Soft Tissue Release

Third Edition

Mary Sanderson

Exam Edition

NielAsher.
Continued Education for Manual Therapists

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Contents

Abbreviations

CEO	common extensor origin
CFO	common flexor origin
CTM	connective tissue massage
GAG	glycosaminoglycan
ITB	iliotibial band
LSSM	London School of Sports Massage
MET	muscle energy technique
MTPJ	metatarsophalangeal joint
NMT	neuromuscular technique
PIR	post-isometric relaxation
PSIS	posterior superior iliac spine
RI	reciprocal inhibition
RICE	rest, ice, compression, elevation
ROM	range of movement
RSI	repetitive strain injury
SCM	sternocleidomastoid
SPD	symphysis pubis dysfunction
STR	soft tissue release
TFL	tensor fasciae latae
TMJ	temporomandibular joint
TTH	tension-type headache

Introduction

Soft tissue release (STR) is a dynamic, participative and versatile massage technique that contributed to the healing of my own injury twenty years ago.

Sport has always been a passion of my life and, after taking a degree in Sports Studies and qualifying to be a massage therapist with the London School of Sports Massage (LSSM), it became my career as well as my hobby. Using the massage techniques I had been trained in, and the expertise I had acquired, I began to have considerable success not only in preventative work but also in treating sporting injuries. My professional career flourished. My fulfilment from sport, however, plummeted when I sustained a hip injury at the end of 1992. I was blighted with injury myself and could not run.

I tried various specialists who used differing techniques. I had a thorough biomechanical assessment that revealed no significant deficiency so I was not prescribed orthotics. A chiropractor worked on the sacroiliac joint, which was stiff. One very impressive physiotherapist gave me an accurate diagnosis: 'gluteus medius compartment syndrome'. All these were accurate and valuable assessments but I still could not run. Any massage I had using deep stroking seemed to irritate the condition, as did the gluteus medius strengthening exercises. Finally I came across an American massage therapist who was presenting a course on advanced massage therapy; he laid me on my side, put a very strong elbow into my tensor fasciae latae (TFL) and told me to move my hip. After three years of not being able to run properly it was almost an immediate transformation. I required further treatment and specific re-educational exercises to maintain the change and minimise the recurrence of the problem, but from that day on I lost the majority of my pain.

My professional and sporting life turned a new corner together. Soft tissue release – the combination of movement and manipulation – put my sporting life back on the road to recovery and sent my professional life along a new path. Detailed, accurate and technical work to the soft tissues is often the missing link within physical therapies. Skilled massage is not the answer to everything but it is a vital therapy to accompany the others. Many injuries are due to minor soft tissue dysfunction and muscle imbalance and can be rehabilitated with the right massage.

It is almost a natural development for the experienced massage therapist to start involving movement as he or she finds 'stubborn' areas, so there are probably numerous ways of working in a similar fashion. In this book, I outline the techniques that I have found to be successful in my experience over the past twenty-one years. STR is not intended to exclude traditional massage techniques. Experience in massage therapy is the foundation of good practice in STR; involving movement and the active co-operation of the subject is a positive step forward for the skilled therapist.

My initial introduction to STR was through the LSSM. My knowledge has grown and evolved in this area of expertise through my own experience and liaison with other therapists. This book is not intended for diagnosing injuries, but purely offers an insight into an efficient method for assessing and treating the soft tissues.

Mary Sanderson
May 2012

Part I

Introduction to Soft Tissue Release (STR)

SOFT TISSUE DYSFUNCTION

The Soft Tissues

As well as bones and joints, the musculoskeletal system consists of soft tissues: these comprise skeletal muscles and connective tissues such as fascia, tendons and ligaments. Ligaments are a type of fibrous connective tissue and connect one bone to another, to form and stabilise a joint. Muscles contract and relax to maintain posture and to provide movement. They are attached to the periosteum (the layer of tissue surrounding the bone) by tendons or aponeuroses, which are thickened extensions of the muscle's fascia. Fascia is all-encompassing and packages, supports and envelops all the body's muscles and organs. It separates different muscles yet allows them to glide smoothly beside each other. The fascial planes provide pathways for nerves, blood vessels and lymphatic vessels. Fascia therefore plays a key role in maintaining the health of muscle. If the fascia has been torn or overstressed, its subsequent loss of elasticity will cause and maintain chronic tissue congestion.

Overuse Injury

Micro-strains to muscles always occur. If an individual performs a variety of different movements in everyday life, maintains controlled dynamic and static posture (control and stability during movement and static holding positions), rests sufficiently and has good nutrition, these strains heal and cause no problems.

This is usually not the case, as many people are involved with repetitive activities. Whether through lifestyle, occupation or sporting pursuits, repetitive positions and movements continually stress affected areas, causing micro-tears in them. Secondary tension arises around these tears to protect them from further use.

Repair takes place with the formation of collagenous tissue. This micro-damage, secondary tension and repair can go unnoticed by the individual. However, as the activity persists over weeks, months or years, the same tissues are constantly traumatised, so the tension and fibrous tissue are maintained. The body adapts to the hypertonicity and its posture becomes altered. As fascia supports the movements of the muscle, it too can shorten and become thickened.

Weaknesses, imbalance and reduced function become evident, but warning signs of potential malfunction are often not heeded and possibly not even detected until the continual overload causes a breakdown. This breakdown can take several forms, for example severe soft tissue trauma such as a hamstring strain, a variety of tendon injuries, or an annular disc tear.

This is how an overuse injury is sustained but the causes are famously multifactorial and it is not always easy to determine which happened first. The numerous precipitating factors that contribute to an overuse injury include:

- Faulty positions in day-to-day life, such as poor posture in front of a computer screen; in this instance, the shoulder girdle and head can become protracted, impairing movement and function of the region.

- Participating in sports with faulty or incorrect equipment, such as riding a bike that is incorrectly set up (for example, the saddle too low), or running long distances on a cambered road.

- Performing an activity with a bad technique, such as swinging a golf club incorrectly, which will put unnecessary stress on certain structures.

- Introducing sudden adaptations to training or a technique, for example a sudden increase in running mileage.

- Neglecting to warm up adequately, which will impair tissue resilience to injury.

- Insufficient recovery (e.g. lack of rest or poor nutrition) after an activity, which will impair the body's ability to heal.

- Sudden movement occurring beyond what the tissues are capable of in terms of flexibility.

- Muscle balance – relative strength between muscles working together; if muscles are out of balance, uneven pulling will occur across a joint, affecting its range of movement (ROM).

- An individual's specific biomechanics; for example, over-pronation or supination in the foot may not be correctable with re-educational exercises alone and could need orthotic prescription.

- Congenital conditions, such as scoliosis, and previous injury, which place uneven tension on the body.

- Age – the connective tissues become stiffer with aging, so injury is more likely and healing is slower.

The following is an example of how an overuse injury can develop: a distance runner, because of an increase in mileage on hilly terrain, acquired micro-tears in the quadriceps muscles. One leg was slightly favoured during running and took longer to recover; chronic tension developed in the quadriceps, together with adherence to the iliotibial band (ITB). The gluteus medius on that side became inhibited as the tensor fasciae latae (TFL) over-worked and became hypertonic. All this had gone undetected by the athlete, who continued to train. Before long, however, a sharp pain developed towards the lateral knee, making running impossible. The ITB was grating on the lateral condyle of the femur. The runner perceived the injury to be a recent one in the knee, but it in fact originated much earlier, in the quadriceps and gluteal muscles.

A good way to start unravelling this overuse pattern is to check the position of the pelvis and back, and the balance of the hip, pelvic and back musculature. From a treatment point of view, it would be imperative to address the TFL, the ITB and any adherence

they may have to the vastus lateralis; from a strengthening point of view, the gluteus medius is likely to need attention to restore balance and prevent the TFL from over-tightening. After treatment, some advice can be offered: ensure that the athlete is stretching adequately after training, investigate what positions are being adopted at work that will affect the musculature, and check that there is enough variety and balance in training to negate the repetitiveness of distance running.

Connective Tissue and Fascia

An understanding of the structure of connective tissue will help explain why soft tissue techniques, such as STR, have such a powerful and positive effect in healing and maintaining the health of the musculoskeletal system. Ligaments, tendons, fascia, retinacula and periosteums are all forms of connective tissue, made up of mainly the same structures but in varying proportions depending on their roles.

Fascia is an all-encompassing array of different layers of fibrous connective tissue, packaging and surrounding all of the body's structures. It consists of two levels: the superficial or subcutaneous layer, which wraps the whole body from head to toe, and the deep fascia, which envelops the organs, viscera and muscles. Myofascia refers to fascia associated with skeletal muscle. Tendons are the more fibrous extensions of myofascia: they attach the muscle across a joint to the periosteum.

All connective tissue is composed of a strong, pliable extra-cellular matrix of collagen, elastin and reticular fibres, surrounded by a ground substance of water and glycosaminoglycans (GAGs). The long white fibres of collagen are the chief component of connective tissue, and their tough strands give the tissue its shape, strength, resiliency and structural integrity (Juhan, 1998). The matrix is embedded with cells, such as fibroblasts and chondrocytes that rebuild the tissue when damaged (Lederman, 2005). The functions of particular connective tissue are determined by the structure of its extra-cellular matrix and ground substance. In fibrous connective tissue, such as tendons, ligaments and fascia, the ground substance contains little fluid and many fibres of collagen and elastin, forming a tough, stringy

material (Juhan, 1987). Tendons have collagen fibres arranged in parallel formation for strength and rigidity, whereas in ligaments they are arranged more loosely and in different directions to cope with multidirectional forces (Lederman, 2005).

The ground substance lubricates the fibres and allows them to glide over one another (Williams, 1995), providing a medium for exchange of elements such as oxygen, nutrients and cellular waste (Juhan, 1987). The ground substance will therefore affect the health of the cells.

The texture of the ground substance can change from a gelatinous gel-like substance that limits movement, to a more flexible state that facilitates it. This property is known as thixotropy. Movement, soft tissue manipulation, heat and vibration maintain a porous, hydrated ground substance which allows for gaseous and nutritional exchange and the smooth gliding of collagen and elastin fibres.

Injury, chronic stress and immobility cause the ground substance to dehydrate and harden, leading to the formation of adhesion and scar tissue. Fibroblasts migrate to the injury site and secrete collagen. As the tissue continues to be stressed over a period of time, the collagen thickens and spreads through the fascial web. The random laying-down of collagen fibres reduces the lengthening potential and thus limits the movement of connective tissue (Juhan, 1987).

As all of the skeletal muscles are supported in myofascial tissue, local injury or stress can lead to body-wide compensatory shifts. The widespread rigidity of fascial tissue locks the soft tissues into positions of strain and dysfunction, and pathophysiological changes unfold. Fascial disruption can cause minuscule shifting of bones that may irritate joint surfaces and reflexively produce further soft tissue dysfunction (Chaitow, 1996). Reduced or altered movement patterns manifest, and the compression of nervous tissue and blood and lymphatic vessels is compounded. The restoration of myofascial tissue is fundamental not only in releasing muscle tension but also in correcting postural misalignment, reducing neuro-excitability and improving venous and lymphatic flow.

Acute and Sub-acute Injury

Major injury can be the result of a direct trauma from an external force, or may occur as a consequence of repeated micro-tears (overuse). The severity of injury is judged by the number of fibres damaged. Tearing of fibres can occur within a muscle or muscles, and the fascia surrounding the muscle can be torn in more severe strains. Following any initial injury, RICE (**R**est, **I**ce, **C**ompression, **E**levation) is the recommended first aid. Rest is vital to prevent further damage, but controlled movement that does not stress the injured area in the sub-acute phase will encourage collagen fibres to align along the lines of structural stress (Lederman, 2005). Ice is analgesic and also decreases metabolic activity, as well as reducing blood and lymph flow where bleeding and swelling are occurring. Compression should be administered carefully so as to reduce the development of swelling without curtailing circulation. Elevation is beneficial where appropriate, to help venous and lymphatic flow against gravity and also to minimise swelling.

Ligament Injury

Ligamentous tearing is referred to as a sprain. In this book, ligaments and joint capsule membranes are generally not included in the treatment of the soft tissues, although they are forms of connective tissue. Ligaments can, however, be treated with STR and are therefore occasionally mentioned. Controlled exercise and movement have a positive effect on the recovery of ligaments, as the latter have a relatively poor blood supply compared to muscles and tendons, so healing is often slow. By administering appropriate STR, the collagen turnover is increased, and by ensuring that the muscles, tendons and fascia around the injury are in good condition, their repair will be enhanced.

Tendon Injury

Tendinopathies present with degrees of pain, swelling, stiffness and weakness and are often classified as overuse injuries, so the causative factors need to be addressed alongside treatment. Tendons are mechanically strong, as they transfer the force of the contracting muscle to the bone; because of this, however, they lack elasticity. Tendons are susceptible to weakness when

injured, and appropriate release of restrictions will greatly enhance strengthening programmes. With any tendon injury, it is necessary to treat the muscle from which the tendon originates, as well as neighbouring or other relevant soft tissues in the pattern of release; tendons have on average only 5% stretch capability compared to the attached muscle, so this needs to be considered when performing the stretch aspect of STR. Areas of congestion commonly prevail at the musculotendinous junction. Particularly where there is inflammation, treatment on the actual tendon should be limited, but STR is a useful tool, as the lock is only momentary and can be administered very close to inflammation without direct irritation. Ice to the inflamed area is recommended. Often, injury to a tendon is referred to generally as a 'tendinopathy', but the following are commonly defined tendon conditions:

Tendinitis: Inflammation and scarring of the tendon itself.

Tenovaginitis: The synovial sheath around the tendon is inflamed and thickened.

Tenosynovitis: Inflammation between the synovial sheath and the tendon.

Peritendinitis: Inflammation and thickening of the paratenon. (A paratenon is the membranous tissue around tendons that have no synovial sheath, for example the Achilles tendon.)

MASSAGE AND STR

Massage Techniques

As well as having its own specific attributes, STR has all the physiological benefits of traditional massage. Massage can increase venous and lymphatic drainage. The increase in interstitial pressure during and after massage allows for easier fluid absorption so that fresh blood can enter fatigued or traumatised areas. Adhesive tissues can be mobilised and scar tissue broken into smaller particles for phagocytosis and lymphatic absorption to occur. Massage strokes can stretch muscle fibres longitudinally and improve collagen flexibility.

There are advanced soft tissue techniques which bring into play the nervous system to override reflex holding patterns. Performed correctly, neuromuscular techniques (NMTs) will eradicate tension areas and scar tissue. STR can sometimes involve this neuromuscular element, as the STR treatment can on occasion be painful.

Methods that specifically target the connective tissues are also highly effective. STR can incorporate the effectiveness of connective tissue massage (CTM) by addressing the connective tissues with a 'CTM' lock (see page 33).

STR and Research

All tissue has conductive ability. When myofascial disruption occurs, a reduction in the electric potential is generated. Research suggests that dense collagen reduces or impedes electrical flow through the tissue, thus reducing the activity of the local fascial cells. The thixotropic quality of myofascia means that when it shortens or thickens, it dries out, and the ground substance turns from a watery solution which facilitates movement to a less flexible gel which limits movement.

Application of pressure brings about a change to a solution and rehydration, where the connective tissue becomes more solute and less sticky and dense. Removal of the pressure causes a re-gelling, but the tissues will have improved in both conductive ability and water content (Oschman, 1997). This boosts electrical activity and improves the neuromuscular relationship.

Movement is essential to the repair and maintenance of healthy tissue. It provides direction for deposition of collagen and encourages vascular regeneration. Movement also lubricates and hydrates connective tissue by improving the balance in the ground substance between the GAGs and the water. This will reduce the potential for adhesion formation (Lederman, 2005).

Research with tissue cultures highlights the importance of both stress and motion to healing. Lederman (2005) also states that 'active techniques will stimulate muscle fibre regeneration, a normal ratio of muscle to connective tissue elements and the development of neuromuscular connections'. Treatment using a

combination of pressure and movement, therefore, should have a significant positive effect on the quality of the myofascial tissue. Passive tissues, when worked on, present as relatively soft, and pressure is diffused by their softness; deep connective tissue restrictions may not get enough mechanical energy to cause thixotropic change (Juhan, 1987). If pressure and movement are applied together with muscular contraction, tissue density is significantly increased. This in turn increases the pressure delivery through the myofascial tissue and will enhance the effectiveness of treatment (Lowe, 1999).

Combining concentric muscle contraction with a specific broadening pressure into the myofascial tissue facilitates a greater mobilisation of the connective tissues (Lowe, 1999). Longitudinal stress may also positively influence the pattern of myofascial tissue (Cantu and Grodin, 1992), and the application of longitudinal strokes while the tissue undergoes eccentric contraction effectively stretches and lengthens the connective tissues.

It would seem that treatment could be more rapid, and the pressures applied by the therapist reduced, when pressure and external movement of the tissues are combined.

Soft tissue release has a fast response in alleviating tissue restrictions and enhancing tissue health, which suggests a neurological involvement. An immediate reduction in tissue tone cannot be explained by mechanical properties alone, but also involves the autonomic nervous system (Schleip, 2012).

The only currently available research specifically into the technique of soft tissue release (STR) is a preliminary single case study on a hemiplegic stroke patient. Barnard (2000) found that the application of STR to the muscles controlling elbow flexion and supination increased elbow ROM and reduced elbow flexor spasticity; ten minutes of passive STR was performed on five consecutive days, and a 41% improvement in elbow ROM was observed eight weeks after intervention.

There is a lack of empirical evidence to prove that STR is effective, so there is huge scope for research into the technique. Palpation skills are difficult to measure, and therefore, as is often the case,

research is lagging behind clinical experience and anecdotal evidence.

Prevention of Injury

Regular stretching and massage help to maintain the ultimate health of the soft tissues, thereby reducing the possibility of injury. If areas of malfunction of soft tissue are detected, they can be dispersed before a more serious injury occurs. Strong individual muscles will resist stress better than muscles that are shortened and adhered. In competitive sport, for example, where intense training is necessary for success, muscles are continually being shortened, micro-torn and fatigued. Massage will elongate and nourish the shortened tissues and separate adhesions, facilitating repair and adaptation to the training. Treatment will vary according to the intensity and the amount of training, but in most cases potential problem areas can be detected prior to dysfunction or reduced performance.

Ice and Intense Training

Micro-tearing is an essential part of training: tissue is torn and as it is repaired it becomes stronger to cope with the demands of training. Many elite sports people use ice after intense training to help move through the stages of repair, so that healing and recovery are faster and more complete than they would otherwise have been. Ice should be used directly after training. Massage treatment should be conducted later, and the length and depth of the treatment will vary according to how it fits in with intense training and recovery.

Overuse Injury

When dealing with injuries caused by overuse, massage comes into its own. With STR, large areas can be assessed fairly quickly, so severe problems of hypertonicity, muscle shortening, adhesion and scarring can be detected and addressed, prior to focusing on a specific spot. Correct usage of STR can separate and re-align adhesions, break down collagen tissue and lengthen chronically shortened fibres. With STR it is also possible to specifically target fascial tissue to reduce pressure on a muscle. All this

enables muscles to become nourished, pliable and flexible so that they may contract and relax without resistance. So, whether breakdown results from sporting activities such as long-distance running, or from repetitive everyday pursuits which stress the musculature, such as sustained postures, a course of treatments facilitates rebalancing and a return to full function. Where chronic inflammation is present, ice can be used alongside treatment.

Traumatic Injury

Correct treatment is essential, even in relatively minor injuries or low-grade strains, to ensure that full mobility and strength are regained. Massage techniques in conjunction with RICE will help the healing processes. Massage away from the site of injury during inflammatory stages is beneficial because it maintains good circulation, thereby encouraging drainage of any swelling. For example, in an ankle inversion sprain the calf muscles may be treated. In the sub-acute and repair phases of healing, careful use of STR can be effective for encouraging collagen to align in an orderly fashion. In the case of the ankle this may be treatment to the peronei muscles and their tendons and to the lateral ligament complex, as well as maintaining balance by treating all tendons which cross the ankle. STR, being a functional treatment modality, is an ideal technique given the necessity for rehabilitation to consist of active rest. As recovery continues, compensatory problems may develop. In an ankle sprain, plantar muscles of the foot may tighten due to subtly altered biomechanics, and tensions can form in the other leg where limping has occurred. These problems can be minimised with massage, efficient checks and STR.

Immobilisation

After periods of immobilisation, such as when a plaster of Paris cast or a brace has been removed from a limb following a fracture, STR can be used effectively to reduce scarring and oedema, and return flexibility with elasticity to the soft tissues. This facilitates improvements in strength, proprioception and co-ordination. The same is true of post-operative situations, where incisions and periods of rest severely affect the condition of the soft tissues. Any incision will cause scarring, and prolonged rest results in

loss of strength and reduced function. These situations can often lead to muscle tissue being shortened yet under-active. STR is an ideal technique to use in rehabilitation.

STR in Conjunction with Other Therapies

Most injuries contain components of soft tissue damage, which can cause localised pain and dysfunction, so careful administering of appropriate massage will contribute to healing even if other forms of therapy are required. For instance, if there is a mechanical misalignment or restriction, mobilisations or adjustments may be necessary to return movement to a joint. In the case of adverse neurological tension, gliding the nerve at the tissue interface may be required to release the tension. In both of these situations, practitioners trained in these skills are needed for accurate diagnosis and management of the injury. Skilled use of STR, however, will aid in both of these forms of treatment. If the soft tissues are free to move in a controlled and separate way, they will facilitate joint manipulation or nerve mobilisation and help maintain the effects of the other treatment. Many practices and clinics have a multidisciplinary approach to injury management, and STR is an invaluable adjunct to the healing and rehabilitation process.

Soft tissue expertise is growing all the time, and when using STR it will prove beneficial to be aware of what specialist soft tissue and movement practitioners have developed and continue to develop. An understanding of the anatomy trains (Myers, 1997a, 1997b), for example, may contribute to the releasing of holding patterns in a case of overuse injury. Knowledge of Robert Schleip's high leverage points in the myofascial web could also be useful: for example, addressing the tissue around the greater trochanter has an impact on the pelvis as a whole.

Important Considerations

Massage, including STR, is a safe therapy, provided that contra-indications are understood. There are occasions when massage is detrimental or dangerous, so an understanding of contra-indications prior to any massage is imperative. Massage can have amazing results in preventative care and is highly effective in treating minor soft tissue injuries or overuse conditions;

however, it is necessary to liaise with, or to seek a diagnosis from, a qualified medical practitioner prior to treating complex injuries solely with massage. Massage therapists need to recognise their strengths and limitations. Diagnosis from the medical health care practitioner, prior to massage, allows an integrated approach that enables therapists to ensure that the STR treatment suits the subject's needs.

As with all massage, it is important to avoid over-treating areas with STR. When working on particularly congested tissues, there may be some discomfort during release. Treat systematically and holistically rather than repeatedly going over the same area or location of dysfunction. This will minimise any tissue damage due to the massage itself.

ASSESSING THE SOFT TISSUES

Texture

Experience gives the massage therapist the ability to distinguish between the various kinds of soft tissue according to how they feel. When relaxed and in good condition, muscles should feel soft and pliable. Tendons, being fibrous extensions of the muscles' fascia, feel firmer and more 'stringy'. Where there is specialised thickening of fascia, such as the iliotibial band and the thoracolumbar fascia, tissue will also feel firmer and less resilient.

