significant contributor to a chronic pain issue presenting many years later.

Chronic pain occurs from various combined sources, including nociceptive, inflammatory, neuropathic, myofascial, as well as peripheral and central sensitisation. *Musculoskeletal* (*MSK*) conditions are a predominant source of chronic pain worldwide [29]. The clinical and etiological characteristics of myofascial pain have been poorly investigated. The subsequent lack of evidence has led to undertraining of health care professionals, and poor recognition of the clinical importance of *myofascial pain syndromes* (a group of painful conditions that affect muscles and connective tissues) [30, 31].

Myofascial pain syndromes are characterized by pain, *myofascial trigger points* (*MTPs*) (palpable nodules in taut bands of muscle fibres), referred pain, coupled pain, and autonomic changes. Chemical changes within the muscle may also lead to peripheral sensitization. MTPs can generate continual nociceptive traffic to induce central sensitization, cortical re-organization, and alterations in descending inhibitory pain pathways [32–36]. MTPs are associated with muscles in sustained contraction causing limited movement across joints [37]. The MSK system is symmetrical; a muscle in sustained contraction on one side will cause compensatory MSK issues to occur on the other. Therefore, a patient with MSK imbalance may proceed to have many different myofascial areas affected from one previous injury or insult. It is important to note that *palpable pain points* (*PPPs*) exist, not only in skeletal muscle, but also in fascia and scars.

One of the components of MSK pain is *coupled pain*, which is distinct from referred pain. Referred pain is pain perceived at a location other than the site of the painful stimulus or origin of pain. Referred pain results from neuronal stimulation within a dermatome (a localized area of skin that has its sensation via a single nerve, from a single nerve root of the spinal cord). In coupled pain, the source of pain is distant, not dermatomal, from the localized area of pain. Examples include shoulder pain or knee pain originating from strained ipsilateral external oblique muscle, or lower quadrant abdominal pain originating from an ipsilateral quadratus lumborum muscle in sustained contraction [38–40]. This distant site has no direct muscular or neurological connection, yet the coupled pain is resolved by restoration of the originating tissue to a normal anatomical state [41].

Myofascial release can be effective but lacks a standardized approach and therefore prevents good quality comparative analysis.

Given the societal burden of pain and overuse of opioid medications, it is clear that clinicians require a different and more effective model of assessment and treatment that minimizes opioid prescriptions and realizes myofascial components of pain [19, 42]. This chapter will outline the importance of surgical scars and myofascial dysfunction as other important determinants of a chronic pain presentation. *myoActivation* is one component of the multimodal approach to patient care that helps to accurately determine and treat the myofascial components of chronic pain without the need for prescription medications.

1.2 Aim

The aim of this chapter is to describe a system of standardized assessment and treatment for chronic pain called *myoActivation*®. We will comprehensively describe the distinctive features of this system, from the patient's clinical history to after-care management. We will present evidence for the scientific background and individual component techniques of *myoActivation*, where it exists, and outline future approaches for gathering evidence of the effectiveness and efficiency of the *myoActivation* treatment programme as a whole.

This chapter is practically orientated to enable clinicians to understand what *myoActivation* means. Three case studies will illustrate the effectiveness of *myoActivation*. Then, the next steps in the development and evaluation of *myoActivation* will be discussed. Barriers to integrative care (including alternative therapies) are awareness, availability, accessibility, and affordability [43]; these will be discussed in relation to *myoActivation* as well as the need to establish a firm basis of clinical evidence for this treatment system.

Finally, we must emphasize that *myoActivation* should be seen as one component of multidisciplinary care, i.e., part of a multimodal approach to care, which includes focus on eventual return to physical function and work/school, improving recovery from opioid dependency, weaning prescription drug use as well treating the psychosocial components of pain.

1.3 *myoActivation* overview

myoActivation is a unique structured system of assessment and treatment designed to reduce myofascial components of chronic pain. A key principle of *myoActivation* is to understand that the site of pain is often not the source of pain [38–41, 44]. For example, spasm of the quadratus lumborum muscle mimics appendicitis and low back pain may originate from the abdominal wall musculature [38, 39, 45]. Myofascial pain is characterised by the presence of myofascial trigger points. Myofascial trigger points develop in response to many different insults such as trauma, injury, surgery, repetitive microtrauma, poor posture, muscle overuse, or overload [46, 47]. Myofascial trigger points that cause pain can originate in scars, skeletal muscle, and/or fascia.

The *myoActivation* assessment is distinguished by recognition of the importance of lifetime trauma and the mechanisms of any injuries identified. Postural observations during systematized, ordered, movement tests identify the true origin of pain in soft tissues. The most painful or restricted movement on core tests distinguishes the most important tissues to treat first. Careful inspection and palpation of these tissues identifies the myofascial source of pain. Treatment entails refined trigger point injections, using micro-aliquots of physiological saline, to restore anatomic integrity to injured tissues. Fine gauge hypodermic needles are inserted into trigger points

that compromise function of muscle, ligament, tendon, subcutaneous fascia, scar tissue, and the peripheral nerves of the skin. After each individual myofascial area is treated, movement tests are repeated to demonstrate immediate change and direct the clinician to the next most important target area. Several cycles occur during each *myoActivation* session. The purpose of these catenated cycles (see **Figure 6**) is to help unravel multiple sources that contribute to the full myofascial pain presentation.

Immediate treatment responses occur, which include reduction in pain, increased flexibility, and improved fluidity of movement. After-care instructions require the patient to change posture frequently but to refrain from exertional activity for 5 days following every *myoActivation* session. To understand how this technique might be useful in everyday care of patients with chronic pain, it is important to understand the essential components of myofascial pain (skeletal muscle in sustained contraction, scars, fascial lines of tension, and the interstitial space).

2. Scientific background

2.1 Skeletal muscle in sustained contraction

Myofascial pain syndrome is characterized by multisite pain, referred pain, coupled pain, and peripheral and central sensitisations. A component of myofascial pain is due to MTPs associated with muscles in sustained contraction causing limitation of movement across joints [37]. The mechanisms of myofascial pain have been reviewed by Jafri [31] and Shah et al. [48].

A 2007 review identified 19 different descriptions of diagnostic criteria for myofascial trigger points and associated pain but found lack of consensus or standard definition [49].

A trigger point is a hyperirritable spot in fascia or surrounding skeletal muscle. Muscular trigger points are associated with palpable nodules in taut bands of muscle fibres. Compression of a trigger point may elicit local tenderness, referred pain, coupled pain, autonomic symptoms, or a local twitch response. The *local twitch response* (*LTR*) is recognized as a spinal reflex [50]. An LTR when the MTP is needled or activated is considered a positive response to intervention [51].

Microdialysis techniques demonstrate unique biochemical changes in the region of trigger points, which include low pH, increased concentrations of bradykinin, calcitonin gene-related peptide, substance P, tumour necrosis factor (TNF), interleukins, serotonin, and norepinephrine. These are also associated with decreased local blood flow, reduced oxygen content, and increased reactive oxygen species. These nociceptive neuropeptides and inflammatory markers may be the source of peripheral nociception potentially initiating and maintaining central sensitization in myofascial pain syndrome [48, 52, 53].

The veracity of myofascial trigger points representing true pathologic entities have been questioned and debated [54]. However, leading experts in myofascial techniques consider this to be a biased view [55].