An overall assessment of relevant tissues is necessary to evaluate their condition. Many deep muscles are not directly palpable. The release of superficial muscles so that they are supple and relaxed enables the therapist to work into and affect the deep muscles. In some instances, only the border of a muscle may be reached. This is the case with the quadratus lumborum, where pressure is attained laterally and directed towards the vertebrae. The stretch is produced so that the fascia and outer muscle fibres are released, thereby nourishing and freeing the muscle as a whole.

General variations will occur because of age, sex, fitness, type of sport or activity the body is subject to, lack of activity, level of activity or competition, occupation and previous injury.

However, poor texture may be identified and categorised under the following headings:

1. Hypertonicity and Muscle Tightness

Tightness in a muscle represents both an increase in tone and a decrease in the resting length of the muscle. When a muscle is hypertonic, it has too much muscle tone and will feel rigid, but it may have either decreased or increased resting muscle length.

Hypertonic muscles which are shortened need to be lengthened. Skilled use of STR to locate tissue restrictions will facilitate this. In cases of severe shortening it is advisable to shorten the muscle prior to locking in with STR and stretching.

On palpation, the fibres feel resistant and rigid and lack pliability.

2. Scar Tissue

Inflammation and repair result in the formation of a collagenous scar. Scar tissue is new collagen that has been secreted by fibroblasts to repair torn tissue. Sufficient recovery, mobility and strengthening allow this scar tissue to be reabsorbed and replaced with regenerated tissue. Often, because of the severity of the initial bleed or insufficient awareness and/or rehabilitation, scar tissue remains; even minimal scarring can impair function. Initially, scar tissue binds, protects and supports the area but ultimately it lacks the mobility, extensibility and strength of the tissue it has replaced. With this in mind, it is worth considering how not to break down too much scar tissue in one treatment.

On palpation, scar tissue can feel gritty, stringy or woody, or, in severe cases, hard and solid.

3. Adhesions

Adhesions are fibrous bands, formed in the same way as scar tissue, which inhibit movement between tissues that should be moving separately from each other. Following inflammation and the ensuing healing, there is heightened metabolic activity as the scar tissue is being formed. During this process, fibrin is deposited to 'glue' the wound, but local changes such as curtailed circulation and an increase in metabolic waste can cause the early granular tissue to become sticky; often the fibrous deposit is not reabsorbed.

This usually results in longitudinal bands of adherence. In the text, 'separation' of neighbouring muscle groups is frequently advised and refers to the separating of adherence that may be occurring between muscles or bellies within a muscle.

Adhesions may feel woody and stringy, and may 'flick' if palpated transversely. It may be difficult to differentiate a muscle border from a neighbouring muscle border where their epimysiums are adhering.

4. Oedema and Swelling

Oedema and swelling are caused by an excess of tissue fluid following injury and the subsequent inflammatory response. Chronic swelling can occur where tightness and scarring compress capillaries and lymphatics, curtailing the flow of fluid in and out of the area. Ensure that oedema is not indicative of a more serious medical condition.

The area can feel spongy, and pitting of the tissue may occur.

5. General Rigidity of Superficial Fascia and Myofascia

Rigidity can be identified in superficial fascia and myofascia when these large body areas feel hard and are difficult to lift and move. Compartment syndrome occurs where the myofascia becomes so tight and thickened that, even when the muscle is relaxed, there is an increased intramuscular pressure causing pain.

Inflammation

Inflammation is the tissue's initial response to injury and will present with one or more of the following signs and symptoms: redness, heat, swelling, pain and reduced function. Working directly on inflammation should generally be avoided because it will slow down healing by causing more tissue injury. Working around the inflammation will ensure that it is well nourished and, by keeping the surrounding tissues free, encourage the healing and decongestion of the area. With a large trauma this may not be possible initially, as the movement aspect of STR will impact on the acute injury; when chronic inflammation presents in overuse injuries there is benefit in treating it. The seven-second test is a useful rule to guide you with treatment.

Seven-second Test

When treating chronic conditions, such as lateral epicondylitis, in which a degree of chronic inflammation may be present, it is sometimes difficult to assess how much direct pressure is appropriate. It is essential to treat the whole pattern of tissue restriction, for example the wrist extensors that merge into the common extensor origin, but it may also be necessary to treat the localised inflamed area. If an area is proving to be sensitive, maintain a pressure for seven seconds to avoid irritation by causing more trauma. If the pain eases or stays the same, then the area can be worked on. If the pain worsens, there is probably too much inflammation for that amount of pressure, so the area should not be worked on directly. If there is any doubt as to whether tissues have been over-manipulated, ice can be applied to ensure a positive outcome from the STR treatment.

Muscle Balance

STR can play an important role in restoring muscle balance; generally, releasing hypertonic tissue facilitates the strengthening of weak muscle. An understanding of how muscles may be classified according to their susceptibility to hypertonicity or inhibition and weakness will enhance treatment programmes.

Muscles can be classified into various categories depending on their roles within the musculoskeletal system. Some muscles are chiefly involved with stability and posture, while others are more directly engaged in providing dynamic movement. Classification is very useful to the practitioner seeking to restore balance, but it is important to realise that it is not always clear cut. Muscle grouping is still a developing area and there are a few different classification models. Research has classified muscles into local and global stabilisers and global mobilisers (Bergmark, 1989; Commerford and Mottram, 2001).

Stabilisers tend to be deep, single-joint muscles that help maintain posture over sustained periods. They contract alongside other stabilisers to support and maintain position, or control movement. They are generally rich in slow-twitch fibres, predominantly aerobic and slow to fatigue.

Local stabilisers are unable to provide significant joint movement. They contract isometrically to increase joint stiffness for segmental control of motion. Examples of these are the transversus abdominis, multifidus, psoas, interspinales, vastus medialis, lower fibres of the trapezius, and deep cervical flexors.

Global stabilisers function to stabilise and provide some joint movement. They control the range of movement, generally through eccentric muscle contraction, and maintain posture through isometric effort. They can also contribute to movement through concentric contraction. Examples include the serratus anterior, posterior two-thirds of the gluteus medius, gluteus maximus, spinalis, longus colli and oblique abdominals.

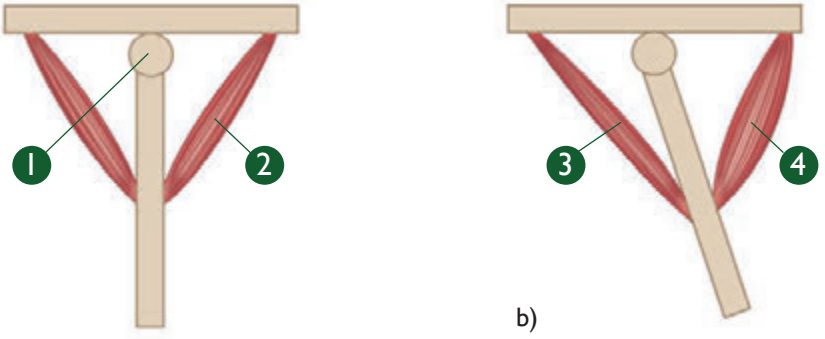
Mobilisers tend to be more superficial and provide a larger range of movement for fast, dynamic requirements. They can perform under aerobic and anaerobic conditions and contain high levels of fast-twitch muscle fibres. Examples of these are the levator scapulae, scalenes, latissimus dorsi, iliocostalis, rectus abdominis, tensor fasciae latae and hamstrings.

Through dysfunction, local stabilisers are likely to become inhibited and slow to activate. Global stabilisers are prone to inhibition that may manifest itself as lengthening and weakening of the muscles. Stabilisers subsequently become unable to provide a stable base for other muscles to work from.

Mobilisers, on the other hand, tend to take on the failed stability role in addition to their own, and, over time, become stressed, overactive and tight. A dominant tight mobiliser pulling in one direction, with an inhibited stabiliser unable to maintain position or control movement against it, will cause imbalance.

Comparative illustration of a muscle in balance compared to an inhibited and tight muscle.
a) muscles in balance,
b) muscle shortened/inhibited.

1. Joint
2. Muscle in balance
3. Inhibited muscle
4. Tight muscle



This will negatively affect joint alignment and movement. If maintained, postural misalignment and altered movement patterns can result in overuse injury.

Neutral joint position and posture together with controlled motion place minimal strain on the musculoskeletal system and facilitate its smooth and efficient function. To achieve this, the stabilisers must activate quickly and effectively enough, and the mobiliser muscles need to be pliable, relaxed and of adequate length for their specific activity requirements.

Soft tissue techniques, such as STR, can provide fast and effective release for tight muscles. By relaxing and lengthening tight muscles, it becomes easier for the subject to engage the inhibited muscles.

Clinical experience suggests that one such condition is patellofemoral maltracking, for which athletes are frequently prescribed strengthening exercises for the vastus medialis oblique. These are often ineffective. Releasing tightness in the vastus lateralis, however, quickly resolved their complaints. Another very common example of muscle imbalance occurs in the lower and upper fibres of the trapezius. Tight upper fibres and weak lower fibres can contribute to neck, shoulder and shoulder girdle dysfunction. Many people who have experienced poor results from performing exercises aimed at engaging the lower trapezius fibres have subsequently responded extremely well once STR has been applied to release the upper fibres.

Equally, manual therapy alone may not be enough to maintain tissue changes; specific re-educational exercises play an essential role in maintaining the beneficial effects of manual therapies during and following a course of treatment. Correctly prescribed and monitored re-educational exercises will improve motor control, strengthen and reactivate inhibited muscles, and stretch short and tight muscles. Initially an exercise or group of exercises may be very subtle and specific to the presenting condition and is normally progressed appropriately to enable full function. Exercises such as yoga, Pilates, Feldenkrais and the Alexander Technique are excellent modalities for re-balancing the

musculoskeletal system, with a strong emphasis on strengthening, lengthening, core stability and motor control.

In conjunction with such re-educational regimes, STR can help restore muscle balance, postural misalignment and efficient movement patterns.

Yoga asana – Pidgeon.

Yoga asana – Pidgeon variation.

Yoga asana – Pidgeon variation.

Plank.

Side plank.

Progressive side plank.

Part 2
STR – The Technique

The technique is administered simply by applying and maintaining a pressure on, or 'locking into', the relevant tissues while simultaneously stretching away aligning fibres.

ADMINISTERING STR

The Technique – 'Lock and Stretch!'

First the fibres are located. They are then locked into by applying an appropriate pressure. This pressure is maintained while a stretch is produced by moving a limb; the limb can be moved either by the therapist or by the active participation of the subject. This produces a powerful release where tissues are adhering. Movement and localised lengthening of the affected fibres has occurred, in conjunction with separation or movement of the lesion with the locking-in pressure.

When conducting a general treatment, the area is initially warmed with massage strokes and the use of oil or lotion. Alternatively, the muscles can be warmed up with light passive STR using a broad locking technique. Progression to specific STR will facilitate the detection of adhesive tissue, and so should be conducted even in a maintenance massage. If a problem area is located, working between the muscle borders to stretch the fascia and within the muscle itself is necessary. It is not essential to cover every section of the muscle, as releasing one specific area will cause neighbouring fibres and fascia to soften and stretch. The lock should be achieved carefully and maintained while a stretch is initiated. If working close to bone, the lock should generally be angled away from the bony surface to avoid crushing of the tissue and bruising. If in doubt over the acuteness of an injury, conduct the 'seven-second test' (see page 22).

Benefits of STR Over Stretching Alone

If a fibrous or adhered area is present in a muscle that is predominantly strong and flexible, a conventional stretch could simply stretch the area as a whole without the congested area itself being released. A stretch alone is not enough to separate the gluing of these particular muscle fibres. Muscles can be flexible without necessarily being in good condition. With STR, the specific area can be targeted and locked in place while its neighbouring tissues are specifically elongated, thereby focusing on the restriction.

Benefits of STR Over Traditional Massage Strokes Alone

When administering most massage techniques, the tissues remain passive while the therapist glides through them or works on and across them. With STR, a specific position within the tissues is acquired and it is then the tissues themselves which are moved and elongated. This makes textural assessment procedures easier. Therapists can pinpoint specific areas more quickly, particularly where there may be several muscle layers with fibres going in different directions. With the stretch, the fibres are re-arranged and elongated for efficient function. Complex soft tissue dysfunction, where many muscle groups and holding patterns are involved, can be remedied because of the specificity of the pressure and the stretch.

FACTORS TO CONSIDER

1. Types of STR

There are basically three types of STR: passive, active and weight-bearing. All three involve movement, but in active and weight-bearing STR it is the subject who produces the movement, whereas in passive STR it is the therapist. Passive work provides a good release and can be very relaxing.

Passive STR to the soleus. Lock in and maintain the pressure as the therapist dorsiflexes the foot.

Active STR is more powerful and should be preceded by passive work or other massage to warm up the area. Progression to active work is more energy efficient for the therapist, allowing concentration to be centred on the application of the pressure. Many subjects prefer to become actively involved with a particular release, especially when areas are painful to work with, because it gives them more personal control.

Active STR to the soleus. Lock in and maintain the pressure as the subject dorsiflexes the foot.

Applying resistance during active STR may enhance the release in some cases. As the subject attempts to produce a stretch, but is resisted by the therapist while doing so, isometric muscle

contraction takes place in the antagonist muscles; because of this, there is an enhanced relaxation in the muscle undergoing treatment. This effect is known as 'reciprocal inhibition' (RI).

Resisted STR to the soleus.

Weight-bearing STR is highly effective in returning an area to full function. The muscles are under tension, and a degree of eccentric contraction will be occurring to control the required movement. Manipulation under this tension may be very severe, and should therefore be the last stage in any treatment programme.

Weight-bearing STR to the soleus.

2. Application of Pressure or 'Lock'

How the lock is applied, including its direction and angle of pressure, is important for effective results. The lock can be used to lengthen or traverse the target fibres. It can also be used to delve between muscle groups, to isolate tendons or to separate bellies within a muscle. A form of friction is being created where pressure is attained, and the movement is made by the subject either passively or actively. Friction breaks the fibrous tissue binding the fibres and the movement enables this to happen in the correct direction to re-align them.

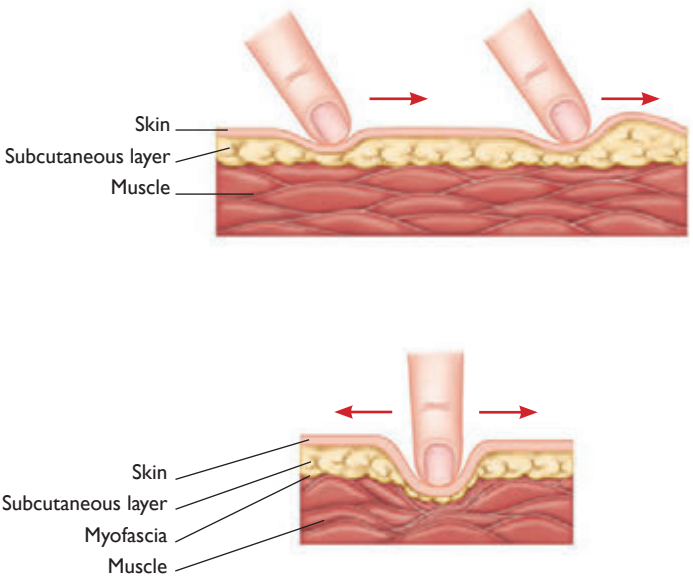
Fingers are used to delve between the gastrocnemius and the soleus.

The Achilles is gently grasped on either side.

One thumb reinforced with the other to split the bellies of the gastrocnemius.

Specific Attention to the Fascia

A connective tissue massage (CTM) lock is designed to work specifically on the connective tissue, by providing a load on the fascia prior to moving the muscle fibres. Depth should be attained before slowly gliding the fascia; when there is resistance, the lock should be moved 2–3 cm further. Once this is achieved, it is maintained while movement of the muscle fibres occurs.



A connective tissue massage (CTM) lock;

a) superficial fascia (subcutaneous layer)

b) myofascial mobilisation into fascial layer of muscle.

3. Maintenance of Pressure

Pressure is maintained during the stretch, whatever the type of lock. The release occurs with the movement made by the subject. The lock is maintained while the fibres around are moving; this may cause the lock to jump or flicker, but the movement is still being produced functionally by the subject, not by moving the lock.

4. The Stretch

Maximal stretching is not the best way to release specific problem areas; the stretch should be localised. The basic principle behind STR is that congested fibres can be targeted more accurately. In some instances, the stretch may involve only the smallest of movements. On occasion it is also necessary to shorten a muscle prior to locking in, to relax the fibres so that an effective lock can be applied.

There may be many different ways to produce a stretch, particularly where muscles have more than one action. In some cases, the therapist may even choose to combine movements; for example, when treating the biceps brachii, the elbow can be extended and pronated as the pressure is applied. Where a more extreme stretch is being attained, the therapist should guide the subject into one movement and follow it with a further stretch. For example, in the case of the hamstrings, the hip may be flexed first as the pressure is applied, and then a further stretch applied with the extension of the knee.

5. Flexibility

STR is a very useful technique for subjects who require flexibility for whatever reason. It may be that the muscle or tendon fibres are shortened because of overuse or imbalance, or perhaps the nature of the relevant activity necessitates a high level of flexibility, such as that demanded in gymnastics or martial arts. In these cases, full stretching should be incorporated within STR only after the tissues have been worked on thoroughly. It is also important to note that range of movement must be tested prior to instructing a subject to move into an extreme stretch.

6. In Conjunction with Muscle Energy Techniques (METs)

METs can be used to great effect alongside STR. MET refers to stretching techniques which involve using the subject's own muscular energy to help release holding tension. For example, following an isometric muscle contraction there is a period of relaxation called 'post-isometric relaxation' (PIR). A therapist experienced in this can use the PIR principle to enhance muscle relaxation and, therefore, its stretching capability. The use of RI has already been mentioned with reference to 'resisted STR'.

MET to the soleus.

7. Discomfort during Application

Where tissues are so severely adhered and fibrous that it may be painful to separate them, STR has two advantages over other techniques. Firstly, there is a pleasant, momentary relief when the pressure is released, even if a new lock is being sought. Secondly, subjects feel in control of their own discomfort. This may be particularly the case with high-performance sports people, who willingly put themselves through painful training sessions for success in their events!

AIDS FOR APPLYING STR

Tools

As with all massage, the tools of the trade are the fingers, thumbs, knuckles, whole hands, forearms and elbows.

The phalange is reinforced to apply a deeper lock.

A good working posture should be adopted so that deep pressure can be applied when necessary with minimal strain to the therapist. The larger superficial muscles with general shortening are treated first with broader pressure points, such as the broad ulnar surface, a soft fist or the heel of the hand.

A soft fist provides a broad surface lock.

A broad ulnar surface.

Prior to working the deeper muscles, the area is assessed and released from tension so that the superficial muscles can be reached through with minimal discomfort. Deep work can be done with a smaller surface area, such as the thumb or knuckle, so that the force applied is greater. When applying a deeper pressure in this way, the therapist should always reinforce the lock; this can be achieved with the weight of the opposing hand, and body weight behind it, to protect the therapist from joint damage or fatigue. For experienced practitioners, wooden pegs are available which fit in the hand and assist in the achievement of deep pressures. These pegs have to be used sparingly and intelligently, as the therapist will not be getting the same tissue feedback as from using hands or elbows.

Ideally, a correctly positioned treatment couch is required for the delivery of good massage, but STR is a highly adaptive technique which will test the ingenuity of the therapist. Treatment can be conducted through clothes, when necessary. This is useful at sporting events that have no facilities or take place in cold and exposed conditions, and when time is a limiting factor.

Tips to Ensure Effective Administering of STR

- Lock slowly and precisely. Avoid poking or crushing the tissue, to minimise tissue trauma and maximise release.

- Gradually apply the lock to the congested or stuck layer at a transverse or oblique angle. Always address the superficial layers first.

- Follow the subject's breathing. Gain your depth during exhalation to help maintain relaxation. When working very deep or in severely congested areas, it may take two or three exhalations to acquire the lock at the depth you require.

- The adhering tissues will be engaged when the movement occurs; advising the subject on when to breathe will increase awareness during movement and help with relaxation.

- Before asking for an active stretch, guide the subject through a passive one first: this will ensure that the movement is completed correctly.

- Analyse where to go next and move on slowly.

- Avoid spending too long in any one place. If the tissues do not seem to be responding, do not keep locking into the same area – move on.

- Release occurs in many different ways, not just where you are focusing. Allow your awareness to move beyond the tissue you are working on.

- Stay in verbal contact with your subject; ask questions like 'Are you okay?' and 'How does that feel?'

Part 3
Lower Limb

THE PELVIC GIRDLE

The pelvic girdle is strong and stable, with minimal mobility; it joins the lower limbs to the spine, transferring the weight of the body to the legs. The maintenance of good pelvic posture during sitting, standing or moving is critical in ensuring the efficient functioning of the area. Balance and strength in the trunk and hip muscles are key to achieving this.

The lumbosacral junction articulates the sacrum and the lumbar vertebrae and is vulnerable to injury. The iliolumbar ligament is a particularly strong ligament that helps to stabilise the last two lumbar vertebrae. It is a specialised extension of the thoracolumbar fascia (anterior and middle sections) originating from the transverse processes of the fourth and fifth lumbar vertebrae and joining to the posterior inner lip of the iliac crest. The sacroiliac joint connects the sacrum to the pelvic girdle and transfers body weight from the trunk to the leg, so it is important to consider it in any treatment of the area. Superficial to the sacroiliac joint, the sacroiliac ligament's sections attach from the sacrum to the posterior superior iliac spine (PSIS) area. It is imperative to address the connective tissues around these areas, as repetitive stress (particularly from sitting, standing and bending), exacerbated by asymmetrical positioning or activities, may cause scarring and stiffness; this will affect the stability and movement of the area, causing lower back and sacral pain, and possible referred pain to the leg.

Anteriorly, the pelvis joins at the symphysis pubis. Tendinous fibres of the rectus abdominis, external oblique and adductor longus overlie the cartilaginous disc. This offers extra strength and stability to the joint. When presented with osteitis pubis and symphysis pubis dysfunction (SPD), these are the muscles that should be treated.

THE HIP

The enormous strength and musculature of the hip joint is necessary for catering for dynamic and controlled propulsion. The hips support the weight of the body; they also transfer the weight powerfully, to the opposing leg, in a range of different weight-bearing activities from walking and running to jumping. Full range of movement, good flexibility and adequate strength of the hips will encourage a biomechanically efficient and smooth gait.

Hip Extension

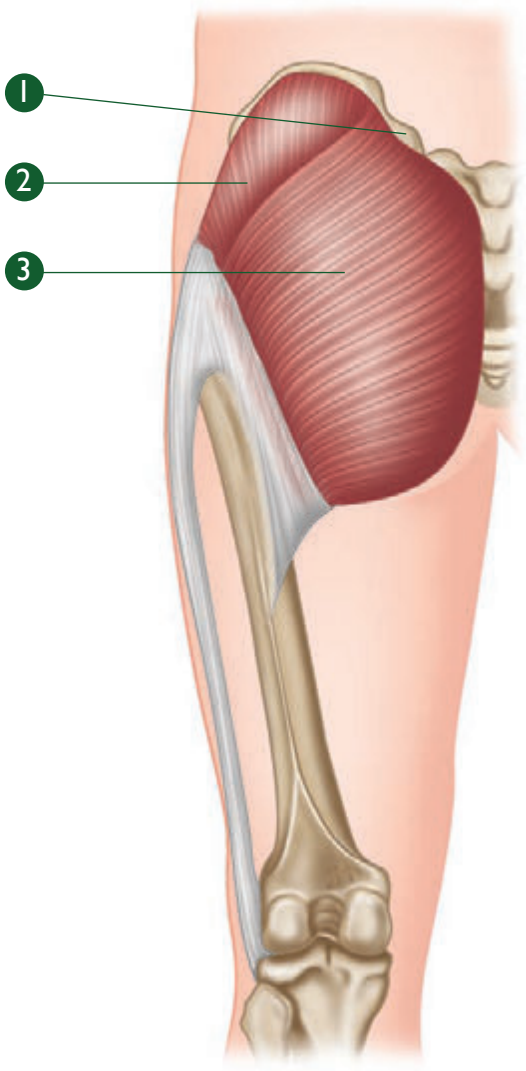
Major Muscles: Gluteus maximus, hamstrings (semimembranosus, semitendinosus and biceps femoris [long head]) and adductor magnus (vertical fibres).

Gluteus Maximus

The gluteus maximus is a very strong muscle involved in powerful hip extension, particularly from a flexed starting position. Movements such as stair climbing, rising from a seated position or squat, walking uphill and running (especially fast running, which requires great drive and power) employ this muscle. As the gluteus maximus arises from the lower fascia of the back, it is consequently involved in trunk extension from a flexed position. It is also an important lateral rotator and will therefore affect planting of the foot. Static build-up of tension can also occur in the gluteus maximus because of its contribution to supporting the body's weight in the seated position; contraction of the muscle will take the body's weight off the ischial tuberosities, and, since we tend to favour the gluteus maximus on one side over the other, imbalance can ensue.

The gluteus maximus is prone to inhibition, commonly due to poor posture and sedentary positions. Imbalance can occur, and this in turn can cause the hamstrings to overwork in the action of hip extension and subsequently place more strain on the tissues of the lower back. STR treatment will enhance the health of the gluteus maximus to facilitate strengthening programmes. Strains

to this muscle are more likely to occur at its origins along the sacrum and iliac crest and towards its fibrous insertion into the ITB and gluteal tuberosity.



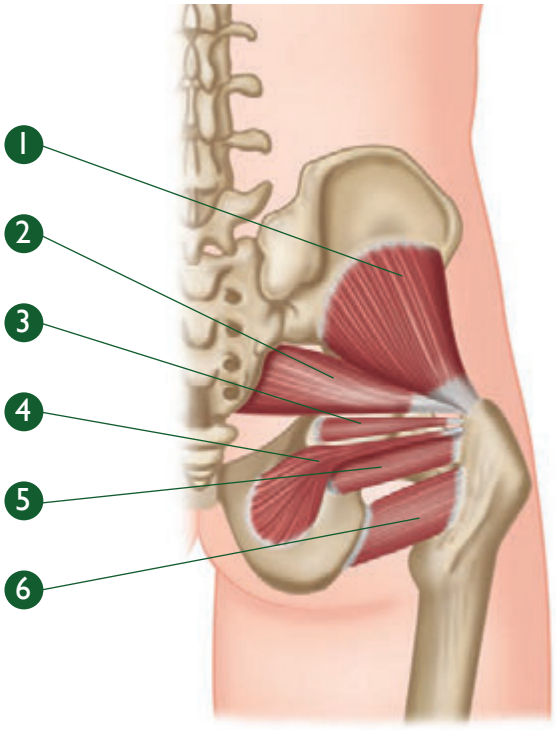
Superficial hip muscles.

1. *Posterior superior iliac spine*
2. *Gluteus medius*
3. *Gluteus maximus*

Lateral Rotation of the Hip

Major Muscles: Gluteus maximus, posterior fibres of the gluteus medius, sartorius and deep lateral rotators (piriformis, obturator internus, obturator externus, gemellus superior, gemellus inferior, quadratus femoris and psoas major).

Deep hip muscles.
1. *Gluteus minimus*
2. *Piriformis*
3. *Gemellus superior*
4. *Obturator internus*
5. *Gemellus inferior*
6. *Quadratus femoris*



These muscles are important in stabilising all hip movements by preventing excessive medial rotation. The piriformis is often problematic. It is involved in the seated position as an abductor; it is also an important stabiliser in walking and running, as it helps maintain stance on the side opposite that of the foot being lifted. The sciatic nerve runs beneath this muscle and, in about 17% of the population, may actually run through it. The nerve can become adhered to the tight piriformis and produce sciatic symptoms (posterior thigh). Sciatica resulting from this situation is known as piriformis syndrome and responds very well to STR.

Gluteus Maximus and the Deep Lateral Rotators – Treatment

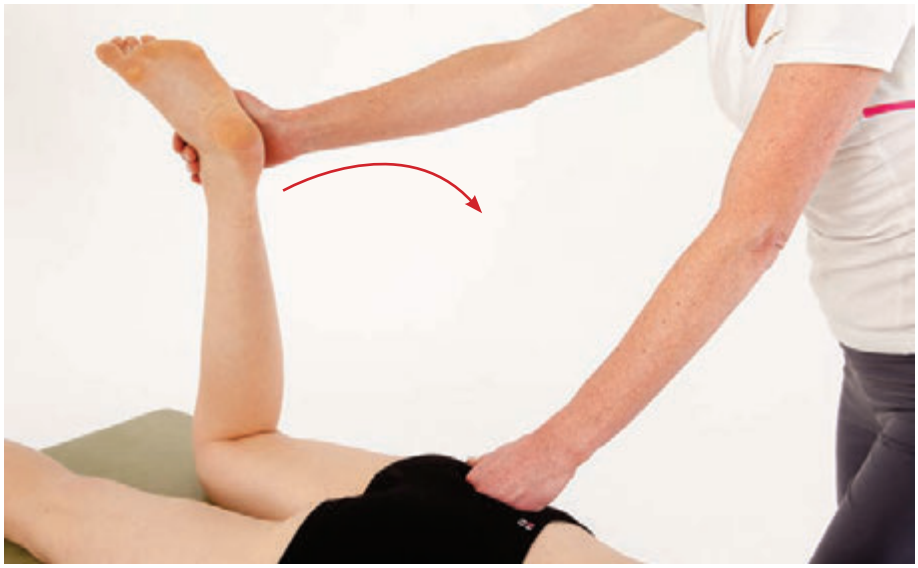
With the subject in a prone position, apply pressure at points off the gluteal attachments by locking in and moving away from the iliac crest and away from the sacrum while the subject attempts to flex the hip by pushing the knee into the table. Given that

the lock is precise, a small stretch will be felt. To obtain a more significant stretch in the muscle as a whole, treat the muscle in a side-lying position, in which full flexion can be obtained by the subject actively flexing the hip.

Active STR to the gluteus maximus in side lying.

Alternatively, with the subject in a prone position and the knee flexed to 90 degrees, gently rotate the leg medially and laterally. This will in itself indicate restriction in the hip and / or pelvis. Lock in appropriately, broad surface first, away from the sacrum, then away from the iliac crest, each time applying the pressure, then medially rotating the leg and releasing the pressure to return the

Passive STR to the gluteus maximus.



leg to the starting point. Systematically cover the whole of the gluteus maximus area. Active STR is beneficial particularly if there is a reduced range of movement, in which case the subject only moves through a range that is comfortable.

Active STR to the piriformis.

Active STR to the piriformis.

Once the muscle is relaxed and stretched, progress to the deep rotators. Angle your elbow or a knuckle gently through towards the piriformis, which can be located halfway between the sacrum and the greater trochanter. Ensure that the relaxation of the muscles is maintained. The other rotators can also be affected, although they are difficult to differentiate. The quadratus femoris can be reached by gliding away from the ischial tuberosity and under the gluteus maximus. Having attained any one of these deep pressures, hold the pressure as the hip is medially rotated, then promptly release the pressure.

Medial Rotation of the Hip

Major Muscles: Anterior fibres of the gluteus medius, gluteus minimus and TFL, pectineus, adductor longus, adductor brevis, adductor magnus and piriformis (at a range of more than 90 degrees).

Medial Rotators – Treatment

The gluteus medius and minimus can be treated as one, the minimus lying directly under the medius. Apply pressure in the gluteus medius (anterior fibres), away from the iliac crest, and laterally rotate the leg; apply a deeper pressure to target the gluteus minimus and again laterally rotate the leg. Another useful manoeuvre is with the subject supine. Link into the medius with the fingers of one hand reinforced with the other hand and slowly pull the fibres transversely very slightly. Lock the subject's opposing hip with your knee to stabilise the pelvis while the subject actively rotates the leg, medially if the posterior fibres are locked

and laterally if the anterior fibres are locked. It is also possible to work the TFL effectively here using the same method.

Lumbosacral Junction and Sacroiliac Joint Area – Treatment

Once the hips and lower back have been warmed up, treatment of this area can commence. Place the subject in a side-lying position and, using a knuckle to apply a CTM lock away from the PSIS, instruct the subject to minimally flex the hip; alternatively, ask the subject to posteriorly tilt the pelvis. Progress to the 'V', between the PSIS and the lumbosacral joint, and apply a CTM lock, again guiding the subject into hip flexion or a posterior tilt of the pelvis.

Lock into the lumbosacral junction as the pelvis is posteriorly tilted.

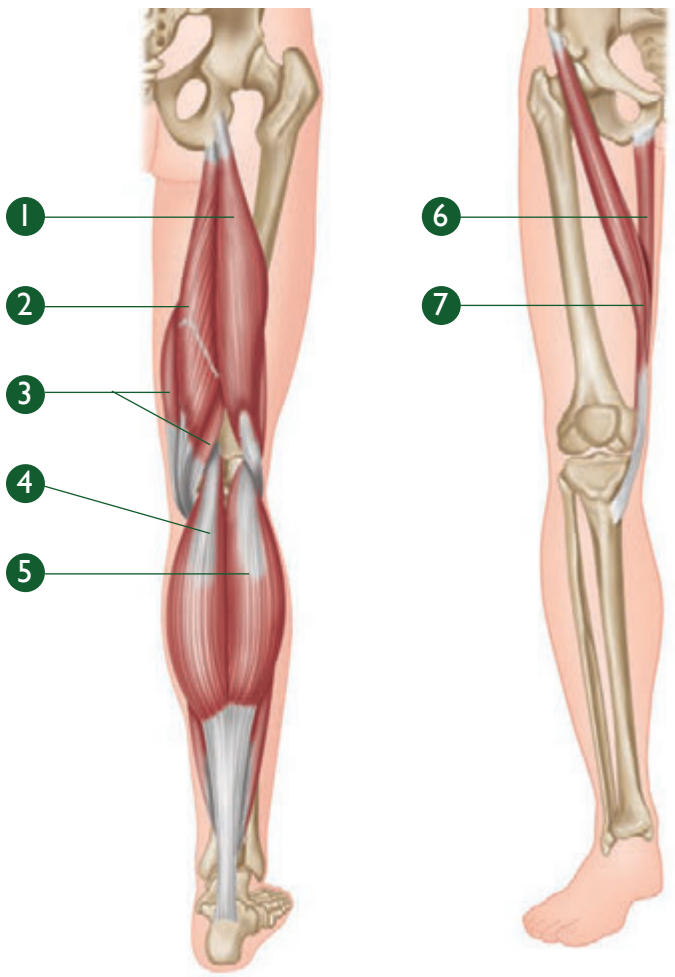
Hamstrings

Main Muscles: Semimembranosus, semitendinosus and biceps femoris.

The hamstrings work with the gluteus maximus to extend the hip if the knee is mostly or completely extended. They also assist the gluteus maximus in extending the spine from a flexed position. If hip extension is not occurring then the hamstrings are also powerful knee flexors. When the knee is semi-flexed some rotation can also occur.

Hamstring strains are common in sports involving sprinting, where the muscles are used powerfully. Sprinters in athletics are renowned for hamstring problems. The sprint starting position puts huge stress on the three hamstrings, which are working around two strong movements: the trunk rises from a crouched position, while the hip extends powerfully to drive the body forwards. A good sprinter may not be running fully erect until 25 metres into the sprint. Strains occur near the origin or in the belly of the muscle more commonly than at the insertion points; they also frequently happen just prior to heel strike as the hamstrings contract eccentrically to control knee extension.

Hamstrings tend towards hypertonicity, and are often over-recruited in hip extension at the expense of the gluteus maximus. Lifestyle factors, such as prolonged sitting and driving, shorten the hip flexors and lengthen the gluteus maximus, increasing the susceptibility of the hamstrings to shortening and of the gluteus maximus to inhibition.



Hamstrings and knee flexors.

1. *Biceps femoris*
2. *Semitendinosus*
3. *Semimembranosus*
4. *Gastrocnemius (medial head)*
5. *Gastrocnemius (lateral head)*
6. *Gracilis*
7. *Sartorius*

Hamstrings – Treatment

There are many different ways of treating the hamstrings, and it is important to adapt the treatment depending on the size and condition of the muscles. Generally speaking, they are best treated from a prone position for the initial investigation. With the knee flexed to 90 degrees, apply locks towards the origin as the knee is straightened each time.

Passive STR to the hamstrings with a broad surface lock.

Treat from the tendons of insertion to the origins, locating the three hamstrings. To acquire a more specific lock, progress to active STR: delve between the muscle groups to separate adherence, using a reinforced thumb or phalange; instruct the subject to extend the knee.

Active STR to the hamstrings with a reinforced phalange.

A greater stretch can be achieved in a supine position. Support the subject's lower leg on your shoulder and lock in with the elbow, or use reinforced thumbs or knuckles for a more focused lock; instruct the subject to extend the knee.

Active STR to the hamstrings using the elbow.

Active STR to the hamstrings using a knuckle.

In addition, lock into and direct the lock away from the origin towards the insertions, and either move the hip into flexion with your shoulder, or advise the subject to flex the hip; the subject may need to hold the leg just above and behind the knee and pull it up into flexion for the best control.

Active STR away from the hamstrings origin.

The pressure should be attained slowly because any adhesion will be very sensitive. Combining hip flexion and knee extension during the same lock can provide a powerful release for the more flexible subject; this should be performed extremely carefully. It is also possible to work this area with the subject in a side-lying position, ensuring that the leg is supported during flexion of the hip; this can be beneficial for the less flexible subject.

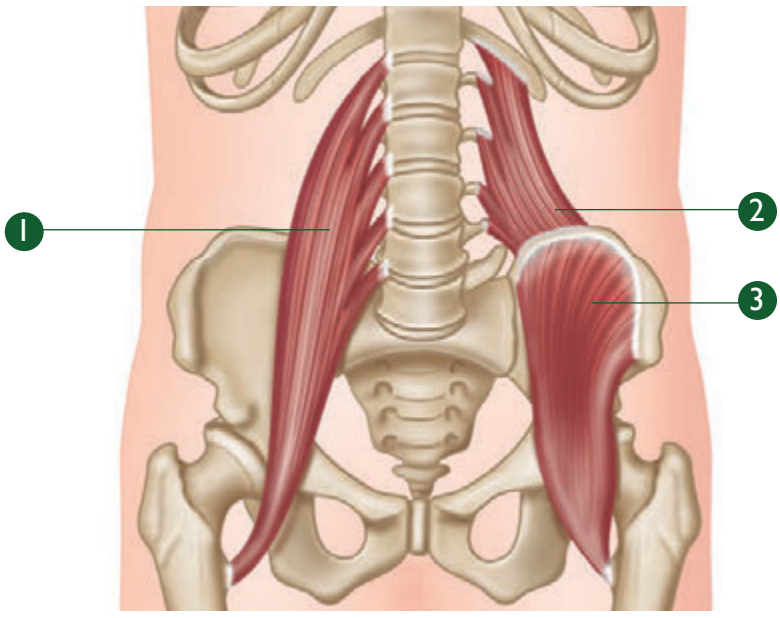
Weight-bearing STR to the hamstrings may provide powerful results. With the subject standing, apply a pressure and guide the subject into a stretch.

STR to the hamstrings in a weight-bearing position.

Hip Flexion

Major Muscles: Rectus femoris, sartorius, TFL, pectineus, iliacus, psoas major and psoas minor (not always present).

All of the hip flexors position the pelvis forwards; if they become adhered or tight they are less effective in holding the pelvis up in a neutral position. This can be associated with weak abdominal muscles and subsequent lordosis. If this is the case, specific isolated abdominal strengthening is vital, and STR to the hip flexors will facilitate the strength gains. The psoas is strong and powerful, and is a major postural muscle. When the insertions are fixed, the psoas assists in flexing the trunk from a lying position. During treatment, both sides should always be considered when presented with any lower back conditions, lordosis or other postural deficiencies. The iliacus and psoas are often termed the 'iliopsoas'.



Deep hip flexors and quadratus lumborum.

1. *Psoas major*
2. *Quadratus lumborum*
3. *Iliacus*

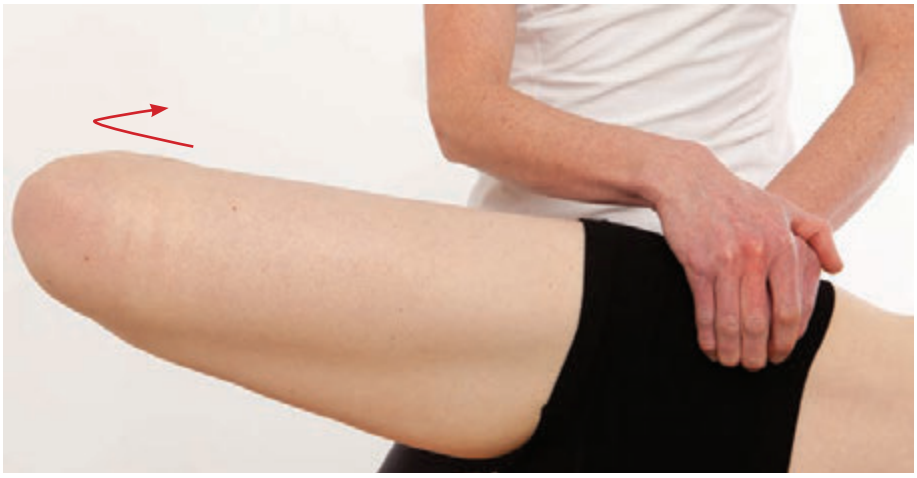
Hip Flexors – Treatment

With the subject supine on the table, treat the rectus femoris, sartorius and TFL by locking in gently but firmly (this can be ticklish) away from the origin; then instruct the subject to tilt the pelvis (posterior tilt). A good alternative is to work the flexors with the subject in a side-lying position. Support the leg well, lock appropriately and take the leg into extension.

Passive STR to the rectus femoris.

This can be difficult with a heavy leg, but with active work, a good lock can be maintained and only a tiny amount of hip extension is needed for an effective release.

Active STR to the rectus femoris.



With the iliopsoas, extreme care and subject relaxation are essential for good results. Position the subject in a supine position with the knees bent; place your fingers at navel level and lateral to the border of the rectus abdominis (halfway between the last rib and the linea alba); as the subject exhales, gently drop towards the muscle, then stop as the subject inhales and wait to go deeper for the second and maybe even third exhalation. Once the depth has been reached, angle the fingers slightly medially and you should feel the psoas. Direct the subject to perform hip flexion, and you will feel the muscle shortening to confirm your location. If this is too uncomfortable, release the pressure slightly. Following this, maintain your lock and instruct the subject to straighten the leg for STR. Good release also occurs from instructing the subject to perform a posterior pelvic tilt. You are really only affecting

the surface of this deep muscle, but by locking the fascia you are achieving a release in the muscle as a whole.

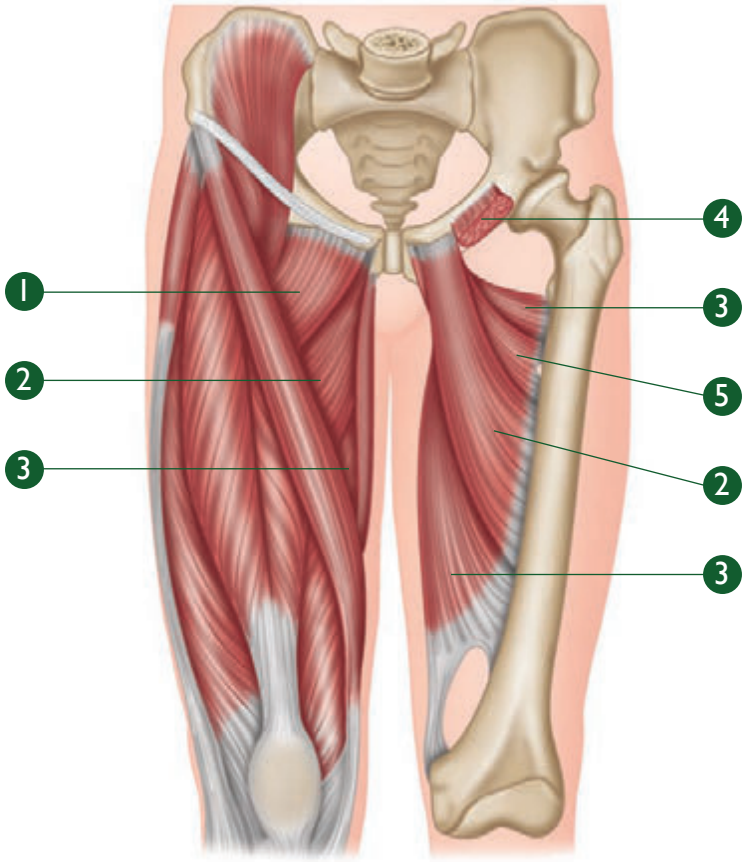
Keep the subject in the same position to work the iliacus. Slowly glide over the anterior superior iliac spine and move over the concavity of the ilium. Lock and instruct the subject to straighten the leg.

Active STR to the iliacus.

Apply a lock more medially to address the psoas and iliacus as they merge to form the iliopsoas tendon. Effective release of the iliacus can be performed in a side-lying position, whereby you can hook into the muscle and instruct the subject to extend the hip; ensure the pelvis is maintained in a neutral position.

Hip Adduction

Major Muscles: Adductor longus, adductor magnus (oblique fibres), adductor brevis, gracilis pectineus, gluteus maximus (lower fibres) and piriformis (at a range of more than 90 degrees).



Adductors.
1. *Pectineus*
2. *Adductor longus*
3. *Adductor magnus*
4. *Pectineus (cut)*
5. *Adductor brevis*

All the adductors are important in preventing overbalancing laterally by keeping the thigh pulled inwards during the support phase of walking and running. Tears in the adductor group are frequently referred to as 'groin strain' and commonly occur when the adductors are weak in relation to the quadriceps. Sports involving sprinting or sudden changes of direction are predisposed to this type of injury. Overuse (such as from horse riding or football), resulting in hypertonicity, can also induce problems here. Injury often presents at the muscle origin or at the musculotendinous junction. Maintenance massage is key to gaining and maintaining flexibility and strength in the area. The adductor magnus is the largest and most posterior of the adductors. Its origin is close to the hamstrings, and the muscle does assist in hip extension. Often when athletes perceive niggling 'hamstring pain' the adductor magnus is the cause. Depending

on the position of the thigh, the muscle is also involved in medial or lateral rotation.