A systematic MSK exam can distinguish patients with MTPs and chronic pain from subjects with no pain [56]. One of the main problems with medical community acceptance of MTPs has been the lack of objective imaging techniques to corroborate examination findings and to assess treatment outcomes [57]. Imaging techniques that have been reported to establish the presence of muscle MTPs include: *magnetic resonance elastography* (MRE) [58], and *sonoelastography* (SEG) (**Figure 2**) [59]. MRE couples MRI with cyclic shear waves to assess tissue stiffness in myofascial taut bands. Stiffness in taut bands was found to be 50% greater than adjacent normal muscle tissue. SEG is a non-invasive method that combines

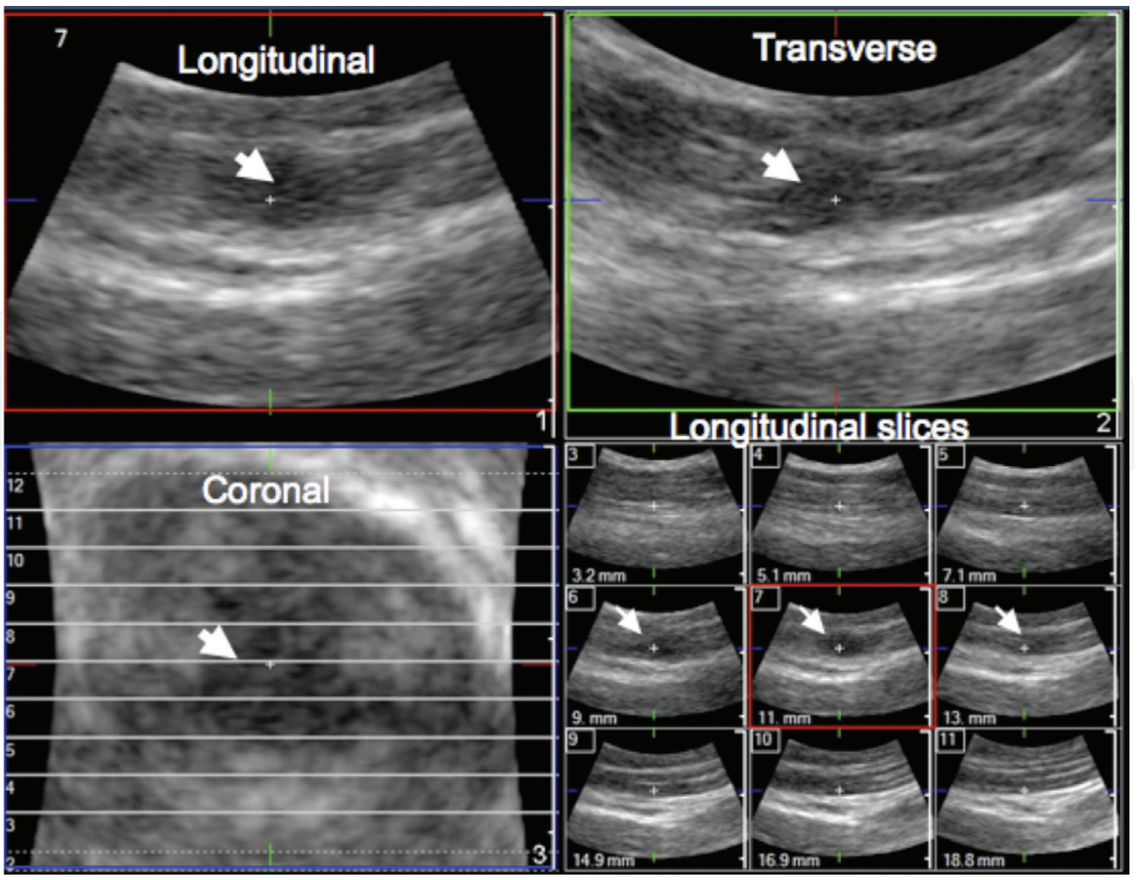

Figure 2.
Sonography of muscle trigger points (reproduced from Sikdar et al. [59], with permission from Elsevier).

ultrasound with simultaneously applied external vibration to distinguish ultrasound colour variance with tissue stiffness. Muscle trigger points identified as palpable painful nodules in muscle appear as focal, elliptical shaped, hypoechogenic areas. Localized regions of low entropy in symptomatic muscle make the tissue macroscopically more heterogeneous than a normal muscle that has relatively uniform echotexture. Texture analysis of SEG images can distinguish between painful muscle trigger points compared to normal muscle [60, 61].

2.1.1 Muscle activation

Muscle activation is the term used to describe when a muscle in sustained contraction is restored to a normal relaxed state, through manipulative therapies or needling techniques [62]. When a needling technique is used, there is no difference in outcomes between dry needling compared to a liquid injectate (such as lidocaine) [63–65]. Muscle activation is associated with reduction in pain, and improved flexibility, fluidity and range of movement. There is no consensus on the most effective needling techniques for different pain presentations [66]. Elicitation of an LTR has classically been required for effective muscle activation [51]. Recent work disputes that an LTR is necessary, but acknowledges more research is required [67]. Decreased spontaneous electrical activity and acetylcholine levels are seen at active myofascial trigger points after dry needling in rats [68].

Vascular, chemical, endocrine, neural, and central changes have been demonstrated following needling techniques [68–86]. Interestingly, dry needling also appears to be associated with activation of diffuse noxious inhibitory control reducing pain sensitivity in remote areas to the site of needling. This may be mediated through endogenous opioid mechanisms [69, 79–84].

There are a number of papers in support of the treatment effects, beyond the placebo effect, of myofascial release [51, 62, 66, 87–99]. Recent reviews have concluded that better quality studies with standardized interventions and outcomes are required to show that myofascial release is an effective intervention in the different types of myofascial pain syndromes [100–102]. Despite this, it is clear that myofascial trigger points in skin, fascia, and muscles play an important role in myofascial chronic pain presentations.

MTPs and their referral patterns have been eloquently outlined in two volumes by Travell and Simons, the first volume for the upper body and the second for the lower half of the body [46, 47]. Unfortunately, the publication of these volumes did not translate into everyday use in common clinical practice due to a number of factors: lack of basic scientific evidence around the aetiology of MTPs, no gold standard to identify clinical MTPs, failure to include reproducible assessment and examination of MTPs in medical curricula, complexity and diagnostic uncertainty from the interaction of more than one MTP on perceived pain, co-occurrence of myofascial pain with other disorders such as arthritis, and under-recognition of myofascial components in chronic pain [30].

2.2 Skin and the impact of scars

The skin is one of the largest organs in the body and is naturally exposed to external stimuli. The skin provides a crucial interface between the body and its environment. Skin has different functions and connections, which include connections to the nervous system through the autonomic nervous system and the locomotor apparatus [103]. The autonomic nervous system constitutes the most important connection between the skin, the fascia, and the body [39]. There is continual nervous activity, in afferent and efferent mode, between the skin and central nervous system to maintain normal homeostasis [39, 104].

There is an independent central emotional connection principally between the anterior cingulate cortex and the skin whereby a sympathetic electrical signal can be detected in the skin in response to viewing emotionally charged images [105]. The skin is also a primary site of small fibre nociceptive endings [106]. It is not difficult to speculate that any restriction or impact on the skin, like a scar, will have an impact on normal homeostasis and function and hold emotional memory [107, 108].

2.2.1 Scars

When the skin is breached by surgery or injury, a healing process occurs. There are four stages to healing: haemostasis, inflammation, proliferation, and remodelling [109]. The remodelling process can take many years and depends on the size and nature of the initial wound. During remodelling, type 3 collagen is replaced by a stronger type 1 collagen, but not in an ordered manner. Scar tissue is therefore strong but not as elastic or flexible as normal tissue [109]. There is an increase in nerves and neuropeptides in scar tissue especially hypertrophic scars [110]. In patients asked to move actively, electrical activity from a scarred area is higher than that from normal tissue in the same patient doing the same movement [111].

Mechanoreceptors and mechanosensitive nociceptors in scarred areas sense an alteration from normal and send non-physiological signals creating a pathological reflex arc [39]. Scars can limit normal movement and flexibility of skin, and underlying fascia and muscles. For example, an ankle scar will alter the gait dynamics through maldistribution of myofascial loads [39]. Patients with scars in the abdominal region often have low back pain related to impaired mobility of the soft tissues [111, 112]. Scars also have an impact on the distribution of forces

that pass through the body following motor vehicle accident (MVA) or injury [39]. It has also been suggested that the skin can keep a memory of trauma [107, 108]. It is clinically important to consider this when releasing scars associated with a particular emotional traumatic event. More research is required to ascertain the characteristics of scars that make a significant contribution to a chronic pain presentation.