Hip Adductors – Treatment

This is frequently a sensitive area to treat even on flexible people. It is important to ensure relaxation, and this may mean significantly shortening the muscle prior to locking in. With the subject in a supine position, hold the flexed knee while the foot is resting on the table. Apply pressure with the other hand at points in the muscle, on the borders of the adductor longus and the pectineus, then passively abduct the leg; alternatively, guide the subject to abduct the leg into your hand, making sure that the opposing hip does not rise.

Passive STR to the adductor longus.

Active STR to the adductor longus (grasp).

Work close to the pubic bone to ensure that the origins are attended to. For the gracilis, a straight leg stretch may be more effective, as the muscle also crosses the knee.

Passive STR to the gracilis.

Passive STR to the gracilis.

To locate the adductor magnus more easily, position the subject at the end of the table and support the whole leg around your body to allow for greater manoeuvrability of the hip; this could be helpful in targeting the adductor magnus, where adding hip flexion may enhance tissue release. Apply an appropriate lock and advise the subject to abduct or flex the hip as necessary to separate adherence. The other adductors can be treated effectively in this position too: traverse and separate them from each other, and subtly change the movement as necessary, depending on the adductor's secondary movements.

Active STR at the end of the couch to facilitate greater movement; useful for adductor magnus.

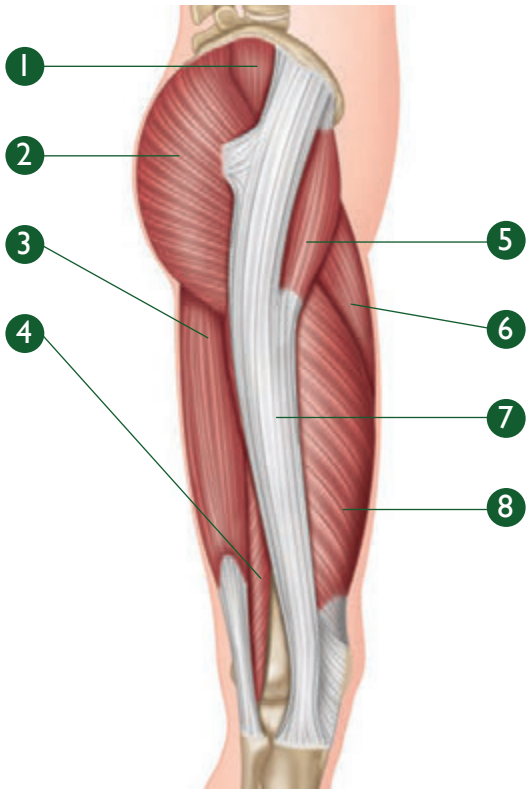
Active STR at the end of the couch to facilitate greater movement; useful for adductor magnus.

The adductor magnus reacts well to weight-bearing STR – the subject can be instructed to produce a stretch while standing.

STR to the adductors in a weight-bearing position.

Hip Abduction

Major Muscles: Gluteus medius, gluteus minimus, TFL, sartorius, piriformis (in the seated position) and gluteus maximus (upper fibres).



Lateral thigh.

1. *Gluteus medius*
2. *Gluteus maximus*
3. *Biceps femoris (long head)*
4. *Biceps femoris (short head)*
5. *Tensor fasciae latae*
6. *Rectus femoris*
7. *Iliotibial band*
8. *Vastus lateralis*

The gluteus medius and minimus support and control the hip and pelvic tilt, through eccentric contraction, as the body weight is transferred from one foot to the other during walking and running. While one foot is off the ground, contraction prevents the opposing hip from sagging. In many people the gluteus medius has a tendency to inhibition, partly because of the seated positions adopted in day-to-day life; in gait the pelvis visibly drops on the non-weight-bearing side because the gluteus medius is not strong enough to maintain the pelvis level. STR treatment to the gluteus medius prior to, and in conjunction with, specific strengthening exercises will enhance the effectiveness of the programme.

Tensor Fasciae Latae and Iliotibial Band

The tensor fasciae latae (TFL) assists in several movements, including hip flexion and abduction, and is a medial rotator when the hip is extended. It is also a weak extensor and lateral rotator

of the knee. It aids stability of the hip and stability of the femur on the tibia in weight-bearing activities. The TFL, along with the gluteus maximus, runs into a thick band of connective tissue known as the iliotibial band (ITB), which links the pelvis with the tibia. The ITB helps to stabilise the extended knee. Overuse injury is common in this area, as the TFL is predisposed to hypertonicity and becoming overactive in gait; this can result in excessive medial rotation of the hip after heel strike, subsequent weakening of the gluteus medius and increased tension in the ITB. Restriction between it and the vastus lateralis can occur, causing the band to rub on the lateral femoral condyle or over the greater trochanter.

Releasing restrictions in the TFL and ITB is renowned for being difficult and painful, but precise use of STR can effectively free even severely adhered areas with minimal discomfort. Problems here are associated with weakness in the gluteus medius, poor pelvic posture, tension in the vastus lateralis and weakness in the adductors.

Hip Abductors and ITB – Treatment

With the subject in a side-lying position, secure the flexed knee and abduct the hip. Apply pressure away from the iliac crest, into the gluteus medius, and adduct the hip. Elbows are often necessary here in cases of severe hypertonicity, or if the leg is proving heavy to hold, but when used with care should not be too uncomfortable.

Passive STR to the gluteus medius.

Passive STR to the gluteus medius.

To avoid holding the leg, progress to active STR. Ask the subject to abduct the hip while keeping the ankles together. Apply a lock and ask the subject to adduct the hip; if the tissue is under too much tension as abduction occurs, support the knee with your other hand while applying the lock.

Treat the TFL in a side-lying position, as in the case of the abductors and the superficial hip flexors. Lock in with the heel of the hand or an elbow and adduct the leg.

Active STR to the TFL..

Alternatively, lock and instruct the subject to perform a small amount of hip extension. This area can be very sensitive and uncomfortable, or ticklish even, so work precisely and efficiently.

To free up the ITB it is necessary to first release the gluteal muscles and the TFL, then gently grasp either side of the band and ask the subject to flex the knee; this will separate adherence between the ITB and the vastus lateralis. Progress to applying specific CTM locks and curl right under the posterior border, then the anterior border, by using one thumb reinforced with the other; after each lock instruct the subject to flex the knee.

Active STR to the borders of the ITB and vastus lateralis.

The fascia can be softened by applying a CTM lock across the ITB while the subject flexes or extends the hip away from the angle of pressure, still from a side-lying position.

THE KNEE

The knee has a good range of movement. It is made stable by strong ligaments and certain musculotendinous structures, in particular the iliotibial band, sartorius, gracilis, semimembranosus, semitendinosus, popliteus and quadriceps. The knee is constantly under stress as weight is transferred from the body to the ground in running and walking. Overuse can occur, and the knee is vulnerable to traumatic injury from twisting and turning.

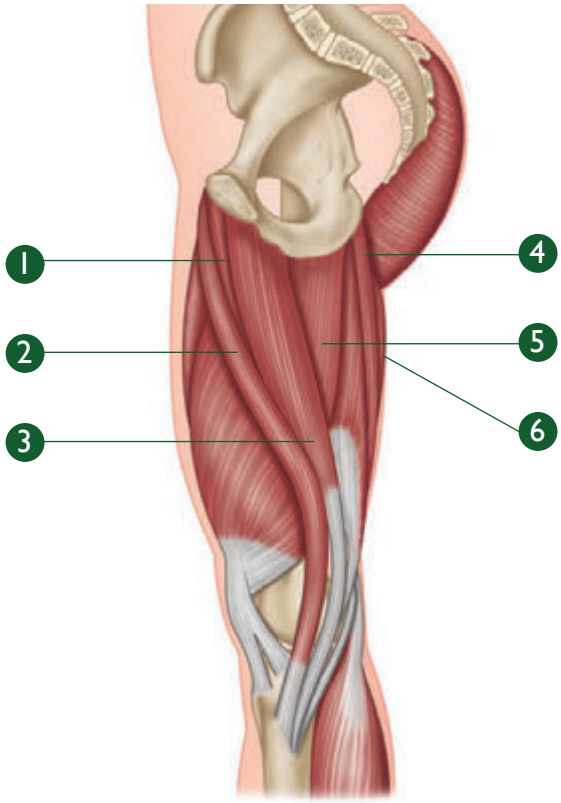
The quadriceps group inserts into the base of the patella and the ligamentum patellae, then joins the patella to the tibial tuberosity. Functionally the ligamentum patellae behaves as a tendon, transmitting the force of the quadriceps to the tibia, and so is often referred to as the 'patellar tendon'. There is a band of retaining connective tissue across the knee that is known as the patellar retinaculum.

Knee Flexion

Major Muscles: Hamstrings, gastrocnemius, gracilis, sartorius, popliteus and plantaris.

Medial thigh.

1. *Adductor longus*
2. *Sartorius* ┐ *Pes anserinus*
3. *Gracilis* ┤
4. *Semitendinosus* ┘
5. *Adductor magnus*
6. *Semimembranosus*



Except for the popliteus, all of these muscles cross over two joints. The knee flexors control extension to prevent hyperextension of the knee during walking and standing. Pain behind the knee can be due to tightness in any of these muscles, often the hamstrings. Commonly they can be strained through running, kicking or dancing. The tendons of insertion of the semimembranosus, sartorius and gracilis merge to form the pes anserinus, and congestion in this area can cause medial knee pain. It is important that all of the tendons around the knee are treated as well as the entire muscle, to enhance movement and aid stability of the joint.

Knee Flexors – Treatment

With the subject in a prone position and the knee flexed, apply a broad surface lock and passively straighten the knee; apply STR to the three hamstring muscles, assessing and releasing hypertonicity.

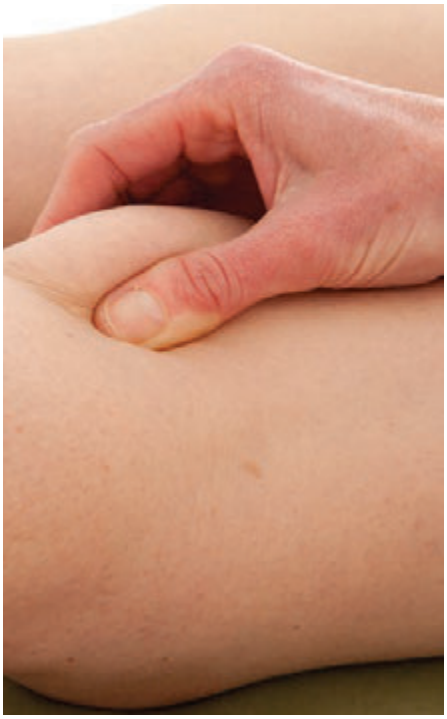
Passive STR to the hamstrings with a broad surface lock.

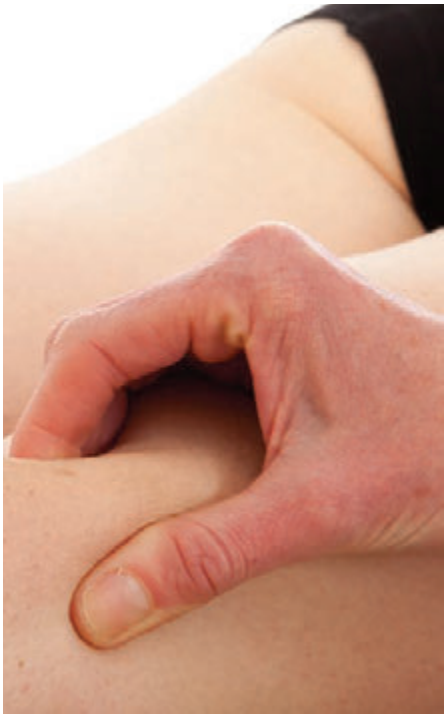
Following this, progress to active STR to acquire a more specific lock, and use a reinforced phalange or thumb, or reinforced fingers.

Active STR to the hamstrings with a reinforced phalange.

Gently grasp the tendons of insertion, one at a time, and extend the knee.

STR to the medial hamstring tendons of insertion (left hand photo); STR to the biceps femoris tendon of insertion (right hand photo).





Gently grasp the pes anserinus and extend the knee. Alternatively, with the subject in a supine position and the knee slightly flexed, lock into the tendons with the fingers and maintain each pressure while the subject extends or flattens the knee into the lock provided.

STR to the pes anserinus.

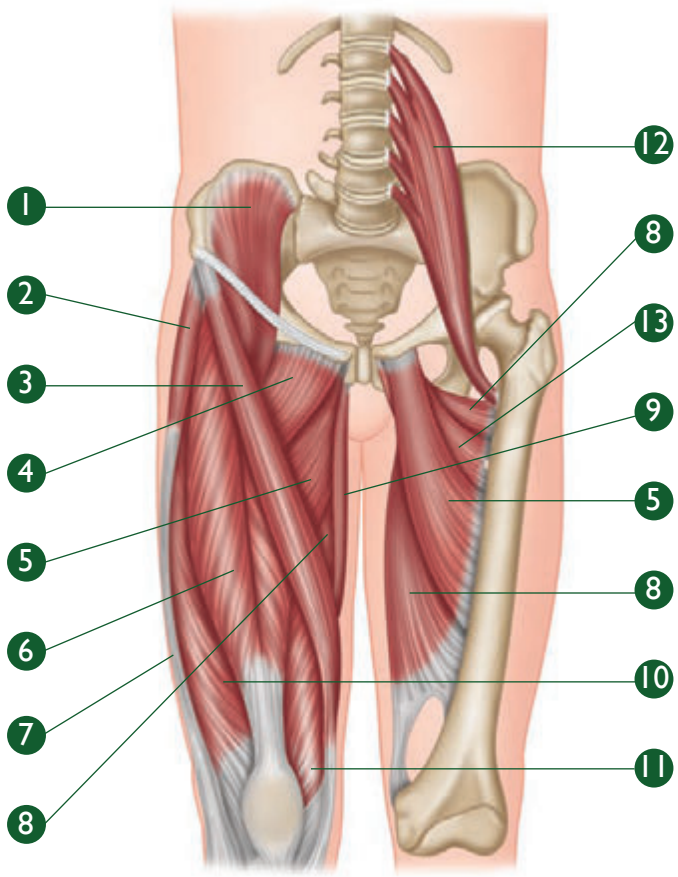
The gastrocnemius is primarily released with the other plantar flexors; the gracilis, with the adductors; and the sartorius as a whole, with the hip flexors.

Knee Extension

Major Muscles: Quadriceps group (rectus femoris, vastus lateralis, vastus medialis [including oblique] and vastus intermedius).

Anterior thigh.

1. *Iliacus*
2. *Tensor fascia latae*
3. *Sartorius*
4. *Pectineus*
5. *Adductor longus*
6. *Rectus femoris*
7. *Iliotibial band*
8. *Adductor magnus*
9. *Gracilis*
10. *Vastus lateralis*
11. *Vastus medialis*
12. *Psoas major*
13. *Adductor brevis*



The rectus femoris works strongly as a knee extensor when the hip is extended, and is ineffective when the hip is flexed. The vastus medialis is strong in the final stages of knee extension. The TFL is also a very weak knee extensor.

The quadriceps is a powerful muscle group, and is exercised significantly in walking, running and jumping. The rectus femoris goes over two joints; it is also involved in hip flexion and therefore has a greater susceptibility to strain. Separating and localised stretching will help to rebalance the four muscles and ensure that full function and strength are maintained; this will not only minimise the possibility of impairment or breakdown of the quadriceps but also prevent overuse injuries to the knee.

There is a danger in working on the quadriceps too soon after a direct trauma in that there is the possibility of the formation of myositis ossificans.

Knee Extensors – Treatment

With the subject supine, support the knee in a semi-flexed position. Extend the knee, apply a lock and flex the knee.

Active STR to the quadriceps tendon.

For a more effective stretch, the subject lies supine with the leg to be worked on over the end of the table, and the other leg flexed at the hip to protect the back.

Passive STR to the quadriceps.

Apply locks towards the origins and slightly transversely to the fibres to separate the vastus lateralis from adherence to the ITB, and to separate the vastus medialis from the sartorius and the adductors. The stretch in these instances is best achieved with the subject actively flexing the knee. Side lying is a good way to work on the rectus femoris by taking the hip into extension (see Hip Flexion section), and this position is also good for achieving separation of the vastus lateralis from the ITB with active knee flexion (see page 65).

STR to the vastus lateralis.

Knee Problems

There are certain knee injuries that benefit from STR work. Patella tracking problems can be helped by releasing the quadriceps and ensuring that its borders are free from adhesion. By relieving adhesion and hypertonicity in the lateral thigh and ITB, treatment may facilitate efficient strength gains in the vastus medialis. This will enable re-balance to occur.

In the case of a synovial plica, in conjunction with traditional friction techniques, STR to both the medial retinaculum and the lateral retinaculum around the knee will break fibrous tissue and stretch and nourish the surrounding connective tissue; this will help to reduce compression over the anterior compartment.

In the event of injury, specific STR to the medial ligament complex is beneficial. General STR to the quadriceps will relieve stress placed on the knee in tendinitis problems. Specific minimal STR to the patellar tendon itself will divide adhesive tissue there. If Osgood–Schlatter disease has been diagnosed, treatment of the insertion point should be avoided, but it is necessary to release the quadriceps from the hypertonicity that is inevitable in strong muscles attached to a fast-growing skeleton; STR will provide valuable relief. ITB syndrome can be treated where the band itself is tight and there is the commonly associated adherence between it and the vastus lateralis. With this condition, congestion in the lateral retinaculum must also be considered. Post-knee-surgery conditions, where muscles are atrophied and range of movement has been reduced, quickly benefit from active STR. This method is useful in that the subject can control the range of stretch, and the muscles and fascia may be freed of fibrous tissue so that efficient strength gains can be attained.

Knee – Treatment

With the subject in a supine position, systematically apply CTM locks at points away from the medial and lateral borders of the patella as the subject flexes the knee.

STR to the medial and lateral retinaculum.

STR to the medial and lateral retinaculum.

Treatment of fibrous areas is necessary, but it is important to glide into the lock slowly and precisely, as these areas may be particularly sensitive. Treatment of the medial ligament is possible using the same procedure. When treating the patellar tendon, a transverse lock to stretch the tendon sheath needs to be applied as the subject is guided into knee flexion.

STR to the patellar tendon.

It is possible to treat the knee with the subject standing; lock in on either side of the patella to affect the medial and lateral retinaculum as the subject performs a semi-squat. This dynamic functional treatment may have quick positive results for patella tracking problems; the subject can be guided through the correct technique to ensure that the knee flexes over the second toe.

Plantar Flexion

Major Muscles: Superficial compartment – gastrocnemius, soleus and plantaris. Deep compartment – tibialis posterior, flexor digitorum longus and flexor hallucis longus. Lateral compartment – peroneus longus and peroneus brevis.

Superficial calf muscles.

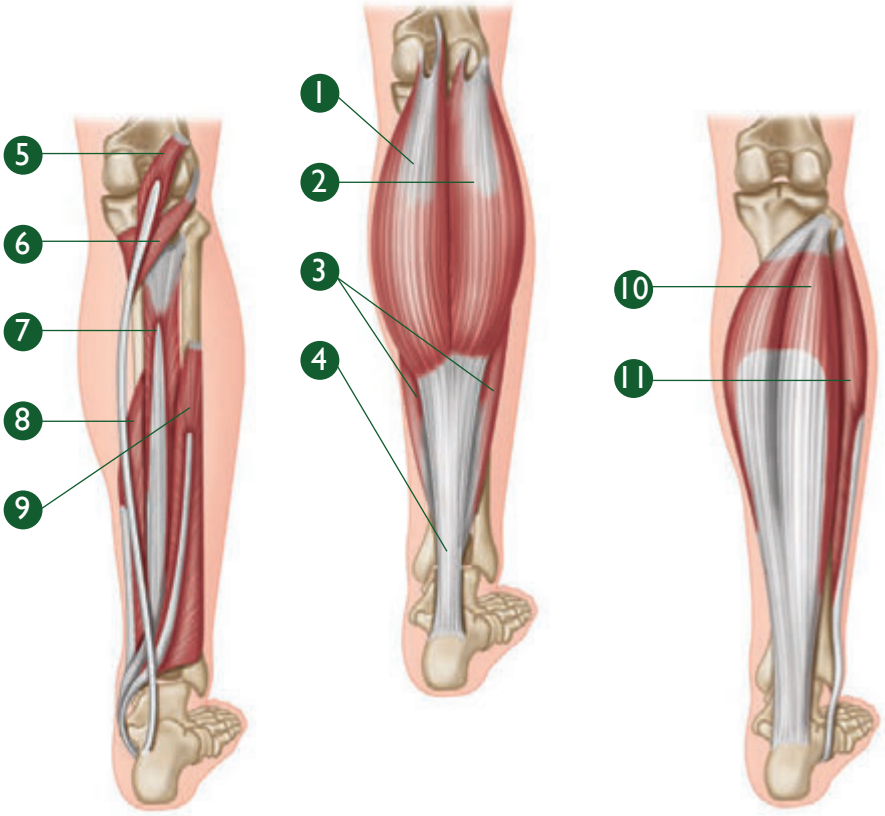
1. *Gastrocnemius (medial head)*
2. *Gastrocnemius (lateral head)*
3. *Soleus*
4. *Tendo calcaneus (Achilles tendon)*

Deep calf muscles.

5. *Plantaris*
6. *Popliteus*
7. *Tibialis posterior*
8. *Flexor digitorum longus*
9. *Flexor hallucis longus*

Intermediate calf muscles.

10. *Soleus*
11. *Peroneus longus*



The gastrocnemius and soleus are the primary plantar flexors of the ankle. During the push-off phase in vigorous walking and running, the gastrocnemius is one of the most powerful muscles in the body, and the tendo calcaneus (Achilles tendon), which forms the insertion point for both the gastrocnemius and the soleus, is very thick and strong. The soleus also contracts statically to maintain stance. As well as its role in plantar flexion, the gastrocnemius

flexes the knee, and, because it crosses over two joints, it is more susceptible to strain. Many overuse problems arise in the lower leg, and imbalances commonly occur; for example, if the gastrocnemius is stretched fully with a straight-leg stretch, and the soleus (because of its attachment below the knee) is not stretched out completely with a bent-knee stretch, then adherence of these two muscles can develop. Congestion frequently manifests at the musculotendinous junction. Compartment syndromes can also prevail where imbalance occurs.

Plantar Flexors – Treatment

Treat the calf generally with STR. Tension and adhesive tissue will quickly become evident. With the subject in a prone position and the ankles over the end of the couch, lock in between the bellies of the gastrocnemius and either dorsiflex the foot or instruct the subject to dorsiflex the foot.

Active STR to the gastrocnemius.

Systematically work the lateral and medial aspects of the muscle.

With the knee flexed, deeper and more specific work can be administered to the soleus; alternatively, rest the subject's lower leg on your thigh for more support. The lock can be angled to separate the soleus and gastrocnemius adherence from the lateral or medial borders. This can be conducted by working up from the musculotendinous junction.

Active STR to the soleus.