2.2.2 Scar release

Scar release can be achieved with soft tissue mobilization techniques or subcision [107, 111, 113]. *Subcision*, or microneedling, also known as percutaneous collagen induction therapy, is a minimally invasive minor surgical procedure used for treating depressed cutaneous scars and wrinkles. Subcision is performed using a hypodermic needle inserted through a puncture in the skin surface [114] or dermaroller. First described in 1995 [115], subcision is a safe, and effective microneedling technique used as an aesthetic treatment for several different dermatological conditions including scars, rhytids, and striae [114, 116, 117]. Microneedling has been shown to induce new collagen formation via platelet and neutrophil release of growth factors (TGFβ, platelet derived growth factor, connective tissue growth factor, connective tissue activating protein), resulting in increased production of collagen, elastin, and glycosaminoglycans [118]. The penetration of a needle through skin has been shown to produce other physiological effects such as activation of the diffuse noxious inhibitory control systems [119], as well as oxytocin mediated peripheral stimulation that inhibits c-fibre discharge to suppress experimental behavioural nociception in rats [120].

Currently, the immediate relief of chronic pain following needling of surgical scars is limited to case reports [110], and to date, there is insufficient evidence to advise on the right time to treat scars after surgery [121]. It will be seen later that scar identification and release is an integral part of *myoActivation* therapy for chronic pain.

2.3 Fascial lines of tension

Fascia is described as "dense irregular connective tissue, this tissue surrounds and connects every muscle, even the tiniest myofibril, and every single organ of the body. It forms a true continuity throughout our whole body" [122, 123]. Fascia has traditionally been named according to the region in which it invests, for example, thoracolumbar fascia or the iliotibial band. This regional focus is considered to be a barrier to the understanding the whole-body interconnectivity of fascia [124]. Fascia has both loose and hard fibrous connective tissue components. Loose fascia functions to help slide and glide between structures and dense fascia exerts a tensile strength in tissues like tendons. Fascia is a complex structure. It contains cells (fibroblasts, fasciocytes, myofibroblasts, and telocytes), an extracellular matrix (fibres, hyaluronan, and water), nerve elements (proprioceptors, interoceptors, and nociceptors), and a system of microchannels (the primovascular system) [125]. The contractile elements may contribute to spasms, dysfunction, and pain [39]. The fasciocytes produce hyaluronan in response to shear stresses [125]. The fascial fibroblasts produce collagen in response to load and stretching. Telocytes are probably important in regeneration [126]. Fascia is rich in proprioceptors and is an essential integrative component in the locomotor apparatus in assessment and control of human posture and movement organization [70]. Fascia has been nicknamed our organ of form [39, 127, 128]. Techniques are currently being developed to improve imaging of fascia [129].

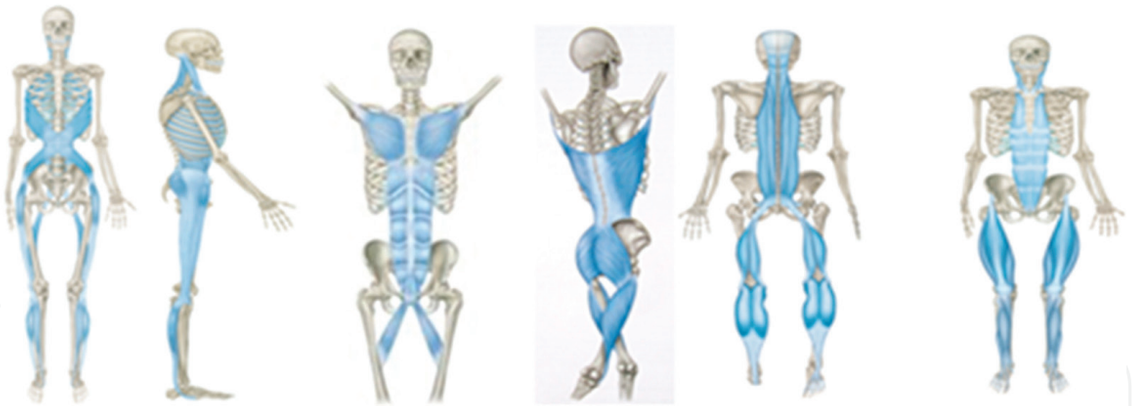

Figure 3.
Proposed myofascial chains (reproduced from Wilke et al. [136], with permission from Elsevier).

Fascia flexibility is reduced following injury and subsequent immobility; this worsens with time and persists even with restoration of movement [130]. Stretching, however, reduces thickness of inflammatory lesions, reduces migration of neutrophils, and increases concentration of pro-resolving mediators (resolvins) [130–134]. It is becoming increasingly clear that fascia has an extremely important role to play in molecular biology, functional anatomy, exercise, sport science, repair mechanisms, as well as therapeutic modalities [135]. As *myoActivation* is associated with improvements in flexibility and posture, it may well be that one of its effects is mediated through fascial mechanisms that enable movement and stretch in a more normal anatomical manner.

Biotensegrity is a structural design concept that defines the relationship between parts of an organism and the mechanical system that integrates them into a functional unit. Humans are described as tension-dependent organisms with myofascial chains (**Figure 3**) [136]. These myofascial chains enable three-dimensional movement while continually providing information on balance, stability, and mobility. These chains often have an opposing chain to help achieve this balance within the MSK system; for example, a posterior myofascial chain pairs with an anterior myofascial chain.

These chains may well help to explain how some pain presentations at distant sites, and how myofascial release at distant sites (or opposite sides of the body) resolve coupled pain presentations. For example, release of the external oblique muscle in sustained contraction will help shoulder pain, release of tension around the coccyx will help with neck pain, and/or release of the gastrocnemius/soleus muscles in sustained contraction relieves occipital headaches.

2.4 The interstitial space

The interstitial space is a major fluid compartment present in many parts of the body. It contains dynamically compressible and distensible sinuses through which interstitial fluid flows around the body. It is distinct from, but drains into, the lymphatic system. In the average human, up to 15 L of extracellular fluid are normally housed in the extracellular interstitial space. *Interstitial fluid* (ISF) and flow is an important element of normal tissue function; it bathes and surrounds cells, delivers nutrients, and removes metabolic waste [137]. ISF also affects cell signalling, differentiation, remodelling, and migration (giving directional cues to cells) [138]. The ISF only flows under conditions of low hydraulic resistance. Blockage of these channels in pigs induces hyperalgesia [139]. Release of tight tissues, following *myoActivation*, may help to restore interstitial fluid flow and promote the delivery of nutrients and removal of metabolic waste of surrounding tissues.

More research is required to determine exactly which component (muscle, biomechanics, the interstitium, fascia, skin, scars or a combination of these) is the major contributor to a chronic pain presentation. The rest of this chapter will outline the specific details of the basics of *myoActivation*, which provides the much-needed standardized process to correctly identify and treat MTPs in priority order, to reduce chronic pain.

3. *myoActivation*: detailed methods

3.1 Clinical history

As with all chronic pain presentations, it is important to define the clinical problem, the main site of perceived pain, with its transition over time, as well as the goals of treatment for the patient. The focus of a *myoActivation* history frames the clinical problem as the *Timeline of Lifetime Trauma* (TiLT) and the mechanisms of any injuries reported. TiLT requires careful questioning to determine if there have been any motor vehicle accidents, fractures, sprains, falls, tailbone injury, major surgery, minor surgery, burns, bites, or other scars (e.g., chicken pox or acne). The associated healing process of any scar is essential to determine their significance in the pain presentation. Infection during a healing process or injuries and scars sustained at a young age appear to have significant impact. Recreational and occupational activities with any associated injuries are important components that need to be asked. An important enquiry in the *myoActivation* history is to ask the patient what they consider to be their greatest physical trauma. All these details will be synthesized with the subsequent examination findings to help determine the true source of pain.

3.1.1 Investigations

Routine imaging investigations are typically not useful to guide *myoActivation* treatment. However, reports on imaging studies that are provided with a referral or by the patient should be reviewed and acknowledged in the encounter documentation.

3.1.2 Examination

Optimally, the patient has as much skin exposed as possible to allow easier evaluation of postural asymmetries, fascial lines of tension, skin creases, and forgotten scars. Initially, the patient is asked to identify the location of their perceived pain; this point helps direct the examination and is used as an index for subsequent treatment effect. Where the patient identifies the perceived origin of pain is rarely the tissue that is responsible for the true origin of pain. Then, core Biomechanical Assessment and Symmetry Evaluation (BASE) tests are administered (**Figure 4**). In execution of all tests, the clinician is always looking for postural asymmetries.