Once the gastrocnemius and soleus have been released, it is possible to work through these muscles to affect the deep posterior

compartment. Position the lower leg vertically and use fingers to tweeze into the deeper layer, pushing the lower leg into your supporting shoulder as necessary, but taking care not to crush the superficial tissue; ask the subject to dorsiflex the foot. With the subject in a side-lying position, lock in away from the tibia to free up congestion by the bone; ask the subject to dorsiflex the foot.

Active STR to the deep posterior compartment.

Achilles Tendon

Achilles tendinopathies can become chronic as a result of overuse. The causative activity needs to be moderated or stopped, because the condition can easily become aggravated. A general calf treatment is important, as congestion in the gastrocnemius and soleus can often be the reason for problems in the Achilles.

After the calf treatment, gently pinch the tendon. Lift the paratenon from the tendon and maintain this grasp as the foot is dorsiflexed.

Passive STR to the Achilles tendon.

Alternatively, ask the subject to dorsiflex the foot for active STR. Apply two or three locks, working from the calcaneus to the musculotendinous junction in the calf. Effective release of tissue congestion will facilitate strengthening and re-education.

Active STR to the Achilles tendon.

Following surgery for a partial or complete Achilles rupture, STR works well as part of rehabilitation. Apply STR to the lower leg as a whole, including the foot, and use the above-mentioned method to treat the Achilles.

Dorsiflexion

Major Muscles: Tibialis anterior, extensor digitorum longus, extensor hallucis longus and peroneus tertius (not always present).

The tibialis anterior is the main dorsiflexor; it also plays an important stabilising role in maintaining balance as the distribution of weight changes during locomotion, and it helps to control planting of the foot. The extensor digitorum longus plays a role in maintaining balance between plantar flexion and dorsiflexion. The fascia is thick in the anterior lower leg, so there is a higher risk of sustaining compartment-syndrome-type injuries due to overtraining. This could result from a sudden increase in exercise, particularly on hard surfaces such as in a group exercise class, from a build-up of running mileage or from walking too far in unaccustomed heavy shoes. The anterior compartment tightens and the fascial covering becomes tense, causing a pressure between it and the muscle. Ultimately, the pressure can lead to restricted blood supply, pain and loss of function. Rest is essential in the acute stages.

Dorsiflexors – Treatment

STR using a CTM lock is effective at reducing pressure build-up from tight fascia in the anterior compartment. It is advisable to shorten the tibialis anterior prior to locking, as it will prove more

comfortable when the muscle is tight. Use a knuckle or reinforced thumb to engage the muscle with a CTM lock towards the points of origin, and maintain the hold while the underlying muscles are momentarily elongated with active plantar flexion.

Active STR to the tibialis anterior.

Work from the ankle up the shin; use fingers to separate the tibialis tendon and other extensor tendons from under the retinaculum. STR will cause minimal aggravation and will manage the problem. Even in severe cases, if the tight compartment is caught early enough, the need for a fasciotomy may be avoided.

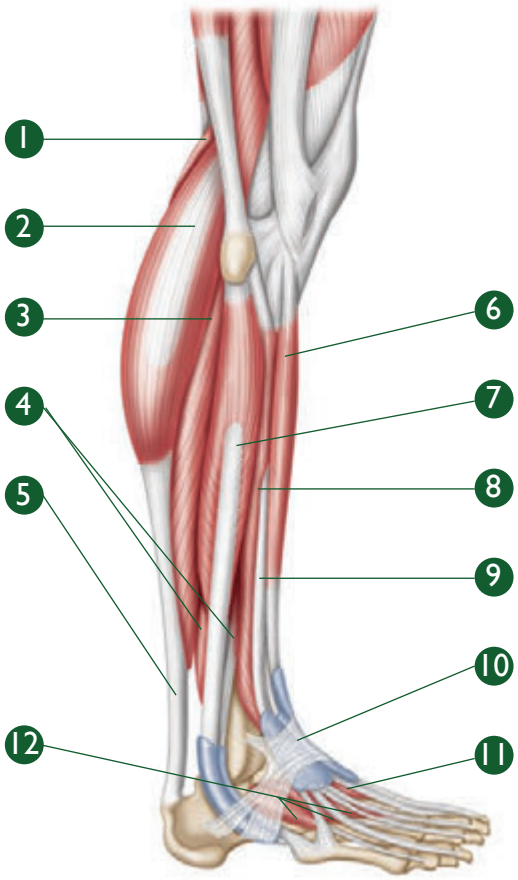
Inversion of the Foot

Major Muscles: Tibialis posterior, tibialis anterior, flexor digitorum longus, flexor hallucis longus and extensor hallucis longus.

The tibialis posterior helps maintain and control forefoot positioning, by preventing the medial arch from flattening. Its tendon attachments are palpable at the medial malleolus and the navicular. Tenosynovitis can occur with overuse.

Lateral lower leg.

1. *Plantaris*
2. *Gastrocnemius (lateral head)*
3. *Soleus*
4. *Peroneus brevis*
5. *Tendo calcaneus (Achilles tendon)*
6. *Tibialis anterior*
7. *Peroneus longus*
8. *Extensor digitorum longus*
9. *Extensor hallucis longus*
10. *Inferior extensor retinaculum*
11. *Extensor hallucis brevis*
12. *Extensor digitorum brevis*



Eversion of the Foot

Major Muscles: Peroneus longus, peroneus brevis and peroneus tertius (not always present).

Peroneus longus contributes to posture by helping to maintain the medial arch. The brevis aids the maintenance of the longitudinal arch. The peronei muscles have a major function in controlling ankle stability on rough terrain.

Invertors and Evertors – Treatment

With the subject supine, hook under the peroneus longus at the lateral malleolus and maintain the lock until the subject has inverted and/or dorsiflexed the foot. Follow the muscle up the side of the leg. Treatment can also take place effectively in a side-lying position.

Active STR to the peroneus longus.

The brevis can be located around the lateral ankle and is a prime muscle to consider in ankle inversion sprains.

THE ANKLE

General work to the lower leg and foot needs to be undertaken with the presentation of any ankle problem. STR to these muscles is highly beneficial following ankle sprains. It can be used directly following RICE during the general rehabilitative measures, to ensure strength gains. It is also useful in the case of a poorly healed ankle presenting with weakness and instability due to fibrous tissue and muscle imbalance, even many years after the initial injury. Inversion sprains are the most common ankle sprains, affecting the anterior and posterior talofibular ligament and the calcaneofibular ligament and/or the peronei. Following the sprain, adherence commonly occurs within the extensor tendon sheaths, the extensor retinaculum and the ligaments, which can leave a residual egg-shaped swelling. In this instance, STR to the ligament is useful, together with work on all the muscles that evert and dorsiflex the foot. Balance still needs to be restored wherever the primary damage has occurred. To restore freedom of movement, lock onto ligamentous tissue as well as onto and between the tendons; instruct the subject to perform

an appropriate stretch. Combination movements of flexion, extension, eversion and inversion work well in separating the tendons from each other and from the retinaculum, as they take in all the primary and secondary movements of the muscles.

Once the tissues affecting the ankle have been released and the joint is moving well, strength training and proprioceptive re-education exercises become more effective and help to make the repair permanent. In the case of a major injury such as ligamentous rupture or bone breakage, healing will always be slow. Swelling, scar tissue, pain and reduced movement can become permanent because of the damage and forced immobilisation; STR, as outlined above, will prove invaluable in regaining ankle mobility and reducing swelling.

STR to the extensor tendons at the retinaculum.

Shin Splints

'Shin splints' is a general term for chronic pain in the lower leg. It can develop from the anterior, the posterior and sometimes the lateral compartment, although more commonly it refers to pain occurring on the medial tibial border. This is more accurately defined as 'medial tibial stress syndrome'.

When there is pain on the medial tibial border, the plantar flexors require particular attention. Chronic problems are usually caused by the soleus, flexor digitorum longus and tibialis posterior, and frequently present in the lower third of the tibia. The injury can be due to hypertonicity or compartment syndrome of the muscle, adhesion between the tendon and the bone, inflammation of the periosteum or an actual stress fracture of the bone. Many distance runners who suffer with this condition successfully resort to prescribed orthotics to help correct over-pronation. The

repetitive nature of the sport can make a minor biomechanical deficiency apparent. Whether orthotics are necessary or not, STR is an indispensable form of treatment for shin splints. STR will decrease tissue adherence and tension with minimal aggravation of the inflammation.

Shin Splints – Treatment

Wherever the pain presents, it is imperative to address all of the lower leg compartments and the foot to help restore muscle balance. Once the superficial posterior compartment has been released, address the deep compartment. Glide a thumb or the fingers medially off the tibia, lock still and dorsiflex the foot.

Active STR to the deep posterior compartment.

If there is major discomfort or concern there could be a stress fracture; remember to conduct the seven-second test (see page 22) to ensure that treatment is only administered around, and not on, an acutely inflamed area. It is necessary to treat the foot thoroughly to relieve congestion within the insertion tendons of the deep posterior compartment; this treatment will also help to restore balance to the foot and improve its natural posture.

THE FOOT

The foot is a vital area to maintain. Strong, flexible musculature will enhance its shock absorbency, minimising the risk of injury. Control and good movement of the joints in the foot are possible where the soft tissues are strong and supple. This encourages efficient and correct planting of the foot and reduces the possibility of repercussions elsewhere. While standing still, the arches of the foot are maintained primarily by strong ligaments in the sole. There are four layers of intrinsic muscles on the plantar surface that help support the arches of the foot as well as move the toes. These muscles, together with the long tendons that cross the ankle, maintain the arches during movement. Thick layers of connective tissue envelop the muscles and fatty tissue to provide protection for the foot.

There are many injuries which can occur in the toes, such as turf toe, which is a sprain to the first metatarsophalangeal joint (MTPJ); metatarsalgia, which refers to general pain in the forefoot; and hallux valgus and hallux rigidus, which result from excessive or deficient mobility in the MTPJ. Once a problem has been diagnosed, STR can be of huge benefit in relieving discomfort and can contribute to the development of good foot mechanics by restoring muscle balance. STR is also invaluable for helping the traumatised tissues recover following corrective surgery for hallux valgus.

Toe Flexion

Major Muscles: Flexor digitorum longus, flexor digitorum brevis, flexor hallucis longus, flexor hallucis brevis, flexor digiti minimi brevis, interossei, quadratus plantae and lumbricals.

Toe Flexors – Treatment

Release the deep posterior compartment (see page 78) then address the plantar muscles in the foot; lock in using a knuckle and ask the subject to extend the toes.

Toe Extension

Major Muscles: Extensor hallucis longus, extensor digitorum longus, extensor digitorum brevis, lumbricals and interossei.

Toe Extensors – Treatment

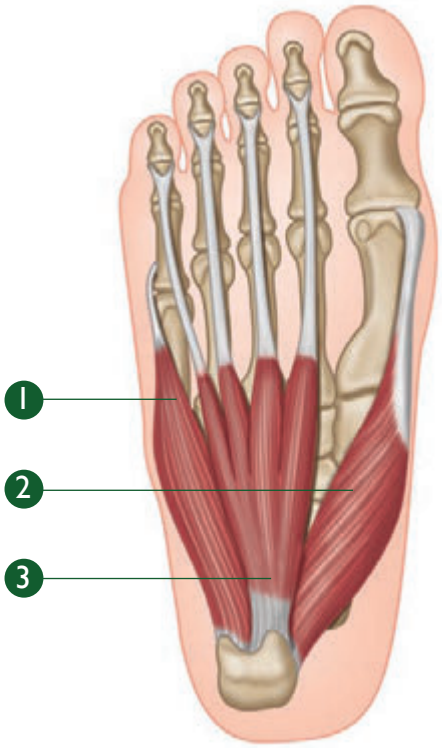
Address the anterior compartment by locking in and plantar flexing the ankle for a stretch; then progress to treating the tissue on the dorsal side of the foot. Glide over and tweeze between the extensor tendons, hold the position and flex the toes.

Passive STR to the extensor tendons.

Lock onto the tendons and flex the toes, or ask the subject to flex the toes.

Toe Abduction

Major Muscles: Abductor hallucis, abductor digiti minimi and dorsal interossei.



Plantar view of foot (superficial muscles).

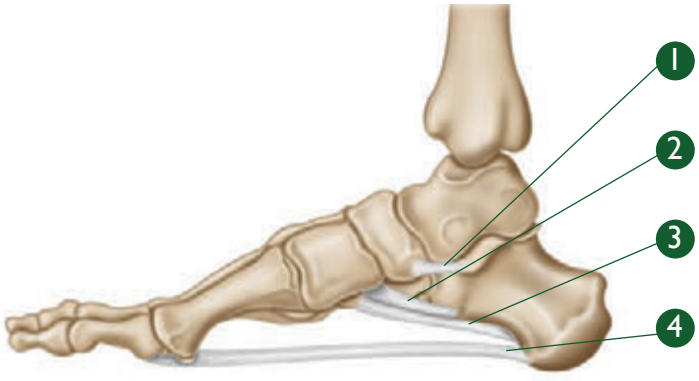
1. *Abductor digiti minimi*
2. *Abductor hallucis*
3. *Flexor digitorum brevis*

Toe Adduction

Major Muscles: Adductor hallucis and plantar interossei.

Plantar Fasciitis

The plantar aponeurosis, or plantar fascia, is a very thick fibrous band of tissue in the base of the foot which covers the plantar muscles and is vital in maintaining the longitudinal arches of the foot. Over-pronation of weak lateral leg muscles can predispose the plantar fascia to injury: the fascia becomes thickened and inflamed. Medial pain at its calcaneal attachment, as well as general tension in the base of the foot, is usual in this condition.



The plantar fascia helps to hold the foot arches up and keep the bones from spreading under the weight of the body.

1. *Plantar calcaneonavicular (spring) ligament*
2. *Short plantar ligament*
3. *Long plantar ligament*
4. *Plantar aponeurosis*

Plantar Fasciitis – Treatment

With problems of the plantar fascia, it is important to treat the calf, Achilles tendon and plantar muscles. There are usually soft tissue restrictions here if the plantar fascia is problematic. A CTM lock is recommended while the toes are extended. Active work is essential so that a strong lock can be maintained. A strong knuckle will prove a useful tool in this treatment.

Active STR to the plantar fascia.

Part 4
Trunk and Neck

THE SPINE

The spine consists of thirty-three individual vertebrae: seven cervical, twelve thoracic, five lumbar, five sacral (fused) and four coccygeal (fused). Although only small movements occur between the vertebrae, the combined action of all of them facilitates good overall spinal mobility. Between the vertebrae are cartilaginous discs, which make up approximately one-third of the total height of the spine. The vertebral column is maintained in its upright posture by strong ligaments and muscles; it has three natural curves (four if the sacral curve is included), which together with the intervertebral discs are responsible for absorbing shock. Flexible, strong muscles will enhance the fluid content of the discs and allow efficient maintenance of the spinal curvature.

Most people will suffer with backache at some point in their lives, although maintenance of correct posture can reduce the likelihood of injury problems. Good spinal posture places minimal strain on the muscles that maintain the body's stance. If the body sways from its neutral position, the movement is counteracted by muscles which contract eccentrically. If an inefficient posture is continued, then adaptive responses lead to poor health of the muscles, muscle imbalance and dysfunction in the form of reduced muscle strength, loss of spinal mobility, nerve root irritation and pain generally. Postural adaptation often develops over many years, and someone may not be aware of a problem until the tension and imbalance give rise to a traumatic injury, such as a prolapsed disc.

The position of the pelvis is affected by the abdominal muscles and spinal extensors as well as the hip flexors and extensors. An increase in the lumbar lordotic curve will result in tight hip flexors and back extensors, weak abdominal muscles and a tendency to compensatory thoracic kyphosis. The side flexors need to be evaluated with regard to lateral imbalance. Massage therapists

must be systematic in treating the hips and antagonists with any presentation of back pain. There are many different types of stress placed on posture, and the therapist needs to be aware if the subject suffers from any of these. There may be a structural problem, such as a leg length discrepancy. Occupational factors, for example driving for long hours or sitting behind a keyboard, may be involved. If sports are the cause, the problem could be repetitiveness, such as in long-distance cycling, or an overload of one side of the body, such as in golf or tennis. The root of the problem needs to be addressed and altered if possible. Maintenance massage of the back area is invaluable. Correct posture is still not well understood by the general public so, following treatment, postural awareness should be discussed along with mobility, stretching and strengthening exercises (see Appendix 2).

When someone presents with any neurological deficit or acute symptoms, input from a medical practitioner is essential, and STR may not initially be appropriate where protective spasm and severe inflammation are present. Traumatic injuries sustained from heavy lifting or falling, and sciatic, disc and degenerative conditions, will benefit from having the soft tissues strong, supple and in balance; the timing of the introduction of STR should be carefully considered for maximum benefit. STR can help improve movement patterns and relieve nerve root irritation.

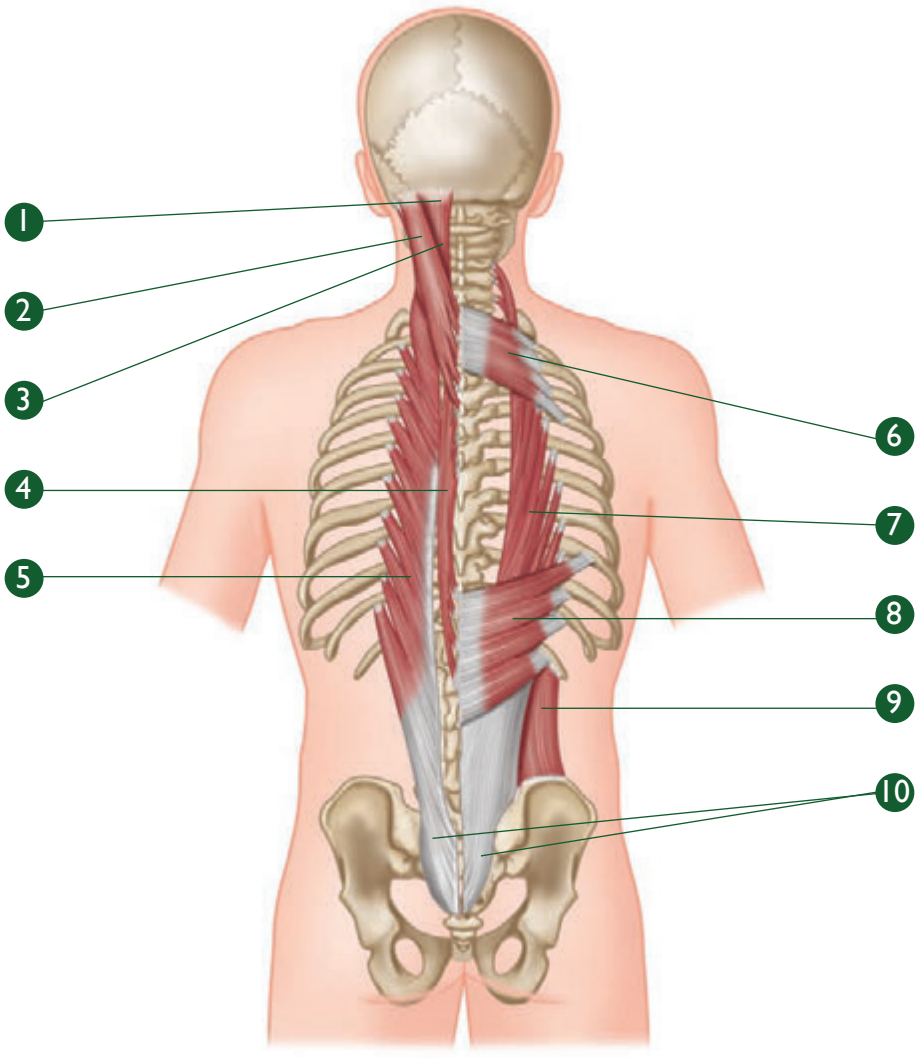
Spine Extension

Major Muscles: Erector spinae (iliocostalis, longissimus, spinalis), quadratus lumborum, interspinales, multifidus, semispinalis and gluteus maximus (from a flexed position).

The contraction of all three muscles on both sides of the erector spinae is the main contributor to extension of the back. The iliocostalis (lateral layer) has attachments that run the length of the spine. The longissimus (middle layer) and the spinalis (medial layer) attach to the skull and to the cervical and thoracic vertebrae. There are many complex muscle contractions that always occur, as the erector spinae also controls flexion of the spine and stabilises the non-weight-bearing side, to prevent the pelvis from dropping, during side flexion. The erector spinae is also critical in maintaining the secondary curve.

Deep back muscles.

1. *Semispinalis capitis*
2. *Splenius capitis*
3. *Semispinalis cervicis*
4. *Spinalis*
5. *Longissimus thoracis*
6. *Serratus posterior superior*
7. *Iliocostalis thoracis*
8. *Serratus posterior inferior*
9. *Quadratus lumborum*
10. *Thoracolumbar fascia (deep layer)*



The transversospinalis muscles are found deep to the erector spinae; in order, starting with the most superficial, these are the semispinalis, multifidus, rotatores and interspinales. The deepest muscles cross only one or two vertebrae.

Spine Side Flexion

Major Muscles: Quadratus lumborum, erector spinae, intertransversarii, external oblique, internal oblique, rectus abdominis and multifidus.

Side flexion is produced by the muscles on the side being flexed. When standing on one leg, the quadratus lumborum acts strongly on the non-weight-bearing side to stop the pelvis from dropping. It also stabilises the twelfth rib during forced expiration, by fixing the origin of the diaphragm. When the quadratus lumborum

muscles on both sides contract, they are responsible for lumbar spine extension and stability.

Spine Rotation

Major Muscles: External oblique, internal oblique, multifidus, rotatores and semispinalis.

During rotation to one side, contraction of the external oblique on the opposing side and contraction of the internal oblique on the same side occurs. The external oblique is the most superficial side muscle and its origins interrelate with the serratus anterior. The internal oblique muscle runs diagonally in the opposite direction.

Fascia of the Trunk

The trunk, like the rest of the body, is covered with superficial and deep fascia. The deep fascia of the neck area is thick and strong, enveloping the muscles, and supports and connects the trunk to the muscles of the shoulder girdle and upper limb. There is a specialised deep layer of fascia in the lower back known as the thoracolumbar fascia. It consists of three layers located in the lower thoracic, the lumbar and the sacral regions. The posterior layer is superficial to the erector spinae, and the latissimus dorsi partially arises from it. The middle layer is situated between the erector spinae and the quadratus lumborum. The anterior and thinnest of the layers is located in front of the quadratus lumborum. All three layers converge at the lateral border of the erector spinae. This then extends to form an origin for the transversus abdominis and internal oblique.

CTM locks are very beneficial in ensuring that the muscle regains full separation. As many of the lower back muscles in particular are very strong, the quality of the lock is crucial for any release to occur.

The deep fascia of the abdomen is thin and elastic to allow expansion of the chest and abdomen. The lower abdomen consists of an aponeurosis (external oblique) and a membrane.