3.1.3 Balance

The first BASE test is balance. The talus has no muscular attachments and functions as a ball and socket joint around which the skeleton sways depending on the distribution of myofascial forces (**Figure 5**). The centre of the body mass is normally located anterior to the S2 vertebrae in humans. In an erect stance where there is no significant anatomical postural distortion, the centre of mass or gravity will be evenly distributed between the feet and over each plantar surface. Therefore, if one

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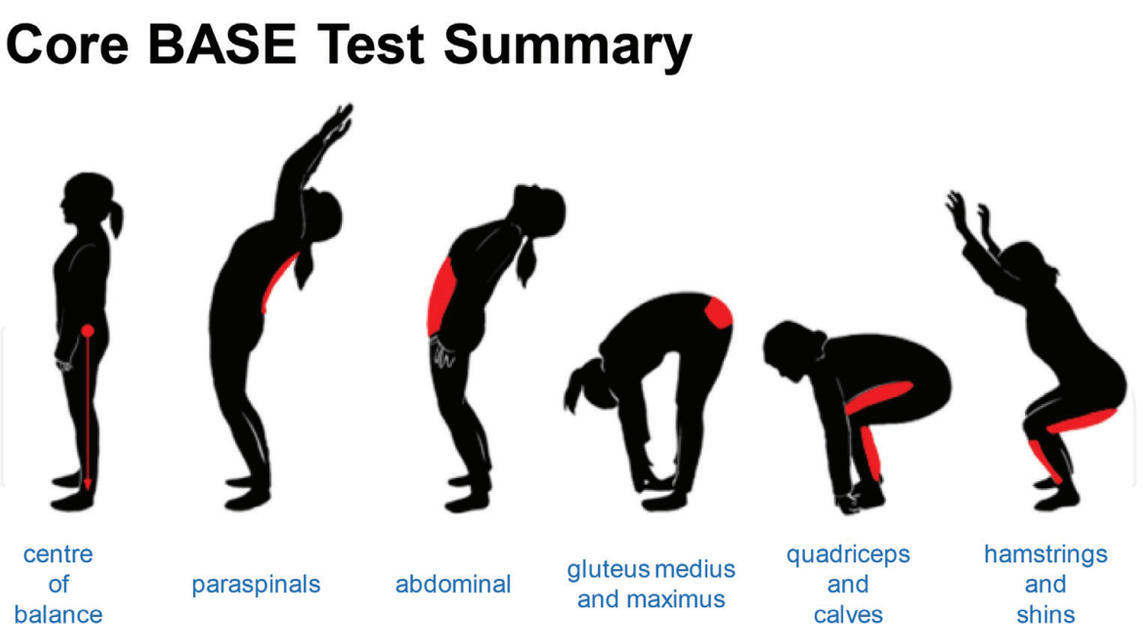

Figure 4.
The core biomechanical assessment and symmetry evaluation (BASE) tests.

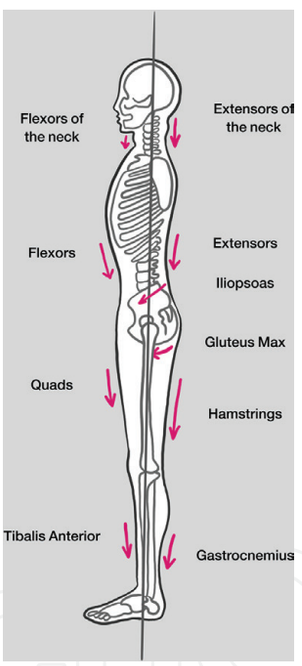

Figure 5.
Muscle groups that play a part in balancing the upright skeleton.

foot feels heavier than the other, then there is a shift of the centre of mass or gravity towards that side of the body. For example, if weight is perceived to be more on the right foot, then there is likely contracted musculature in the right leg "pulling" the pelvis to the right and shifting the centre of mass to the right. At this time, the patient is asked to report about the distribution of weight on their feet (i.e., right or left predominance, towards heels or balls, outside of feet or inside).

At the time of the balance test, the clinician observes postural and position between the right and left sides reviewing; feet (e.g., pronated, elevated little toe, clawed toes), knees (e.g., hyperextended or hyperflexed), level of the hips, shoulder height, any pelvic rotation or tilt, as well as any tilt of the torso or the head. No abnormality detected (NAD) should also be documented.

This will be the first time the clinician touches the patient and a verbal consent prior to examination of any asymmetries is pertinent.

Then, the remaining five core BASE movement tests are performed. These tests are used to screen a patient's body for the true origin of pain. BASE tests compartmentalize the true origin of pain to a defined anatomical region. The objective in having the patient perform these BASE tests is to identify the most painful or restrictive BASE test. The most painful or restrictive BASE test identifies the tissues that are the most significant current contributor to perceived pain. There is a simple elegance to this construct in that each test defines a specific muscle group or body area. The most painful or restrictive test generally provides a clear indication of a starting point for treatment when a patient has multiple sites of pain or widespread pain. Even though the individual BASE tests are common human movements, the coordinated use of these movement tests to define anatomical areas that are the true origin of pain is unique. Administering these core BASE tests is quick, reproducible, and consistent. This is the distinctive feature of *myoActivation*, which will enable future reliable comparative research.

- *Extension arms raised* (*EAR*): the patient is instructed to bend backwards from the hips with his/her arms overhead. Wherever pain is perceived by the patient in this posture, the true source of pain originates in the paraspinal muscles.

- *Extension arms down* (*EAD*): the patient is instructed to arch backwards from the hips with his/her arms down. Wherever pain is perceived by the patient in this posture, the true source of pain originates in the abdominal muscles.

- *Flexion arms down* (*FAD*): the patient is instructed to flex forward with straight knees and bend forward to wherever he/she can reach comfortably. The patient is questioned in regards specifically to pain in the low back. If pain is perceived in the low back in this posture, the true origin of pain is in the medial gluteus medius and/or gluteus maximus muscles.

- *Squat arms down* (*SAD*): the patient is instructed to squat with their arms by their side to where he/she can crouch comfortably. If a patient has a very restricted squat, their technique in performing the squat can be improved by instructing them to drive their buttocks backwards. A deeper squat will invariably result due to increased pelvic rotation from this manoeuver. Wherever pain is perceived by the patient in this posture, the true origin of pain is in the quadriceps or calf muscles. If the pain is perceived to be in the upper leg, then the quadriceps will be the pain source. If in the lower leg, then the gastrocnemius and/or soleus will be the source.

- *Squat arms raised* (*SAR*): the patient is instructed to squat with his/her arms overhead to where he/she can crouch comfortably. Wherever pain is perceived by the patient in this posture, the true origin of pain is in the hamstrings or tissues overlying the shin. If the pain is perceived to be in the upper leg, then the hamstrings will be the pain source. If the pain report is the lower leg, then the medial tibial fascia or soft tissues will be the source.

In performing these core BASE tests, the patient will subconsciously accomplish the required movements through accommodation of his/her previous injuries and joint restrictions. Deviations from normal symmetry often indicate tissue abnormalities. Common postural deviations seen in the performance of core BASE tests

include: shifting of the pelvis, lifting of heels or toes, medial deviation of knees, shoulder girdle rotation, or asymmetry.

The most restricted or painful of the five movement core BASE tests is the guide to a starting point for treatment.

If EAR and EAD or SAD and SAR seem to be equivalent/comparable in causing pain or restriction, then the clinician needs to review lateral muscles and tissues. For example, comparable EAR and EAD requires testing of the quadratus lumborum muscles or the three lateral abdominal wall muscles (external oblique, internal oblique, and transversus abdominis = triceps abdominis). Comparable SAD and SAR requires testing of the tensor fascia lata, vastus lateralis, and the adductor muscles (see **Table 1** for specific muscles).

Once core BASE tests are complete, there are 55 regional BASE tests used in *myoActivation* to assess pain in the head, face, neck, shoulders, and limbs/extremities. It is beyond the scope of this chapter to outline all these regional tests.

3.1.4 Palpation

The technique of palpation develops with experience, but is not difficult to learn. A rolling motion is used, applied using both thumbs or index fingertips simultaneously, on symmetrical tissues to compare right and left sides. Differences between right and left may be apparent by the patient's physical reaction, patient's verbal report, and/or by sensory feedback to the examiner from digital pressure.

The goal in palpation of soft tissues is to identify increased density, which is painful to the patient and feels different to the clinician when comparing the same tissue on the other side. In most instances, when increased density of a soft tissue is identified, the patient will express or react to the noticeable increase in discomfort or pain associated with palpation of the abnormal tissue. When there are conflicting results between the results of BASE tests and findings from palpation, the palpation findings are more important as the indicator of the true source of pain. Where a patient has a high pain threshold, they may not feel discomfort with palpation. The clinician may need to rely on clinical experience to identify the palpable sensation of normal tissue density to identify points in the soft tissues that are outside of the normal range for distortion with fingertip pressure.

Code	BASE test	Tissues commonly responsible
BAL	Balance	
EAR	Extension arms raised	paraspinal muscles
EAD	Extension arms down	triceps abdominis/rectus abdominis
FAD	Flexion arms down	gluteus maximus/gluteus medius
SAD	Squat arms down—upper leg pain Squat arms down—lower leg pain	quadriceps gastrocnemius/soleus
SAR	Squat arms raised—upper leg pain Squat arms raised—lower leg pain Squat arms raised—back pain	hamstrings medial tibial fascia quadratus femoris
	Comparable EAD/EAR	triceps abdominis/quadratus lumborum
	Comparable SAD/SAR	vastus lateralis/tensor fascia lata adductor magnus/adductor longus

Table 1.
Specific muscles associated with BASE tests.

3.1.5 Synthesis

At this time, it is helpful to stop and consider the: history of the presenting complaint, TiLT, most painful or restrictive BASE tests, identified postural anomalies, and notable findings on palpation. This deliberation serves to connect all these factors to discern the relevant myofascial components of the pain presentation. Reviewing the cascade of chronological events that have altered the normal anatomical form will help to untangle the multiple sources associated with the presenting chronic pain complaint. With experience, pattern recognition will be part of this process for common conditions like low back pain.

3.1.6 Consent

Written consent should be obtained after informing the patient of associated risks.

3.1.7 Contraindications to needling treatment

Contraindications to a needling-based treatment include current anticoagulant use, immunocompromised state, needle aversion (trypanophobia), or presyncope.

3.1.8 Treatment anticipation

Patients may be anxious due to needle aversion and anticipation of pain from an unfamiliar procedure. Offering to provide a trial of a single needle insertion usually allows the patient to realize that the actual discomfort is less than the anticipated pain of the needling technique. Use of non-pharmacological and pharmacological techniques to minimise pain of injection and anxiety are essential [140–143].

3.1.9 Choosing a starting point

Once patients are comfortable with the process, start in the area directed by the most painful or restricted core BASE test. In anxious patients, consider an easily tolerated point first. This may be a treatment area that they cannot visualize or a less sensitive body area such as the gluteus medius. In patients who seem skeptical or uncertain, begin treatment closer to their perceived source of pain. Alternatively, start at a site that is guaranteed to make a significant difference in pain and/or flexibility, such as releasing any scar that is in a tissue area directed by the most restrictive or painful core BASE test, i.e., considered to have some association with the presenting problem.

3.1.10 Scars

Scars have significant biomechanical consequences in movement and in the transmission of forces following a subsequent injury. Abdominal incisions are major contributors to pain, pain at distant site, and disturbances in function of internal organs [144, 145]. Inspection of scars for guttering or tethering with movements helps to determine their significance. Scars with a very high potential of significance are associated with Caesarean-section procedures, surgical drains, bone grafts, burns, fasciotomies, chicken pox, and penetrating wounds. Scars with moderate potential of significance include any incisional or excisional surgical scar, especially in the feet. Other important scars include immunization scars, or scars from glass cuts, animal bites, and cystic acne.

Scars can be released by a series of needle insertions through scar tissue. Release of normal skin adjacent to the scar and palpably dense myofascial tissues

surrounding the scar will also contribute to reduction of scar-related tension. Wide scars can be released in a zigzag pattern of needle insertions through the scar tissue. Release of myofascial tension following scar release is proportional to the degree of the "biting" sensation felt while undermining the scar. With experience, it will become apparent that some scars hold emotions related to the traumatic event when the scar occurred [108]. Release of traumatic scars can induce some remarkable, involuntary patient emotional responses. Patients need to be pre-warned about this possible experience. The patient may maintain composure during the clinical encounter, but subsequently report that the emotional release occurred minutes or hours after the treatment.

3.1.11 Needling MTPs technique

Palpation of the targeted tissue, based on the core BASE tests, will provide the clinician with the relevant tissue to release. It is important to release this tissue at the most painful palpable pain point. Skin antisepsis prior to needling will be dictated by the clinician's institutional policy. Needle selection depends on the site to be treated but usually requires a 30-gauge 25 mm or a 25-gauge 50 mm hollow-bore needle connected to a syringe of 0.9% normal saline.

Common responses to trigger point activation (release) reported by patients include pain reduction, pain resolution, movement of the pain from the original site, pain with needle insertion, "biting" (especially with significant scars), burning (presumed blood flow into a released muscle), muscle twitch, muscle relaxation, release of tension, or shooting pain down a limb (not related to needling of an adjacent nerve). All these sensations are positive therapeutic symptoms and merit acknowledgement. In the uncommon instance where needling results in a muscle spasm, additional needle insertions are indicated to activate more trigger points.

3.1.12 Tips and tricks to help with tolerating needling techniques

Breathing techniques and other appropriate non-pharmacological techniques should also be utilized to distract from the needling process [140–142]. At all times, the clinician must observe the patient for any signs of potential light-headedness/presyncope.

3.1.13 Catenated cycles

Catenated cycles (**Figure 6**) are repeated sequences of BASE testing, palpation, and needling in each session to unravel the multiple sites of anatomical distortion contributing to chronic pain. This is an important process as chronic pain, particularly when it has been persistent for years or decades, results from multiple sites or contributors to the pain pattern. Catenated cycles assist in identifying the various contributing tissues to the larger pain pattern. Each cycle usually identifies the next new and different most painful or restrictive BASE test resulting in a new area of treatment. Poor results from *myoActivation* will result from only performing an initial series of BASE tests to find a starting point for treatment and then needling many tissues without undertaking the catenated cycles.

Catenated cycles demonstrate to the clinician some or all of the following visible changes in patient movement: increase in joint range, greater range of motion, increase in speed of movement, increase in ease, smoothness, or fluidity of movement. This provides immediate feedback on treatment.

For the patient, catenated cycles will demonstrate some or all of the following subjective changes in post-treatment movement: reduction in overall perceived pain at rest and/or in movement, reduction or a diffusion in the area of pain, shift in pain location, perception of pain only at end range rather than throughout the range, or a

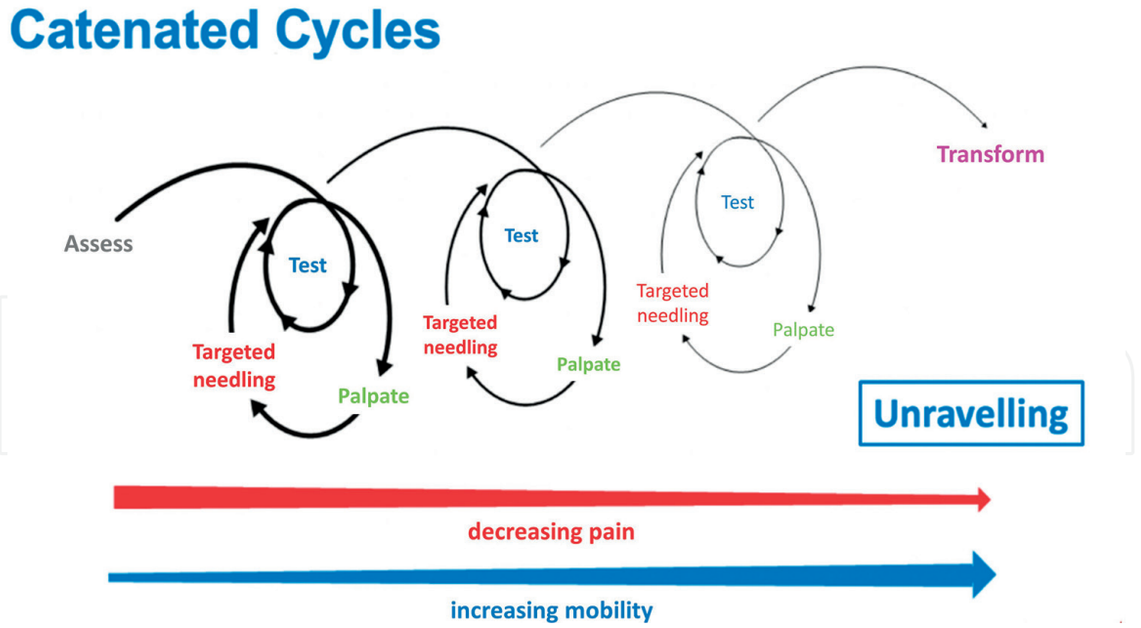

Figure 6.
Catenated cycles, unravelling pain.