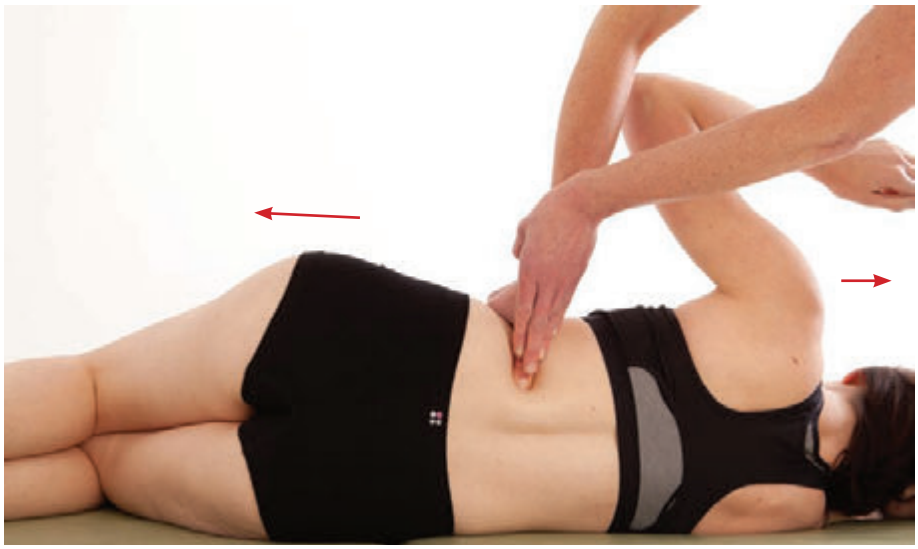
Spine Extensors, Side Flexors and Rotators – Treatment

With the subject in a side-lying position, make a secure reinforced lock just above the sacroiliac joint close to the spine; advise the subject how to perform a posterior tilt of the pelvis. The pressure should be directed slightly towards the head. The pelvic tilt provides a small stretch but the movement is controlled and precise.

Active STR to the erector spinae as the pelvis is posteriorly tilted.

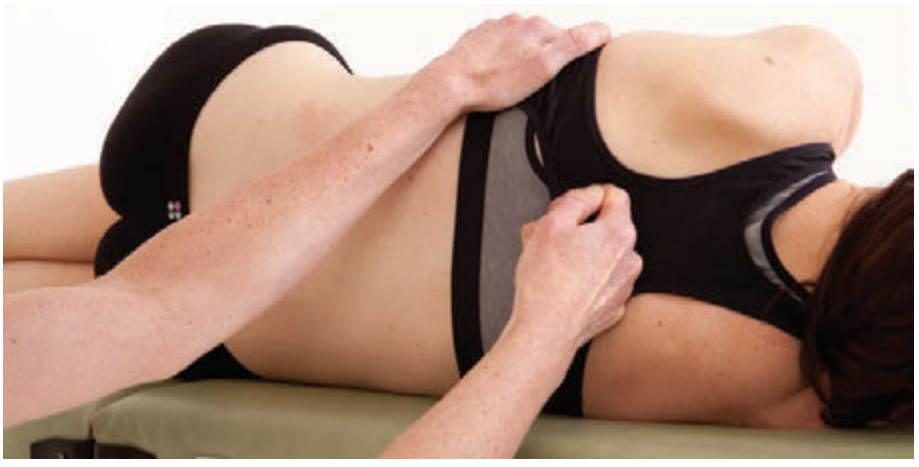
Although trunk flexion can be used, the movement may prove too severe for a lock to be maintained. Apply locks and move up the whole of the lumbar area, then return and treat more laterally to the initial locks. Treat around the sacroiliac joint with two or three CTM locks and either a pelvic tilt or flexion of the spine or hip. For the quadratus lumborum, use one thumb reinforced with the other; take the depth of the erector spinae and drop in on the lateral border of the muscle, in between the rib cage and the pelvis. Maintain this pressure while the subject extends and adducts the hip and abducts the arm.

Active STR to the quadratus lumborum.



Treatment of the erector spinae can continue until you reach an area not affected by the stretch from the pelvic movement. This procedure is usually only beneficial around the lumbar area. For release in the erector spinae further up the back, it will be necessary to lock as the subject flexes the trunk; instruct the subject to arch the back or to push backwards into the lock.

Active STR to the erector spinae in the thoracic region – a lock is attained and the subject arches their back.



Active STR to the erector spinae using an elbow.

The direction of pressure in this case should be towards the base of the trunk.

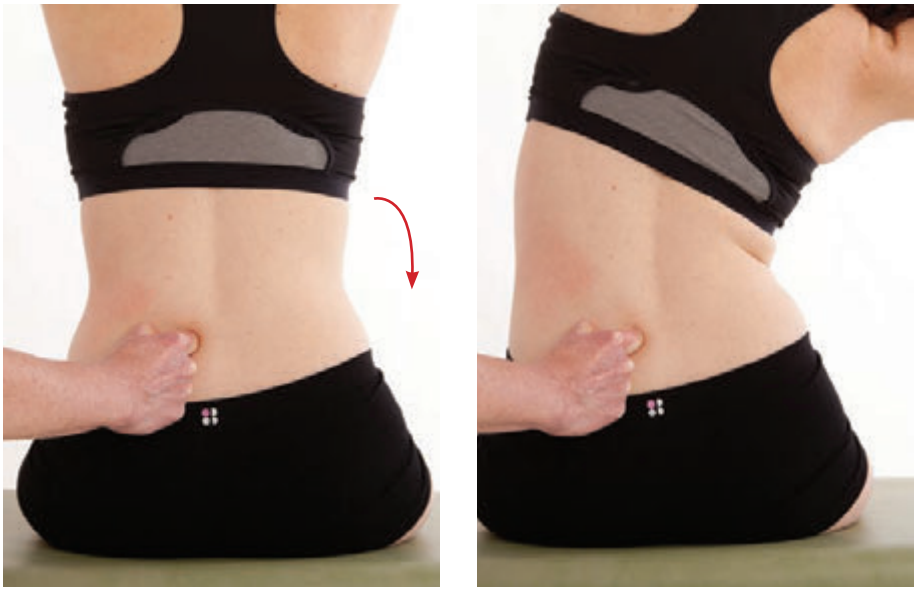
On occasion, weight-bearing STR may prove to be a useful technique. STR can be performed with the subject standing and holding onto a wall or the couch for support; apply a CTM lock and instruct the subject to flex or side flex the spine. Another useful position is with the subject on all fours; lock in on either side of the spine as the subject arches into the 'angry cat' stretch, and release the lock as the subject returns to neutral.

STR to the erector spinae in a weight-bearing position.

Seated STR also works well, even on the larger individual. Because the muscles are under tension it is advised to treat the top layer of the thoracolumbar fascia, rather than trying to delve

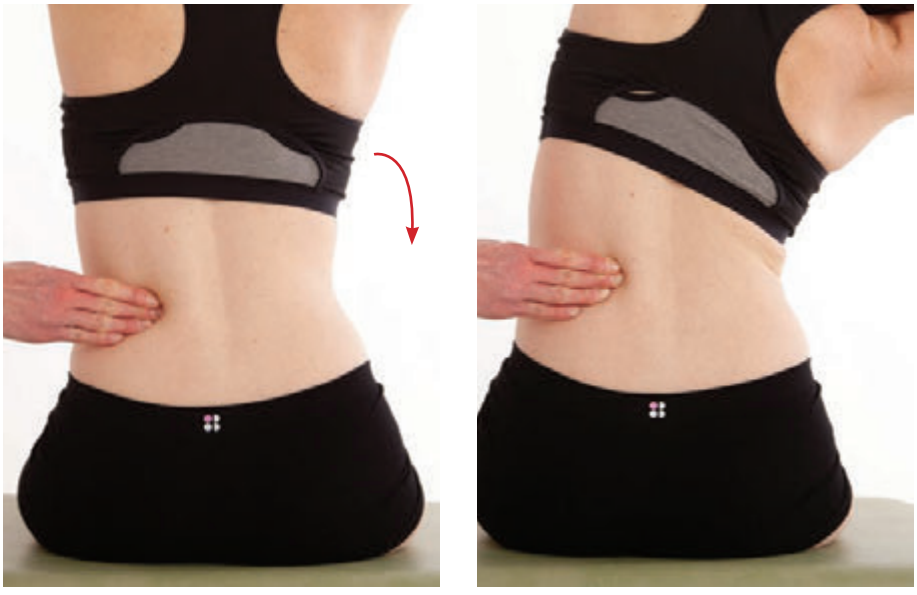
into the extensors. Apply a CTM lock while securing the subject across the front of the hips, and instruct the subject to side flex or flex the spine; severe muscle shortening can be relieved because of the fascial release.

STR to the erector spinae in seated.



By having the subject's arm raised on the side being treated, the stretch on the latissimus dorsi may enhance the STR effect. Also, with the subject seated, the quadratus lumborum can be targeted and the subject can side flex.

STR to the QL in seated.

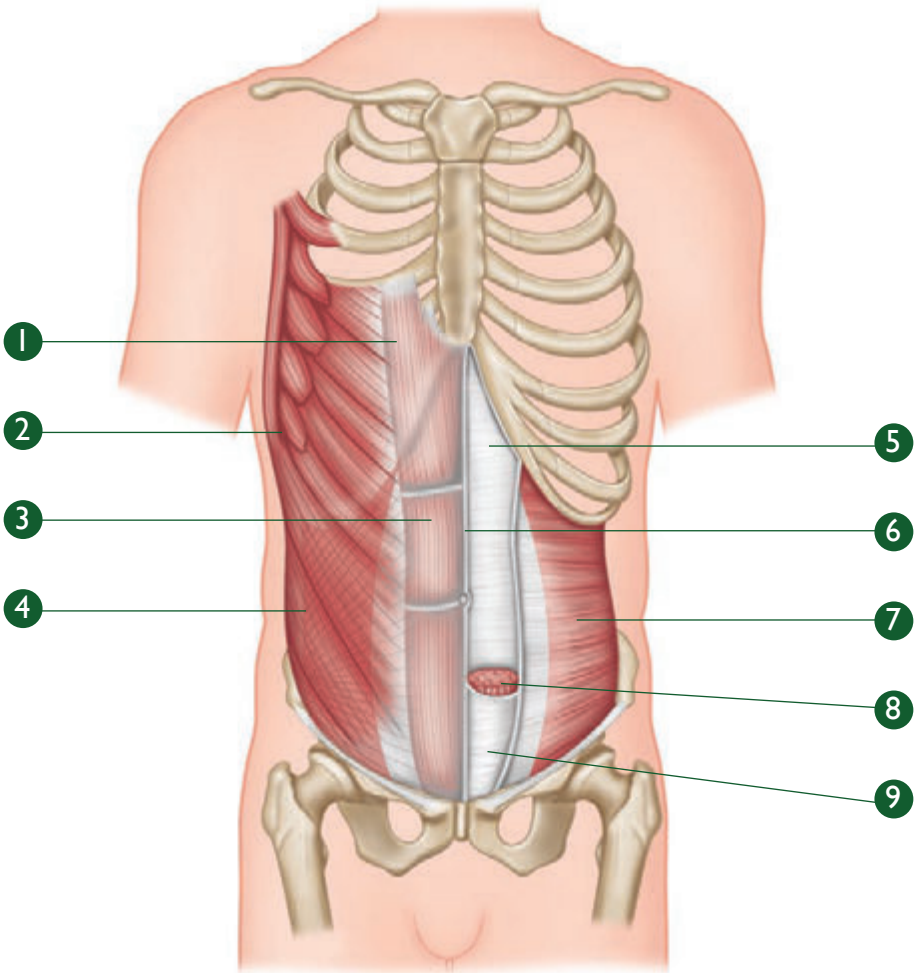


For the thoracic region, working with rotation can prove to be valuable in restoring correct movement patterns. Use your elbow to gently engage the semispinalis thoracis, once the superficial

shoulder girdle muscles have been released, and instruct the subject to rotate the spine to the same side for a stretch. Also, lock deep into the laminar groove to address the multifidus muscles; instruct the subject to rotate to the same side for a stretch.

Spine Flexion

Major Muscles: Rectus abdominis, external oblique, internal oblique, and psoas major and minor (when the insertions are fixed).



Abdominal muscles.

1. *Rectus abdominis under anterior rectus sheath*
2. *External abdominis oblique (muscular part)*
3. *External abdominis oblique (aponeurotic part)*
4. *Internal abdominis oblique*
5. *Posterior rectus sheath*
6. *Linea alba*
7. *Transversus abdominis*
8. *Rectus abdominis*
9. *Anterior rectus sheath*

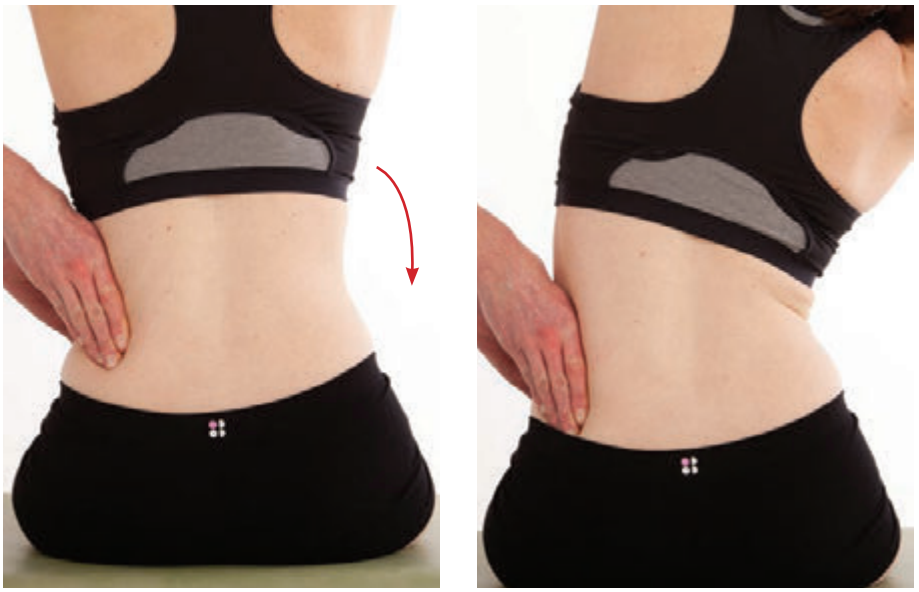
Flexion occurs during concentric contraction of the muscles on both sides of the spine. The flexors also affect the position of the pelvis by modifying its tilt and subsequently the curvature of the lumbar spine. Attachments of the abdominal muscles to the pelvis, at the symphysis pubis, and muscles within the abdominal wall are all occasionally torn, with consequent fascial adherence. Thickening of the fascia can occur with poor posture, leading to further postural imbalance and weakness. If the spine flexor muscles are weak, the pelvis drops, the hip flexors and spine extensors become hypertonic in relation to the spine flexors, and the lumbar curve tends towards lordosis. Correct, isolated strengthening of the abdominal muscles is necessary to regain lost strength.

Spine Flexors and Rotators – Treatment

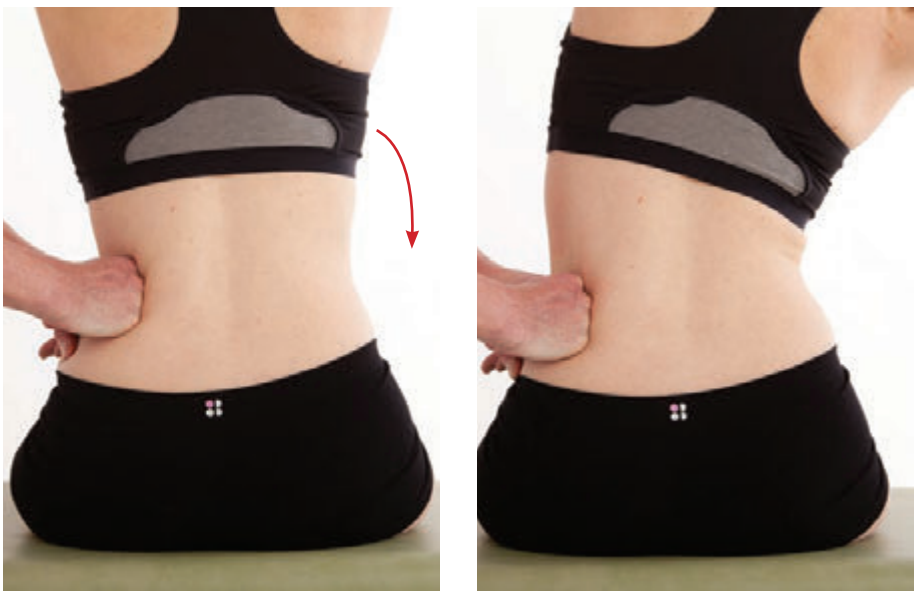
With the subject in a supine position, treat the rectus abdominis: start from the origin on the pubis with a CTM lock, then instruct the subject to perform a very minimal side flexion. Progress to the outer borders of the muscle on one side, hooking under it while the subject side flexes. Angle the lock carefully near to the insertions to avoid bruising from the bone. See the section on hip flexors for treatment of the psoas (page 54). The external and internal oblique muscles may be treated in a similar fashion, by applying pressure as the subject side flexes. Alternatively, use a side-lying position, in which a trunk rotation can be used to provide adequate stretch for a release. Locks must be applied away from the movement, and pressure should be angled to produce a shallow CTM lock.

Treatment in a seated position is an excellent way to add in a greater range of movement when addressing the rectus abdominis or the oblique muscles. Use broad surface locks, such as the whole hand or a soft fist, and instruct the subject to side flex to the opposite side. For release of the internal oblique muscle, lock and rotate to the opposite side for a stretch; for release of the external oblique, lock and rotate to the same side.

STR to the oblique muscles.



STR to the oblique muscles.



Compression of the Abdomen

Major Muscles: Transversus abdominis, external oblique, internal oblique and rectus abdominis.

These muscles increase abdominal pressure and provide a muscular support for the pelvis, abdomen and viscera.

Respiration: Inspiration

Major Muscles: Diaphragm, external intercostals, levatores costarum, serratus posterior and superior, pectoralis minor and sternocleidomastoid.

Respiration: Expiration

Major Muscles: Transversus abdominis, subcostales, transversus thoracis, internal intercostals, external oblique, internal oblique, latissimus dorsi and quadratus lumborum (fixes ribs).

Diaphragm

The diaphragm is a large sheet of muscle that separates the thoracic and abdominal cavities. As it contracts it is drawn downwards, and the subsequent change in pressure causes air at atmospheric pressure to enter the lungs. When it relaxes it returns to its initial position and air is expelled from the lungs. During forced expiration, for example during moderate or heavy exercise, the expiratory muscles become involved in order to drive air out more quickly. Through their contraction, there is an increase in abdominal pressure that pushes the diaphragm up more quickly to expel air faster. The transversus abdominis (the deepest of the abdominal muscles) is the most powerful expiratory muscle. The internal and external intercostal muscles criss-cross the ribs and are responsible for drawing the ribs together (for expiration) and apart (for inspiration) respectively.

Respiratory Muscles – Treatment

Treatment of the respiratory muscles is beneficial for anyone who suffers with breathing difficulties. STR will have a positive effect on asthma sufferers. Athletes will find it can improve their breathing techniques, as the chest adopts a new lightness and freedom.

Ensure that the subject is in a comfortable supine position with the knees and hips flexed. Gently guide your thumb behind and in front of the lower ribs towards the anterior attachments of the diaphragm while the subject is slowly inhaling; hold the position and allow inhalation to finish. Still maintaining the pressure,

instruct the subject to exhale gently; after exhalation, release the pressure. For the intercostal muscles, a side-lying position is a good way of exposing the ribs. Lock in between the ribs, hold the pressure and instruct the subject to breathe in and to breathe out. The external intercostal muscles are the most superficial and are therefore more directly affected by this technique.

Lock into the intercostal muscles in between the ribs.

THE NECK

The neck flexors are generally weaker than the extensors, which have to hold the heavy head in an upright position, against gravity. The extensors are constantly under tension, contracting statically and eccentrically to maintain posture. Postural deficiencies can especially occur with repetitive activities or positions, for example sitting, writing for long periods, painting a ceiling or engaging in sports such as cycling. The soft tissues can become micro-torn and tense; as the activity persists, holding patterns and imbalances prevail. An increase in the cervical curve, forcing the head forwards, is a common result. Problems manifest as movement restrictions, headaches, vertigo, tinnitus, and muscle, joint and nerve pain. Impingement of vertebral arteries and nerves can occur, which may not necessarily have a muscular cause, and medical advice needs to be sought if a subject presents with dizziness or referred pain that is not clearly muscular in origin.

As well as controlling specific movements, many of the small neck muscles are involved in maintaining the balance and stability of

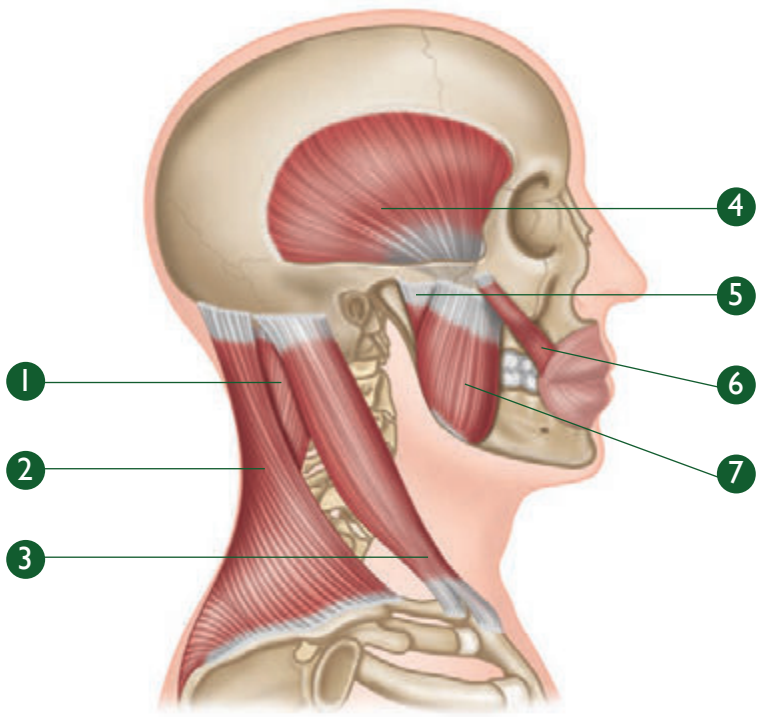
the head on the neck; these cannot be palpated, so they will not be discussed. The platysma is the most superficial anterior muscle and is a thin, flat muscle that adheres to the skin.

Seated STR is a good way to start an assessment and treatment, and the neck flexors can be generally addressed if the head and neck are protracted. Then, systematically working the agonists and antagonists will ensure good recovery of chronic neck tension and side-effects such as tension-type headaches (TTHs). This will also facilitate a return to good posture and an enhanced functional capacity.

Because of its extreme mobility, the neck is also vulnerable to traumatic injury, an example being whiplash. Following such injury, there will be ligamentous damage, and the neck muscles will present with extreme tension. This is due to fierce reflex muscle contractions that protect the head against rapid movement. Provided that the results of a medical screening are satisfactory, STR is an indispensable therapy. Degenerative conditions, such as spondylosis, can also benefit from STR; use of active STR will ensure that the subject only moves through a range that can be performed comfortably. Improving movement and posture will relieve pressure from the facet joints and discs.

Neck.