different pain focus altogether at a different location that only becomes perceptible when the initial painful site has been treated. Another advantage of the catenated cycles is that the patient has to get up and move after each treatment, which distracts from any pain resulting from the treatment process.

3.1.14 When to stop

It is optimal to end sessions at a successful end-point. These might include resolution of pain, reduction in pain, improved flexibility, increased fluidity of movement, positive postural changes, or change in the weight distribution of the feet to being more grounded (even plantar weight distribution). Otherwise, the decision during treatment to stop further needle insertions is a clinical judgement that is dictated primarily by the patient's ability to tolerate the procedure. Fatigue and feeling overwhelmed are not uncommon responses especially during the first treatment session. Despite receiving written consent, it is always advisable to request ongoing verbal consent at the appropriate times to ensure the patient is agreeable with ongoing care. An important principle is not to do too much at each session.

3.1.15 Risks

In general, there are very few significant risks associated with *myoActivation*. Most common are bruising and short-term muscle pain. The most significant, but extremely rare complication is potential for a pneumothorax. All clinicians needling in the neck and thoracic region must be aware of the preventative strategies, and the symptoms and signs of pneumothorax. Written information should be supplied to patients detailing: what symptoms to notice, and the contact numbers for help and an algorithm of appropriate actions if these symptoms occur once the patient has left a clinical area.

Potential side effects of *myoActivation* include: sweating, light-headedness/presyncope, pain from needle insertion, hematoma, muscle spasm, nausea, vomiting, syncope, post-treatment muscle pain [146], pneumothorax, infection, and failure to respond.

3.1.16 myoActivation after-care

Instructions following treatment are directed to promote recovery of treated tissues and prevent symptom regression. Patients are advised to move regularly, with frequent changes in posture (every 10–15 minutes) while awake in the first 24–48 hours after each treatment. They are also advised to avoid myofascial loading, repetitive exertion, and prolonged postures for 5 days. After this time, they can start graduated activity. The post-treatment response will be an individualized experience for each patient. Multiple factors will govern the outcome resulting from treatment including: degree of sedentary activity in daily life, physical demands in the workplace, patient age, genetically determined responsiveness of soft tissues, and the psychosocial factors related to chronic pain.

3.1.17 Number of sessions

It is optimal to schedule 2–3 sessions, 1 or 2 weeks apart, to minimize the need to do too much at each session, minimize pain following therapy and to help determine responsiveness. After three sessions, the clinician can determine if there is sufficient positive response to continue. There is a wide range in numbers of sessions required in positive responders.

3.1.18 Concurrent therapy

Chronic pain is a complex biopsychosocial problem. *myoActivation* is just one component of a multidisciplinary care. Most patients benefit from concurrent treatment in collaboration with other health professionals knowledgeable in treatment of patients living with chronic pain.

4. Case studies

Three cases are presented. Patients 1 and 2 were seen by a family physician with a focused practice in chronic pain exclusively employing *myoActivation*. Patient 3 received care from a paediatric pain physician. Assessment and treatment for all cases primarily involved application of the *myoActivation* methodology.

4.1 A 31-year-old male with right sciatic and low back pain

A 31-year-old labourer was referred by his family physician for management of back and right lower extremity pain. He was not using regular prescription analgesia medications, but used occasional ibuprofen and marijuana. He had been dealing with intermittent lower back pain since he was 15.

Eight months prior to this assessment, he "pinched a nerve on the left side of this body" while lifting a granite countertop. He was off work for 1 month, participated in a return to work program, and was judged fit for work. He did not feel ready to return to physical labour and took 3 months off. At the end of this period (2 months before this visit), he experienced a pinching sensation in the right buttock while sitting. The symptoms progressed to "sciatic pain" in his upper back radiating to the right knee. These symptoms dissipated but he presented with episodic excruciating pain in the right upper buttock radiating down the right leg. The pain was precipitated by standing, going up stairs, or starting to walk. He had no symptoms of motor weakness, saddle numbness or urinary dysfunction.

TiLT revealed a laceration to the right upper lip from a shovel at age 6 requiring stitches, multiple sutured lacerations on hands from work as a chef and a chicken pox scar on right upper lip. He sustained a right ankle injury from a snowboarding injury aged 15. He had snowboarded for 21 years prior to his work-related back injury but felt that he would never be able to snowboard again.

Past medical history included a 12-year history of depression with frequent suicidal ideation. Current antidepressant medications include bupropion and escitalopram.

Standing posture findings	
Pain focus	No pain at rest while standing
Postural assessment	Feet, no abnormality detected (NAD)
	Knees level, hips level
	No pelvic rotation or tilt, no torso shift
	Left shoulder elevated
	Head NAD
Plantar weight distribution	Equal weight on feet, lateral edges, central

BASE testing	
Extension arms raised	Normal range of motion (ROM), pain low back
Extension arms down	Normal ROM with no pain
Flexion arms down	Limited ROM, pain low back, right more than left
Squat arms down	Normal ROM with no pain
Squat arms raised	Normal ROM with no pain

Worst BASE test in terms of limited ROM and pain was flexion arms down.

Treatment	
Trigger point injections	Right gluteus maximus at origin
Post-treatment assessment	Normal ROM in flexion arms down
Patient quotes	"I am not feeling any pain. It feels nice."

On the principle of not doing too much especially on the first visit, it was deemed appropriate to stop at this time. Over the course of the next 28 days, the patient was seen three times to manage ever diminishing right-sided back and leg pains. Right-sided jaw and neck pains became more prominent in the patient's symptomatology with resolution of his back pain. *myoActivation* principles and process were followed using core and regional BASE tests to resolve these issues as well.

On visit 5, 51 days after initial assessment, the patient stated he was doing really well. Nothing was really troubling him although he was a bit stiff after snowboarding 2 days previously. He remarked his hamstrings were tight, but he was working on stretching them every day and doing some yoga. He did, however, snowboard for a half-day and then a full day. He told himself he would go easy, but was able to snowboard without limitation. He reported that to have the confidence in his body and be able to snowboard was important for him as it was very meditative and his escape. His also reported that his mood had significantly improved. No treatment was necessary on this visit and the patient was discharged.

4.2 A 42-year-old female with fibromyalgia and chronic fatigue syndrome

4.2.1 Visit 1

A 42-year-old hospital kitchen worker was referred by her family physician for fibromyalgia and chronic fatigue syndrome. She had been receiving out-patient care (assessment, investigations (MRIs, X-rays, bone scan) and therapy) through a hospital-based complex chronic diseases programme. She had completed an online programme for pain self-management strategies at a local university, which she found tremendously helpful.

The patient described the onset of pain symptoms 15 years previously following a tooth extraction with subsequent infection. She had a pain and fatigue crisis 3 years previously from which she was unable to get out of bed for 4 months. She reported that currently she has had widespread symptoms including; gastrointestinal upset, brain fog, left temporomandibular joint dysfunction, nerve issues, right-sided migraines, central posterior neck pain, and bilateral scapular pain, left greater than right. A diagnosis of fibromyalgia and chronic fatigue syndrome was made 2 months prior to this visit. She is on long-term disability.