1. *Splenius capitis*
2. *Trapezius*
3. *Sternocleidomastoid*
4. *Temporalis*
5. *Masseter (deep part)*
6. *Zygomaticus major*
7. *Masseter (superficial part)*



Neck Flexion

Major Muscles: Sternocleidomastoid (SCM), scalenus anterior and longus colli (flex the neck); longus capitis and SCM (flex the neck and head); rectus capitis anterior (flexes the head on the neck and stabilises the atlanto-occipital joint).

Neck Side Flexion

Major Muscles: Scalenus anterior, scalenus medius, scalenus posterior, splenius cervicis, levator scapulae and SCM (side flex the neck); SCM, splenius capitis, trapezius and erector spinae (side flex the head and neck); rectus capitis lateralis (side flexes the head on the neck).

Neck flexion occurs when the SCM muscles on both sides contract; side flexion to the same side or rotation to the opposite side occurs when the SCM on one side contracts. When the head and neck are fixed, the SCM muscles can raise the clavicles and sternum, thus assisting inspiration. The scalenus muscles, when contracting bilaterally, also assist in neck flexion; if only one side contracts, they assist in side flexion to the same side. The brachial plexus runs between the scalenus anterior and the scalenus medius.

Neck Flexors and Side Flexors – Treatment

With the subject in a supine position, support the head with one hand and gently grasp the SCM with the other hand. Maintain this hold and instruct the subject to extend the neck.

Active STR to the sternocleidomastoid.

Active STR to the sternocleidomastoid.

Alternatively, gently grasp the muscle and passively move the neck away from this lock into side flexion; or instruct the subject to rotate the neck to the same side for a stretch. It is vital not to move too quickly. If the area is particularly congested, apply pressure to one side of the muscle at a time. Lock into the muscle origin, moving to two or three new points to free the clavicular and sternal fibres. STR at the insertion points of the SCM, on the skull, is necessary, and a CTM lock will prove highly successful where fascial thickening is often evident; use of the knuckle away from the bone is helpful in attaining a lock, but move carefully into position. The scalenus muscles assist with inspiration, so incorporating breathing will not only help to relax the subject, but also directly assist with the release. The scalenus muscles can be treated by first side flexing the neck to the same side during inhalation, then gliding away from the clavicle with the lock and moving the head into side flexion to the opposite side during exhalation. For the scalenus anterior, lock in just laterally to the SCM; for the scalenus medius, lock in away from the mid-portion of the clavicle; and for the scalenus posterior, lock in away from the most lateral point of the clavicle. Because this whole area can be highly sensitive, treatment should always be slow.

Passive STR to the posterior scalenes.

Neck Extension

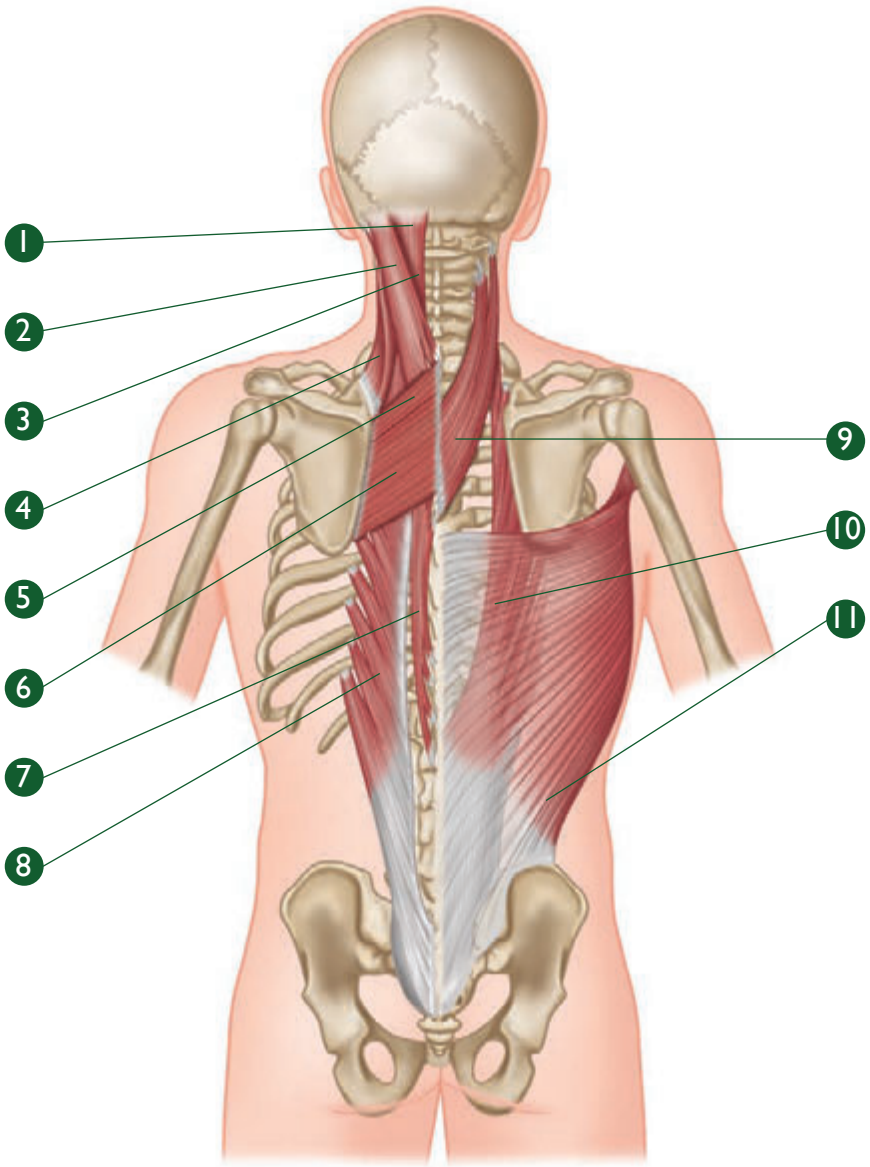
Major Muscles: Levator scapulae and splenius cervicis (extend the neck); trapezius, splenius capitis and erector spinae (extend the head and the neck); rectus capitis posterior major and minor, and superior oblique (extend the head on the neck).

Neck Rotation

Major Muscles: Semispinalis cervicis, multifidus, scalenus anterior and splenius cervicis (rotate the neck); splenius capitis and SCM (rotate the head and the neck); inferior oblique and rectus capitis posterior major (rotate the head on the neck).

Deep back and neck muscles.

1. *Semispinalis capitis*
2. *Splenius capitis*
3. *Semispinalis cervicis*
4. *Levator scapulae*
5. *Rhomboid minor*
6. *Rhomboid major*
7. *Spinalis*
8. *Longissimus thoracis*
9. *Splenius cervicis*
10. *Iliocostalis thoracis*
11. *Latissimus dorsi*



Neck Extensors and Rotators – Treatment

There are two main ways to work this area. Firstly, with the subject in a supine position, support the head with one hand and lock into the extensor muscles with the other hand as the neck is flexed, side flexed or rotated. Systematically release the superficial layers of the whole of the back and side of the neck; often, only minimal movement is required for an effective result. Congestion frequently occurs between the trapezius and the SCM, within the splenius muscles and levator scapulae. These muscles may be reached by locking in deep to the lateral border of the SCM as the neck is side flexed to the opposite side, or as the subject is instructed to flex the head.

Active STR to the splenius capitis.

The upper fibres of the trapezius can be addressed using an index finger reinforced with the middle finger as the neck is flexed or side flexed to the opposite side. The deeper extensors can be engaged as the chin is tucked in for a stretch.

Use a CTM lock to engage the suboccipital muscles as the subject is instructed to tuck the chin in.

Active STR to the neck extensors.

Active STR to the suboccipital muscles.

Secondly, in a seated position the subject can perform a variety of movements of side flexion, flexion and rotation as the therapist provides a specific lock. This is a highly effective way of introducing functional awareness as the subject is guided into a stretch.

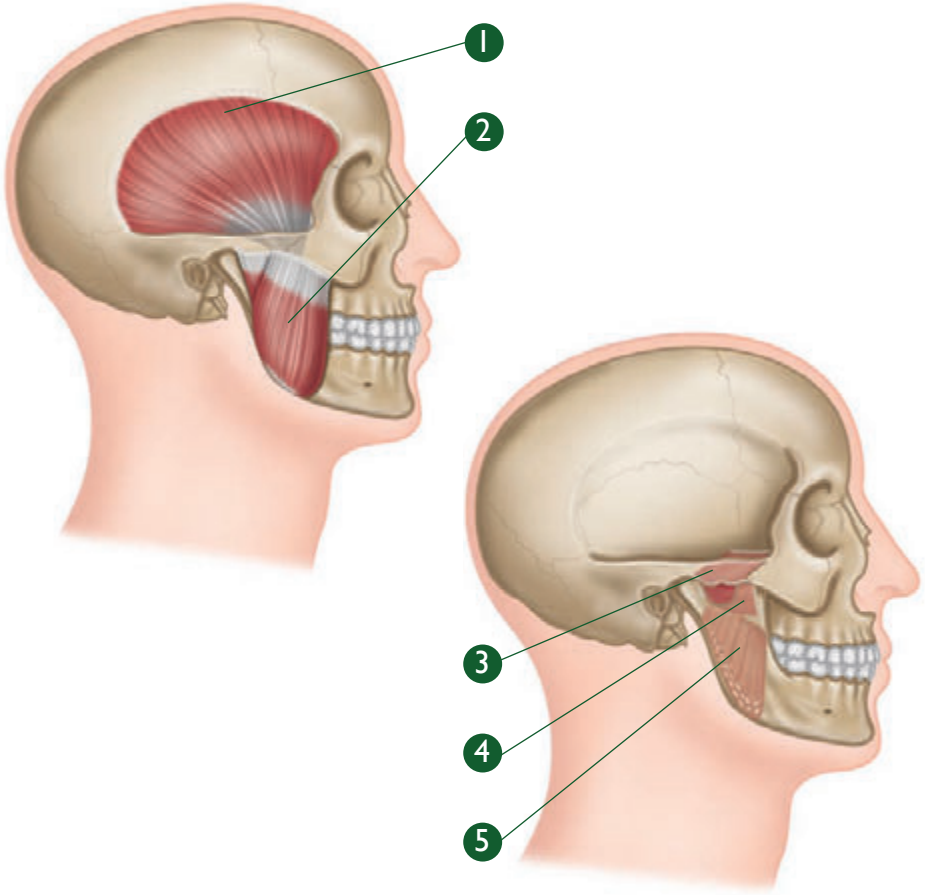
STR to the upper fibres of the trapezius.

STR to the upper fibres of the trapezius using the elbow.

It is important to achieve the pressure gently and precisely or movement will be difficult. The trapezius and levator scapulae can be treated highly effectively this way. The insertion point of the levator scapulae can be targeted by curling under the anterior fibres of the trapezius, towards the medial border of the scapula; the subject can then side flex and flex the neck.

Temporomandibular Joint (TMJ)

There are three main muscles associated with this joint: the temporalis, masseter and pterygoids. Problems present as a general aching in the area, restricted or asymmetrical movement, and clicking. Dysfunction can occur due to trauma, for example a whiplash injury or a direct blow in a contact sport. Tissue congestion can develop from a jaw fracture or loss of teeth, or after major dental surgery during which the mouth has been forced open for long periods. Chewing on one side of the mouth or clenching the teeth may cause an overuse injury to develop, which can lead to pain and headaches.



Temporomandibular joint.

1. *Temporalis*
2. *Masseter*
3. *Lateral pterygoid (superior head)*
4. *Lateral pterygoid (inferior head)*
5. *Medial pterygoid*

TMJ – Treatment

With problems in this area it may be necessary to seek specialist advice, particularly from a dentist, who will check the bite. STR treatment should initially consist of a general treatment to the neck. STR to the muscles which move the joint will help reduce pain and contribute to the re-education of faulty movement patterns;

often a dentist will suggest a set of exercises, such as placing the tongue on the upper palate as the mandible is opened.

Apply a CTM lock to the temporalis and ask the subject to open the mouth.

Active STR to the temporalis.

Then apply a lock to the masseter and again ask the subject to open the mouth. Reinforce the index finger with the middle finger to work more deeply and close to the TMJ to target the pterygoids. Both sides can be treated at the same time initially; observe carefully how wide the mouth opens and note any deviation while palpating the tissues. For more specific STR, perform the lock to one side at a time but avoid over-treating.

Part 5
Upper Limb

THE SHOULDER GIRDLE

The scapula is embedded in strong muscles that attach it to the thorax, thoracic spine, neck and head; its only bony connection is to the sternum via the clavicle. This arrangement allows the shoulder girdle to stabilise shoulder movement and facilitate considerable shoulder mobility.

Muscular imbalance may occur in this area, causing postural problems, impaired shoulder movement and pain. Dysfunction in one part of a single muscle, for example an overuse injury to the upper trapezius, can alter the balance of the girdle as a whole. Severe shortening and tension in the upper fibres raise the shoulder girdle, so the lower fibres opposing this movement lengthen and become inhibited. A common trunk defect occurring here is thoracic kyphosis. In this condition, the shoulder girdle protractors tend towards hypertonicity as activities draw the shoulders forwards; the girdle retractors and trunk extensors become inhibited. Many activities encourage the development of this position, for example working at a computer. Straight-back conditions arise, as an erect posture is forced; in this case, it is the retractors and back extensors that become tight and the protractors that become inhibited.

The sternoclavicular and, more frequently, the acromioclavicular joints can be injured traumatically, particularly in falls. Injury here can lead to future problems with hypermobility, instability and loss of strength. STR around these joints can break adhesive tissue and contribute to healing, reducing the development of chronic weakness. Maintenance work around the joints to minimise the possibility of an individual developing degenerative conditions from overuse is advantageous for anyone involved in throwing or heavy lifting.

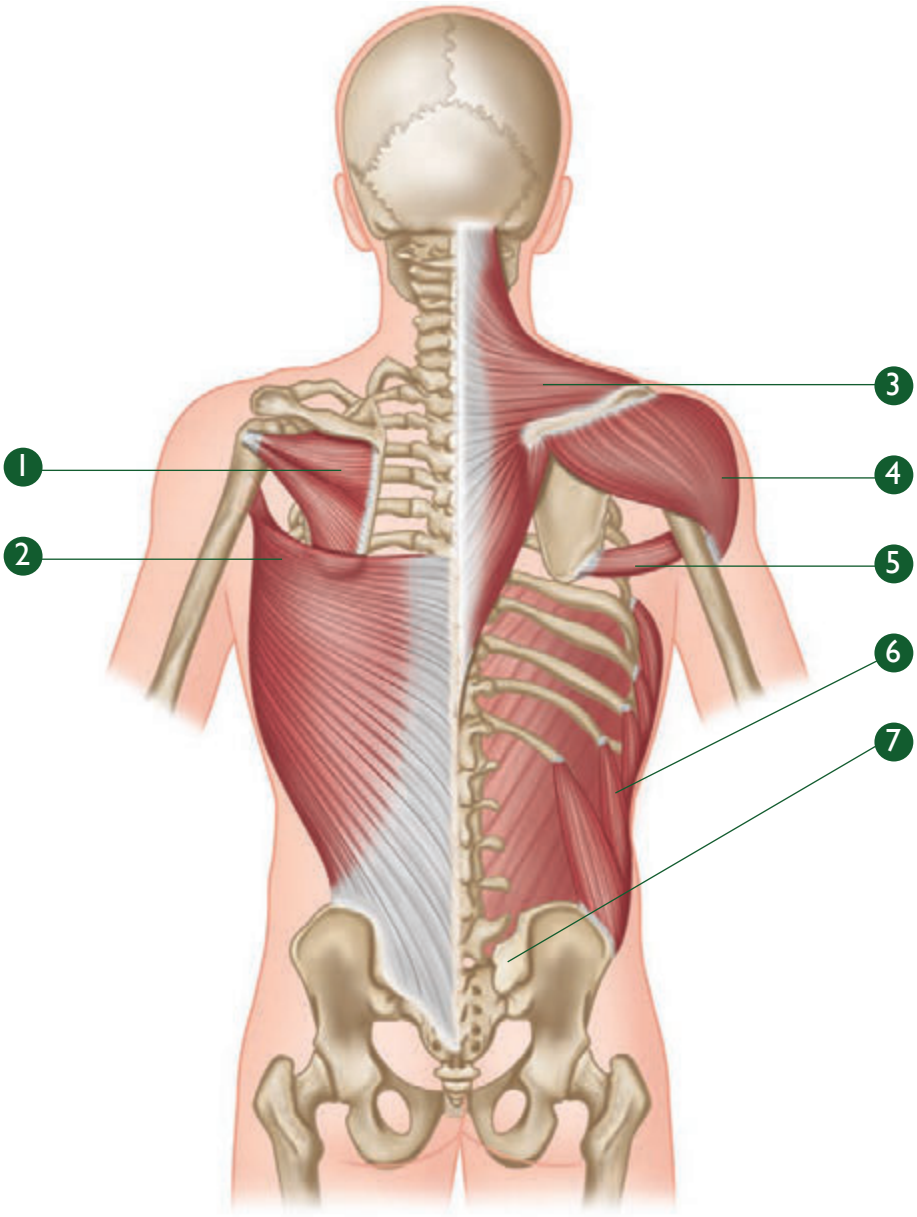
Shoulder Retraction

Major Muscles: Rhomboid major, rhomboid minor and trapezius (middle fibres).

The rhomboids and the trapezius work together to produce retraction. The trapezius also assists in lateral rotation of the scapulae, and the rhomboids in medial rotation. Both muscles are important in stabilising the scapulae during shoulder abduction and adduction. The trapezius has many functions and therefore plays a crucial role in the overall action of the upper limb.

Superficial back and shoulder muscles.

1. *Infraspinatus*
2. *Latissimus dorsi*
3. *Trapezius*
4. *Posterior deltoid*
5. *Teres major*
6. *External oblique*
7. *Posterior superior iliac spine*



Shoulder Retractors – Treatment

With the subject in a prone position, apply pressure, working from the lower to the middle fibres. Lock at points away from the vertebrae, and locate points away from the outer edges of the muscle and its insertion points on the spine of the scapula. Instruct the subject to push the shoulder into the table to produce protraction. As the trapezius is softened, progress to the rhomboids. Provided that there is sufficient flexibility in the muscles and range of movement in the shoulder joint, support the anterior shoulder and move it into medial rotation, placing the subject's arm behind the back. This draws the scapula up so that the rhomboid attachments can be easily located along the vertical border.

Active STR to the rhomboids.

Pressure near to the vertebral attachments must also be administered. After each new lock has been applied, the subject actively protracts by pushing the shoulder into the supporting hand.

The rhomboids and trapezius can be targeted effectively from a seated position using passive or active STR.

STR to the middle fibres of the trapezius.

Shoulder Elevation

Major Muscles: Trapezius (upper fibres) and levator scapulae.

As well as facilitating elevation, the levator scapulae works with the trapezius to produce neck extension when both sides contract. When one side contracts, side flexion occurs. The levator scapulae also assists in medially rotating the scapula.

Shoulder Elevators – Treatment

With the subject in a prone position, support the anterior shoulder under one hand and hook over and into the upper fibres of the trapezius with the other; maintain the lock and depress the shoulder with the supporting hand.

Passive STR to upper fibres of the trapezius.

Passive STR to upper fibres of the trapezius.

Working from the head, the trapezius fibres can be targeted as the therapist cups the shoulder with the other hand and pushes it down into depression.

The levator scapulae may be treated in a similar way; the insertion can be located at the superior angle of the scapula by directing the pressure under the upper trapezius fibres. It may prove easier for the subject to actively depress the shoulder so that the lock can be

maintained; lock in with a reinforced thumb and ask the subject to slide the hand down the side of the leg. This will generally cause considerable release in the area.

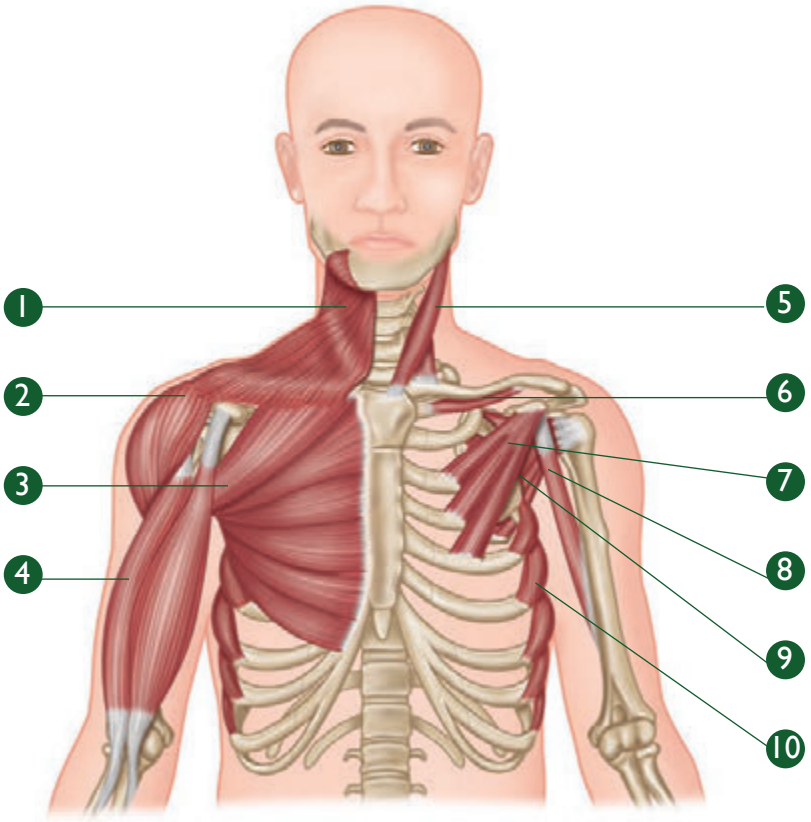
Shoulder Depression

Major Muscles: Subclavius, pectoralis major, pectoralis minor and trapezius (lower fibres).

The subclavius prevents elevation and protraction of the shoulder girdle.

Shoulder Protraction

Major Muscles: Serratus anterior and pectoralis minor.



Chest and anterior shoulder muscles.

1. *Platysma*
2. *Anterior deltoid*
3. *Pectoralis major*
4. *Biceps brachii*
5. *Sternocleidomastoid*
6. *Subclavius*
7. *Pectoralis minor*
8. *Coracobrachialis*
9. *Subscapularis*
10. *Serratus anterior*

The serratus anterior is a girdle protractor and is therefore highly developed in athletes such as boxers and throwers, for whom punching and throwing require a powerful forward movement of the scapula. The muscle also plays an important role, along with the rhomboids and the middle fibres of the trapezius, in stabilising the scapula against the thorax during arm movements. It assists the trapezius in lateral rotation of the scapula. Weakness or inhibition of this muscle can cause medial winging of the scapula. The serratus anterior requires particular attention following shoulder dislocation, as it is susceptible to loss of strength.

The pectoralis minor assists the serratus anterior in protraction, and also raises the ribs to assist in forced inspiration.

Shoulder Protractors – Treatment

STR to the serratus anterior is most easily administered with the subject in a side-lying position. The muscle may be targeted using fingers to lock in across the muscle, so as to avoid crushing tissue between the ribs. Gently pull the arm back to extend the shoulder and produce retraction of the shoulder girdle; alternatively, lock in and instruct the subject to perform active retraction.