TiLT revealed that at age 10, she had been launched over the handle bars of her bicycle breaking an upper front tooth. Again, at age 10, she fell onto her tailbone requiring her to sit on a donut for a prolonged time after injury. At age 11, she rode a bike that was too big for her and injured her right knee from repetitive movement. She had bilateral knee scars from childhood injuries, right forearm burns from cooking, and a scar from a cut in the mid back from an exploding soda bottle, aged 12.

Past medical history revealed that she had had previous surgeries including dental and a lower segment C-section (LSCS). The patient reported post traumatic stress disorder related to severe pain during her LSCS due to inadequate analgesia from her epidural. Other relevant past medical issues included Hashimoto's thyroiditis, postural orthostatic tachycardia syndrome, irritable bowel syndrome, and fibromyalgia.

Current medications	Synthroid, naltrexone, acetaminophen with codeine
Standing posture findings	
Pain focus	Left scapula
Postural assessment	Feet NAD
	Knees level, hips level
	No pelvic rotation or tilt, no torso shift
	Right shoulder elevated
	Head NAD
Plantar weight distribution	More weight on left foot, medial sides, heels

4.2.1.1 Catenated cycle 1

The TiLT identified a significant tailbone injury in childhood. Clinical experience has demonstrated that tethering of soft tissues overlying the coccyx results in a significant biomechanical distortion. Therefore, in this case the first test indicated is sacrococcygeal palpation.

BASE testing	
Palpation findings	**Exquisitely tender in midline over coccyx**
Treatment	**Fascia over coccyx**

4.2.1.2 Catenated cycle 2

BASE testing	
Extension arms raised	Severe ROM limitation with left shoulder pain
Extension arms down	Moderate ROM limitation, left shoulder pain
Flexion arms down	Moderate ROM limitation with pain lower back
Squat arms down	Moderate ROM limitation with pain calves
Squat arms raised	Severe ROM limitation with pain thighs
Palpation findings	**Palpable pain points C5-T11, left more than right**
Treatment	**Bilateral paraspinals from C6 to T12**

4.2.1.3 Catenated Cycle 3 and Cycle 4

BASE testing	
Extension arms raised	Severe ROM limitation with left shoulder pain
Extension arms down	Moderate ROM limitation, left shoulder pain
Flexion arms down	Moderate ROM limitation with pain lower back
Squat arms down	Moderate ROM limitation with pain calves
Squat arms raised	Severe ROM limitation with pain thighs
Palpation findings	**Palpable pain points C5-T11, left more than right**
Treatment	**Bilateral paraspinals from C6 to T12**
Extension arms raised	Mild ROM limitation with left shoulder pain
Extension arms down	Moderate ROM limitation with left shoulder pain
Flexion arms down	Moderate ROM limitation with pain lower back
Squat arms down	Moderate ROM limitation with pain calves
Squat arms raised	Moderate ROM limitation with pain thighs
Straight arm pinch	Limited range in left shoulder

The straight-arm pinch BASE test specifically assesses restriction in scapular mobility from sustained contraction of the ipsilateral serratus anterior muscle.

Palpation findings	**Palpable densities overlying left ribs 4–6 between anterior and posterior axillary lines**
Treatment	**Left serratus anterior**

4.2.1.4 Post-treatment assessment

Decreased lower back pain and left posterior shoulder pain. Increased ease and range in flexion arms down, extension arm raised, extension arms down, and straight-arm pinch.

4.2.1.5 Patient quotes

"That's crazy!" "I feel so light!"

4.2.2 Visit 2 (7 days after visit 1)

The patient reported she had had a rough week, with soreness and pain for about 5 days, especially from the injection over the coccyx. She felt her pain pattern was different. She felt lighter but was still feeling brain fog. The left shoulder blade felt stiff but not painful.

Standing posture findings	
Pain focus	Head pressure
Postural assessment	Feet NAD
	Knees' level, hips' level
	No pelvic rotation or tilt, no torso shift
	Shoulders' level
	Head NAD
Plantar weight distribution	Equal weight on feet, medial sides, heels

4.2.2.1 Catenated cycle 1

BASE testing	
Extension arms raised	Mild ROM limitation with pain lower back
Extension arms down	Moderate ROM limitation with pain lower back
Flexion arms down	Normal ROM with no pain
Squat arms down	Normal ROM with no pain
Squat arms raised	Normal ROM with no pain
Treatment	**C-section scar**

4.2.2.2 Post-treatment assessment

Decreased brain fog. Increased ease in ambulation.

4.2.3 Visit 3 (14 days after visit 1)

She has not had any pain in her neck or shoulder. Right knee was biggest problem.

Standing posture findings	
Pain focus standing	No pain at rest while standing
Postural assessment	Feet NAD
	Knees' level, hips' level
	No pelvic rotation or tilt, no torso shift
	Shoulders' level
	Head NAD
Plantar weight distribution	Equal weight on feet, central, balls of feet

4.2.3.1 Catenated cycle 1

BASE testing	
Extension arms raised	Moderate ROM limitation with fatigue in right lower back
Extension arms down	Severe ROM limitation with fatigue in right lower back and neck
Flexion arms down	Limited ROM with pain in low back
Squat arms down	Normal ROM with no pain
Squat arms raised	Normal ROM with no pain
Palpation findings	**Palpable tender density in right external oblique muscle medial to anterior superior iliac spine (ASIS)**
Treatment	**Right external oblique**

4.2.3.2 Catenated cycle 2

BASE testing	
Right lateral arch	Mild ROM limitation with right low back pain
Left lateral arch	Mild ROM limitation with hip tension

[The lateral arch BASE test specifically assesses restriction in pelvic mobility from sustained contraction of the ipsilateral iliopsoas muscle].

Palpation findings	**Exquisite tenderness to light palpation of the right iliopsoas tendon in the femoral triangle**
Treatment	**Right iliopsoas**

4.2.3.3 Post-treatment assessment

Decreased lower back and flank pain. Increased ease in ambulation, extension arms raised, extension arms down, and lateral arches.

4.2.4 Visit 4 (50 days after visit 1)

She had a lot more mobility since the last visit with no significant pain other than the right knee. She had not had a migraine in several weeks.

Standing posture findings	
Pain focus standing	Right knee
Plantar weight distribution	Equal weight on feet, medial sides, heels

4.2.4.1 Catenated cycle 1

BASE testing	
Extension arms raised	Moderate ROM limitation, pain in quadriceps
Extension arms down	Moderate ROM limitation, pain in right knee
Flexion arms down	Normal ROM with no pain
Squat arms down	Normal ROM with no pain
Squat arms raised	Normal ROM with no pain
Palpation findings	**Palpable tenderness and density in right external oblique inferomedial to ASIS**
Treatment	**Right external oblique**

4.2.4.2 Post-treatment assessment

Decreased right knee pain. Increased range in extension arms raised, extension arms down, and lateral arch BASE tests as well as ease in ambulation.

4.2.5 Follow-up (294 days after visit 1)

The patient reported significant improvement in all her symptoms. Previous blinding aura migraines occurring 2–3/week were now reduced to mild aura migraines 1–2/month. She had full resolution of her neck pain at the base of her skull (pain previously scored at 7–10/10), her coccygeal pain (previously 2–4/10), and hip pain (previously 6–8/10). She reported significant reductions in her left scapular pain (previously 6–8/10, now 2–6/10) and right knee pain (previously 4–7/10, now 2–4/10). She was also experiencing improved cognitive function, improved focus and reduced sensitivity to light and sound.

4.3 Paediatric case study: low back pain

A 4-year-old girl was referred to a paediatric complex pain clinic by her neurosurgeon with a 2-year history of low back pain. Her mother reported that her daughter's pain started approximately 1 month following lumbosacral dermal sinus tract surgery. There had been no obvious pain prior to surgery. Her pain was focused in the midline from level of T12 to sacrum. The pain was variable but worse towards end of day, early evening, and night-time. The pain was associated with her being "cranky and irritable". Relief was gained with heat, necessitating many hours per day in a warm bath. The pain was aggravated by swimming, sitting and cold weather, but there were no issues with walking. The pain was not relieved by acetaminophen or ibuprofen. There were no scoliosis, no motor deficits, and no urinary or bladder issues.

In the past medical history, there had been no motor vehicle accidents, no fractures or other trauma, no falls on the coccyx/tailbone, and no other surgeries. The only scar was that related to her dermal sinus surgery. In response to the question "What has been her greatest physical trauma?" the answer was her dermal sinus surgery with a minor delayed healing of a part of the wound. The child was born at term by normal spontaneous vaginal delivery following a normal pregnancy. There were no other health issues, no allergies, and no current medications.

The lumbosacral dermal sinus tract excision surgery was uncomplicated, followed by an uneventful recovery and discharge from hospital 3 days postoperatively. Recent investigations included blood work, X-rays, and an MRI of the spine: all reported to be normal. Neurological, neurosurgical, and orthopaedic consultations revealed no abnormality to explain her ongoing pain.

The child was 22 kg and very active and clingy to her mother. She was reluctant to be examined, but interestingly was keen to participate in the core BASE tests as long as she was copying her mum. Pain site was as reported in the history.

Standing posture findings	
Pain focus	Low back
Postural assessment	Hips level, shoulders level
Plantar weight distribution	Patient unable to differentiate

BASE testing	
Extension arms raised	Mildly ROM with pain low back
Extension arms down	Normal ROM with no pain
Flexion arms down	Limited ROM with pain low back, right greater than left
Squat arms down	Normal ROM with no pain
Squat arms raised	Normal ROM with no pain

The worst BASE test in terms of limited ROM and pain was EAR and FAD.

It was not possible to determine the weight distribution on the feet. The core BASE tests that appeared to be most restricted were EAR and FAD; the most painful of these was EAR. The child was able to perform the other core BASE tests with no apparent difficulty. The surgical scar over her sacral area was well healed, but the mid portion of it had a 2-cm wider part that had presumably been the site of the reported delayed healing. There was no tenderness over the coccyx.

The examination revealed no obvious abnormality other than the scar in the midline and a right paraspinal muscle in sustained contraction.

The child was started on magnesium bisglycinate, vitamin K2, and vitamin D3. Three weeks later, scar release and right paraspinal release were performed under general anaesthesia. At follow-up, 4 months after initial assessment, the child was pain free and active in dance.

5. Discussion

5.1 How does myoActivation work?

myoActivation is a process that enables the clinician to connect or link the patient's TiLT with the myofascial findings on examination. The targeted myofascial activations appear to restore the biomechanical, neuroendocrine, and autonomic balance to reduce chronic pain. Research is required to determine which components of the myofascial system are really important in making the observed changes seen following *myoActivation*.

5.2 What makes myoActivation different?

A distinctive and foundational principle of *myoActivation* is that the perceived site of pain is often not the source of pain. *myoActivation* constitutes a paradigm shift in how to take a pain history and examine a patient with chronic pain.

The history focuses on a TiLT, including surgery, motor vehicle accidents, fractures, scars, and injuries. It highlights the importance of scars as contributors to chronic pain, especially scars inflicted at a young age or associated with poor healing. It relies on excellent clinical acumen to observe postural abnormalities and skeletal asymmetries, and to locate palpable painful points that help guide therapy as illustrated in the cases presented.

Standard structured BASE tests are used to distinguish significant fascial or muscle trigger point contributors to chronic pain. This structured assessment and treatment is reproducible and therefore a unique framework to perform comparative research. A synthesis of pertinent findings connects the dots that link the patient's TiLT with the myofascial findings, looking at the patient as a whole biomechanical structure and not as segmented symptomatic parts.

Needling is performed with hollow bore needles, with a cutting tip, which is utilized to target and release scars, fascia in tension and PPPs in muscles; therefore, it is not the

same as classical intramuscular stimulation (IMS), traditional Chinese acupuncture, western medicine acupuncture, prolotherapy, or dry needling targeted at the site of pain. Immediate changes occur such as decreased pain, improved flexibility and improved fluidity of movement, which are easily demonstrated with the repetition of BASE tests.

Even if a needling technique is not used, for example in children or in individuals with needle aversion, the *myoActivation* TiLT, assessment, and examination can be used to determine if there is a myofascial component to chronic pain and direct patients to non-needling therapies such as physiotherapy and massage.

myoActivation uses catenated cycles of intervention and reassessment of baseline tests to unravel the important muscle groups and fascial tensions contributing to the particular pain problem, then repeats baseline tests to highlight the next biomechanically significant tissue in tension. It typically requires 2–5 *myoActivation* sessions to get to the treatment goal of improved flexibility and reduced pain or resolution of pain.

myoActivation can be used to reduce pain in different pain populations for a variety of different pain conditions. It can cause an emotional release, fatigue, sense of lightness, or well-being at the time of *myoActivation*. It restores hope to patients as it provides an answer to the cause of years of pain. It provides a tool in the toolbox for clinicians, which is low cost, effective, and does not require specialized equipment or imaging. It can be easily incorporated into primary care practice and, therefore, not subject to tertiary care waitlists. However, to be effective, it does need to be applied by an appropriately trained clinician.

myoActivation as an effective tool means the clinician does not have to rely on pharmaceutical analgesic agents for myofascial pain. Pain resolution and its effects on improved function, and ultimately mood, enables weaning of established analgesia medications, including opioid medications.

5.3 What is the future of myoActivation?

With its low cost and no requirement for resource-intensive clinical investigations, *myoActivation* has the potential to support the movement for "winding back the harms of too much medicine" [147]. However, for that to happen, we need to develop programmes of research and training and to address the barriers of awareness, availability, and accessibility [43].

Demonstrating a firm evidence base for the perceived benefits of *myoActivation* will ultimately require prospective research studies, including multi-centre clinical trials [148]. Many questions remain about mechanism of action, specific approaches in different populations, benefits of integration with other therapeutic techniques, timing of *myoActivation,* and integration with other management techniques. In the meantime, we must rely on patient voices, case studies, audit through patient registries (where *myoActivation* has been delivered by accredited personnel), population–based, case-controlled studies [149] and N-of-1 studies, especially considering the diversity of chronic pain presentations in the population [150].

Clinicians will need to be trained in the art of determining palpable pain points and to learn *myoActivation* before they can fully incorporate this process into their everyday practice. A core group of *myoActivation* faculty, led by Dr. Siren, is developing a programme for training and dissemination of *myoActivation.* Assessment and treatment strategies often begin as local initiatives and are developed into widely accepted standards for care; for example, Managing Emergencies in Paediatric Anaesthesia started in one centre in the UK [151], but is now an internationally recognized course teaching a standard approach worldwide [152, 153]. Other examples include Advanced Cardiac Life Support and Advanced Paediatric Life Support [154].

6. Conclusion

In the face of the burden of chronic pain, including its economic impact, it is imperative to establish new and effective tools to minimize the impacts of this condition. Early intervention is key to success in managing chronic pain. This requires that a tool be available, accessible, and affordable to community clinicians. The current opioid crisis and limited therapeutic effectiveness of many pharmaceutical agents in chronic pain necessitate a different approach.

This chapter has described the core assessment and therapeutic process of a novel technique to manage myofascial components of chronic pain. *myoActivation* is structured and reproducible, with a high benefit to risk ratio. It can be applied to many different chronic pain presentations and different age groups.

Clinicians will need to be trained to successfully incorporate core and regional components of *myoActivation* into their practice. We hope that this chapter will be an incentive for clinicians to learn more about this system of care. It is clear from experience that this is an effective approach and brings a much-needed tool into the toolbox for chronic pain, which, so far, has evaded an efficacious therapeutic modality.

> *"In departing from any settled opinion or belief, the variation, the change, the break with custom may come gradually; and the way is usually prepared; but the final break is made, as a rule, by some one individual, [...] who sees with his own eyes, and with an instinct or genius for truth, escapes from the routine in which his fellows live."*
>
> *Sir William Osler, 1849–1919.*

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Disclosures

Dr. G. Siren is the inventor of *myoActivation*. He trademarked *myoActivation* principally to ensure that a structured assessment and process is followed and maintained.

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