Passive STR to the serratus anterior.

Passive STR to the serratus anterior.

Active STR to the serratus anterior.

Prior to addressing the pectoralis minor, ensure that the pectoralis major muscle has been released. Use fingers or a reinforced phalange to target the pectoralis minor away from the coracoid process; instruct the subject to retract the scapula into the couch.

With the subject in a supine position, the pectoralis minor can be reached specifically by abducting the arm to 90 degrees and

gently delving under the pectoralis major, towards the coracoid process and the origin of the muscle. Once reached, the depth should be maintained while the subject raises the arm to draw the scapula upwards.

Active STR to the pectoralis minor.

Alternatively, a retraction movement can be achieved by the subject pushing the posterior shoulder or arm down into the table. Either way, the pressure needs to be released promptly, as it can be uncomfortable.

Shoulder Girdle in Side-lying and Seated Positions – Treatment

With the subject in a side-lying position and the shoulder medially rotated, secure the anterior shoulder and use both your hands to move the scapula. It is important not to force

this position if the subject has any restriction; treatment should continue by allowing the arm to relax in front. Once in position, focused locks and small precise active movements of retraction, protraction, elevation and depression, together with appropriate locks, may be highly effective in freeing the girdle as a whole. Scapula movement, or lack thereof, can be accurately assessed in this position, so treatment can have rapid results.

With the subject seated, active STR can be easily administered to the trapezius and rhomboids as the subject protracts by pushing the shoulder forwards. A resistance can be supplied here to enhance the release. The lower fibres can be located as the subject elevates the girdle by shrugging the shoulders. Very dynamic active STR can be conducted using broad active arm movements to produce the required shoulder girdle action.

THE SHOULDER

The structure of the shoulder joint allows an excellent range of movement; however, because of this, it lacks passive stability and has to rely heavily on the strength of its surrounding muscles. Any muscular dysfunction, therefore, will affect the strength of the joint itself. Following injury, STR involving all movements is necessary so that an imbalance or restriction does not affect shoulder mobility and strength.

Shoulder Flexion

Major Muscles: Pectoralis major (clavicular fibres), anterior deltoid, long head of biceps brachii, and coracobrachialis.

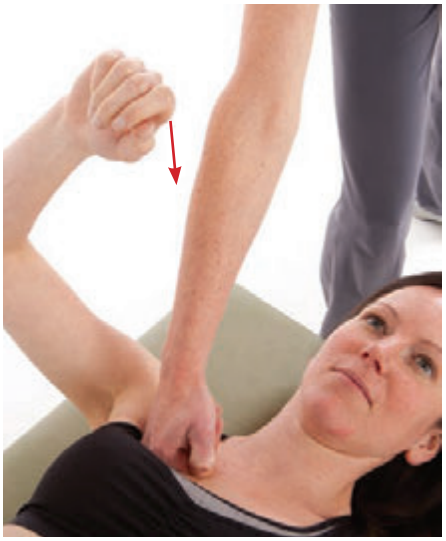
The pectoralis major works in conjunction with the anterior deltoid and the protractors by moving the arm forwards in pushing, punching and throwing movements. It is also strong in adduction, particularly in the horizontal plane.

Shoulder Flexors – Treatment

In a supine position, secure the subject's arm by grasping the elbow, to ensure relaxation. Treat the pectoralis major by locking in at points off the sternum and the clavicle, and conduct

combination movements of shoulder extension, abduction and lateral rotation to produce a stretch; alternatively, instruct the subject to perform a stretch for active STR.

Active STR to the pectoralis major – lock with a soft fist as the shoulder is abducted (horizontal plane, extended and laterally rotated).



Treat the whole muscle in this way, applying the pressure slowly in this sensitive area; towards the insertion points, be sure to angle the lock carefully. Take hold of the subject's hand and move the shoulder into lateral rotation: this is a highly effective stretch that also works well for the anterior deltoid.

Passive STR – lock and medially rotate the shoulder.

The long head of the biceps and the coracobrachialis can be treated by first shortening the muscle and locking in, and then extending the shoulder. Precise locks delving between seemingly stringy tendons will provide a noticeable release in this sensitive area.

Shoulder Extension

Major Muscles: Latissimus dorsi, teres major, posterior deltoid and long head of triceps brachii.

Shoulder Adduction

Major Muscles: Latissimus dorsi, teres major, pectoralis major and coracobrachialis.

The latissimus dorsi is the widest muscle of the back and is a powerful adductor and extensor of the shoulder. With the arms fixed above the head, it draws the body up, together with the pectoralis major, for example in the performance of chin-ups and dips, in the down stroke of the front crawl swimming cycle and in climbing. Strains can occur at the tendon insertion, where tiny STR stretching movements incorporating rotation are beneficial. The teres major, often termed the 'little helper' to the latissimus dorsi, assists the shoulder adduction muscles but is only effective if the scapula is fixed by the rhomboids. Three of the muscles are important for shoulder stability: the teres major helps to stabilise the humeral head in the glenoid cavity; the latissimus dorsi can influence the movement of the scapula; and the pectoralis major keeps the arm attached to the trunk.

Shoulder Extensors and Adductors – Treatment

With the subject prone, lock at points along the latissimus dorsi up to its insertion at the humerus. For the teres major, treat from the origin at the inferior angle of the scapula, and apply pressure at points along the muscle to its insertion point. Each time, lock and take the shoulder into abduction. This can also be done in a side-lying position, in which it is easier to instruct the subject to perform active and resisted movements (see page 31). If the therapist hooks under the latissimus dorsi, away from the serratus anterior, an active flexion movement will provide a significant stretch to the muscle and fascia. The posterior deltoid and long head of the triceps brachii can also be treated with flexion movements.

Shoulder Abduction

Major Muscles: Medial deltoid and supraspinatus.

Any movement of the humerus in the scapula will involve the deltoids. The supraspinatus assists the medial deltoid in shoulder abduction.

Shoulder Abductors – Treatment

Good results can be obtained with the subject seated upright. For the anterior deltoid, the lock is enforced while the shoulder is actively extended; for the posterior deltoid, it is enforced while the shoulder is flexed. The medial fibres can be shortened slightly and locked into as the arm is adducted, but this is difficult, particularly when the deltoids are strong. Alternatively, these muscles may be treated with the subject side lying. Lock into the anterior fibres of the deltoid and instruct the subject to extend or laterally rotate the shoulder. Lock into the lateral fibres and ask the subject to flex or medially rotate the shoulder.

Active STR to the posterior fibres of the deltoid.

To treat the medial fibres of the deltoid, first abduct the shoulder, then lock in away from the acromion; either adduct the shoulder yourself or ask for active adduction into your supporting hand.

Passive STR to the middle fibres of the deltoid.

Active STR to the medial fibres of the deltoid.

Alternatively, lock in without shortening the muscle first and ask the subject to push down (adduct); this will provide a subtle STR effect.

For treatment of the supraspinatus, position the subject prone with the shoulder slightly abducted. Prior to administering STR to this muscle, ensure that the upper trapezius has been sufficiently relaxed; then apply a deep pressure into the supraspinatus by hooking your fingers into the fossa area as the subject slowly adducts the shoulder.

Active STR to the supraspinatus.

Follow this by applying CTM locks at points away from the spine of the scapula, superior to it, each time guiding the subject into shoulder adduction.

Lateral Rotation of the Shoulder

Major Muscles: Teres minor, infraspinatus and posterior deltoid.

Medial Rotation of the Shoulder

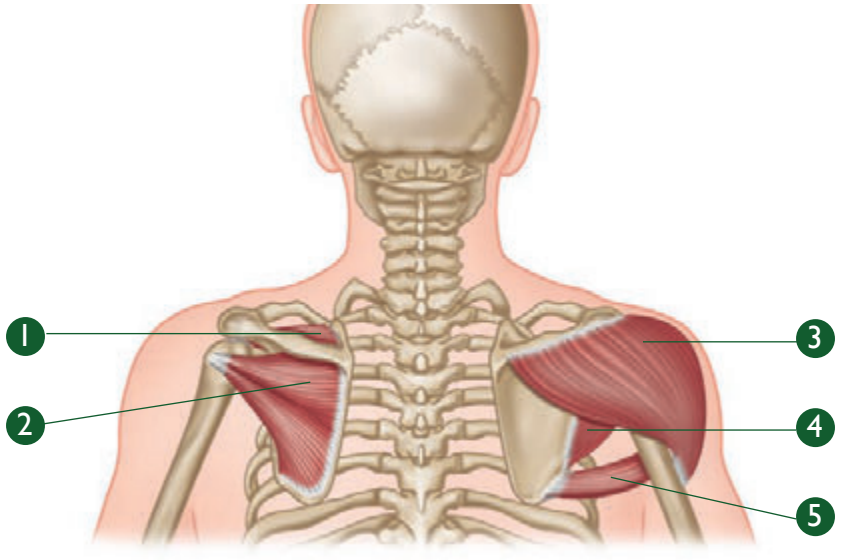
Major Muscles: Subscapularis, teres major, latissimus dorsi, pectoralis major and anterior deltoid.

Rotator Cuff Muscles

The Muscles: Subscapularis, supraspinatus, infraspinatus and teres minor.

The rotator cuff muscles are essential for keeping the head of the humerus in the glenoid fossa during shoulder movement. They also inhibit upward displacement of the head when the biceps, triceps and deltoids are active. These muscles are vulnerable to overuse and traumatic injury. Loss of a particular rotation is a common symptom in shoulder pain.

As the rotator cuff works collectively, work is necessary on all of these muscles, as well as other muscles involved in rotation, such as the pectoralis major and the latissimus dorsi, to encourage rebalance. To test for medial rotation, ask the subject to put the dorsal hand on the small of the back; to test for lateral rotation, ask the subject to put the palmar hand on the back of the head.



Posterior shoulder muscles.

1. *Supraspinatus*
2. *Infraspinatus*
3. *Posterior deltoid*
4. *Teres minor*
5. *Teres major*

Shoulder Problems

With any dysfunction or reduced range of movement of the shoulder, it is imperative to address the shoulder girdle musculature, but in particular the serratus anterior, pectoralis minor and upper fibres of the trapezius towards the acromion. Muscle imbalance in the shoulder girdle and subsequent faulty movement of the scapula are at the root of many overuse restrictions which develop in the shoulder joint. For example, shortened hypertonic serratus anterior and pectoralis minor will draw the scapula forwards and upwards, thus impeding abduction of the shoulder.

Impingement syndrome refers to the pain and pressure exerted on the rotator cuff tendons, positioned under the coracoacromial arch, during shoulder elevation. The impingement can be caused by overcrowding of the subacromial space and by weakness and imbalance of the rotator cuff. STR applied to the shoulder girdle and rotator cuff muscles is extremely beneficial in the early stages of this condition, but it is essential that the underlying causes, such as incorrect muscle balance, posture and technique, are addressed.

Careful treatment of the muscles will alleviate tendinitis. The supraspinatus tendon (supraspinatus tendinitis) and the long head of the biceps tendon are the most commonly affected tendons in shoulder overuse conditions.

'Frozen shoulder', or adhesive capsulitis, is where the joint capsule adheres to itself, commonly on the underside of the capsule, limiting abduction and rotation. It is generally considered to be a self-limiting condition which eventually resolves in around eighteen months. Addressing the rotator cuff muscles, in particular the subscapularis, can have a positive effect on this very painful condition. As controlled movement is a positive step for all healing, gentle STR can work well in alleviating discomfort and speeding up the healing process.

Rotator Cuff – Treatment

With the subject in a prone position, apply CTM locks at points on the scapula, the infraspinatus and teres minor, and perform passive STR by slowly taking the shoulder into medial rotation. Once the area is warmed up, guide the subject into active medial rotation of the shoulder.

Active STR to infraspinatus.

Prior to treating the supraspinatus, it is necessary to first release the upper fibres of the trapezius. Stand at the side of the couch and use fingers, reinforced as necessary, to slowly hook into the supraspinatus fossa, tweezing through the trapezius fibres; instruct the subject to adduct the shoulder.

Active STR to the supraspinatus.

The musculotendinous junction can be treated with the arm supported and abducted to 90 degrees. The actual insertion can be easily located by medially rotating the arm to bring the attachment point to a more forward and superficial position. With the arm abducted, and additionally with the arm medially rotated, it is possible to lock as the subject produces a movement; resisted STR may prove useful.

The subscapularis is best treated with the subject in a supine position and the arm abducted to 90 degrees. Lock onto the anterior surface of the scapula and guide the subject into lateral rotation of the shoulder.

STR to the subscapularis.

Treatment to the rotator cuff muscles can be very sensitive for the subject, so each point should not be laboured: rather, the whole area should be covered slowly and systematically. Active STR is extremely useful as re-education is occurring; moreover it ensures movement within the subject's comfortable range and not beyond.

THE ELBOW

Joint stability at the elbow is predominantly provided by the collateral ligaments and musculature around the elbow. The neck should be considered during treatment of any overuse injury to the elbow. Inflammation of the lateral and medial elbow is related to the muscles that produce wrist movements. Common overuse problems originate in faulty techniques, and repetitive gripping and extension of the elbow such as occurs in racquet sports.

Elbow Flexion

Major Muscles: Biceps brachii, brachialis, brachioradialis and pronator teres.

The brachialis is the primary elbow flexor and controls the movement during extension. It has the capacity to develop myositis ossificans, so extreme care should be taken following a direct trauma. The biceps brachii is a strong supinator as well as an elbow flexor, and these actions are often performed together. The muscle also contributes to shoulder flexion and stability of the shoulder joint, with its long head being more prone to injury. The brachioradialis as a flexor works strongly when the elbow is midway between pronation and supination.

Elbow Extension

Major Muscles: Triceps brachii and anconeus.

The triceps is the only muscle on the posterior of the upper arm. Because the triceps works strongly in fast elbow extension movements, it is exercised in any pushing movements, for example dips and push-ups. Punching or throwing can stress the attachments. Actual strains are rare, but bad technique can cause pain and tearing, particularly at the musculotendinous junction. The anconeus controls extension movements.

Pronation of the Forearm

Major Muscles: Pronator teres, pronator quadratus and brachioradialis.

The pronator teres works strongly alongside the flexors during pronation and flexion movements, such as in the grip in horse riding. The pronator quadratus is stronger if the pronation is conducted with elbow extension.

Supination of the Forearm

Major Muscles: Biceps brachii, supinator and brachioradialis.

The biceps brachii is the strongest muscle in supination. The supinator is exercised most strongly if combined with elbow extension, and has sufficient strength for slow movements with minimal resistance.

Elbow – Treatment

With the subject supine and the elbow flexed, gently grasp either side of the belly of the biceps. Extend and pronate to stretch.

Passive STR to the biceps brachii.

Passive STR to the biceps brachii.

Treat the whole muscle, paying particular attention to the origins and carefully angling the locks because of the sensitivity of the area. Treat the lateral side, and direct the lock under the biceps to work the brachialis. With the shoulder fully flexed beside the subject's ear, lock into points along the triceps and flex the elbow. Pay close attention to the tendon attachments. The supinators and pronators in the forearm can be worked effectively by incorporating combination movements of supination or pronation with flexion and extension of the wrist, to separate the muscles of the forearm.

Active STR to the triceps brachii.

THE WRIST

As with the ankle, there is a band of connective tissue that supports the many tendons which attach across the wrist joint. The space created underneath the flexor retinaculum is known as the carpal tunnel. The flexor pollicis longus, flexor digitorum profundus and flexor digitorum superficialis, as well as the median nerve, all pass through this tunnel. The posterior retinaculum holds the tendons of the extensor muscles in place.

Carpal tunnel syndrome is a result of congestion in the tunnel. Any repetitive actions involving the flexors, such as gripping, can cause inflammation in the tendons. If numbness and tingling are present then the median nerve is also affected. STR is effective for separating the tendons and the adhesions between them and the retinaculum. Frequently this condition can be successfully corrected by surgery, but the use of STR at an early stage can make an operation unnecessary.

Repetitive strain injury (RSI) occurs with overuse, leading to adherence and inflammation of the tendons in the posterior compartment. Activities such as typing or playing the piano repetitively, or racquet sports where the extensors contract eccentrically to brace and control the force during backhand shots, can all cause degrees of RSI.

Wrist sprains are common in contact sports, and STR is a good form of early treatment to ensure good strength gains. With any wrist problem, a systematic treatment of the whole forearm and hand is necessary. Abduction, adduction, flexion and extension need to be considered. At the wrist, STR can separate adherence between the individual tendons and the retinaculum.

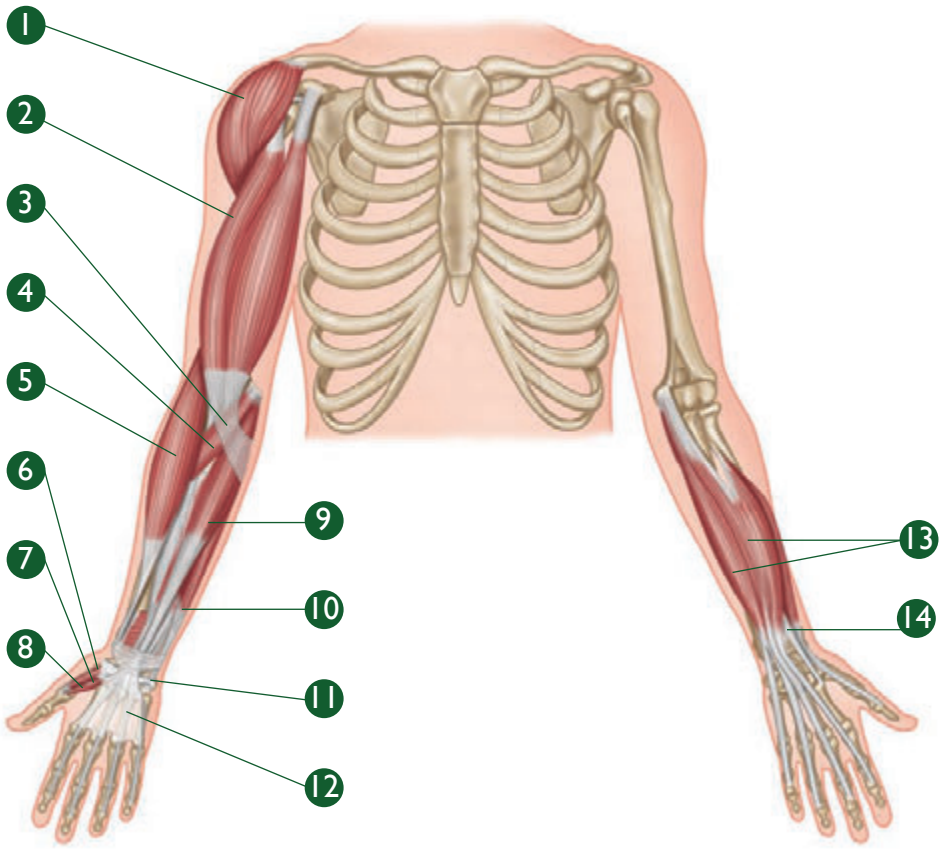
Wrist Extension

Major Muscles: Extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi ulnaris, extensor digitorum communis, extensor indicis, extensor digiti minimi, extensor pollicis longus and extensor pollicis brevis.

Pain located at the lateral elbow is often classified under the umbrella term of 'tennis elbow' ('lateral epicondylitis'). The term refers to an overuse injury, common in racquet sports and manual labour, that leads to chronic inflammation of the common extensor origin (CEO), resulting in fibrous tissue in the tendon or musculotendinous junction, or at the tenoperiosteal junction. In conjunction with RICE and stretching, STR is an invaluable tool in the management of tennis elbow. A general treatment to the forearm should be conducted prior to focusing specifically on the adhesive tissue.

Wrist Flexion

Major Muscles: Flexor carpi ulnaris, flexor carpi radialis, palmaris longus, flexor digitorum superficialis, flexor digitorum profundus and flexor pollicis longus.



Anterior arm superficial muscles.

1. *Anterior deltoid*
2. *Biceps brachii*
3. *Bicipital aponeurosis*
4. *Pronator teres*
5. *Brachioradialis*
6. * *Abductor pollicis brevis*
7. * *Opponens pollicis*
8. * *Flexor pollicis brevis*
9. *Palmaris longus*
10. *Flexor carpi ulnaris*
11. *Flexor retinaculum*
12. *Palmar aponeurosis*
13. *Flexor digitorum superficialis*
14. *Flexor carpi radialis*

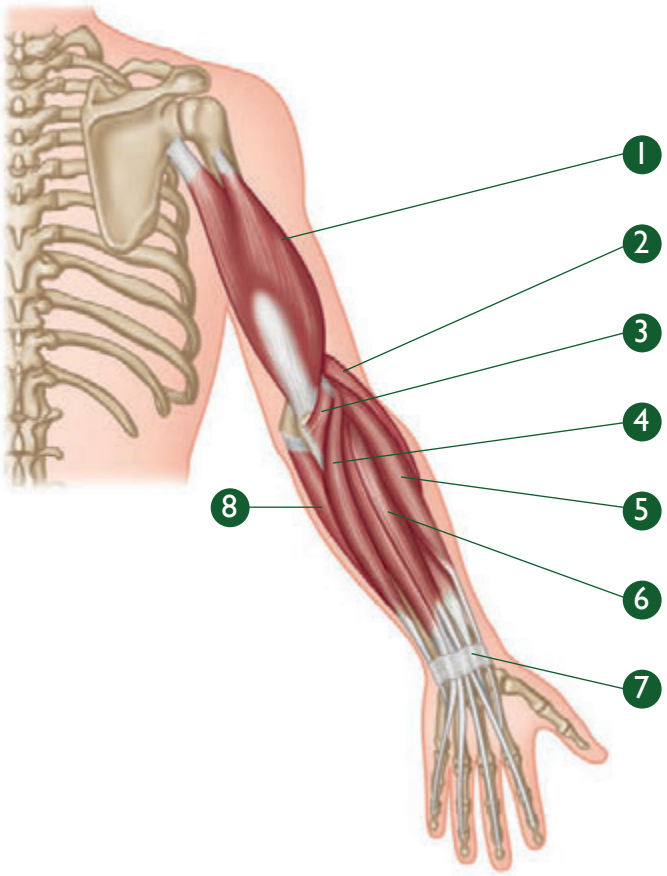
* *Thenar eminence*

Pain located at the medial elbow, where inflammation develops at the common flexor origin (CFO), is generally known as 'golfer's

elbow' ('medial epicondylitis'). It is less common than lateral elbow pain and usually responds to treatment faster.

Wrist Abduction

Major Muscles: Flexor carpi radialis, extensor carpi radialis longus, extensor carpi radialis brevis, abductor pollicis longus and extensor pollicis brevis (jointly produce wrist abduction [radial deviation]).



Posterior arm superficial muscles.

1. *Triceps brachii*
2. *Brachioradialis*
3. *Anconeus*
4. *Extensor carpi ulnaris*
5. *Extensor carpi radialis longus*
6. *Extensor digitorum*
7. *Extensor retinaculum*
8. *Flexor carpi ulnaris*

Wrist Adduction

Major Muscles: Flexor carpi ulnaris and extensor carpi ulnaris (work together in wrist adduction [ulnar deviation]).

Wrist – Treatment

With the subject in a supine position, apply STR to the extensors from the wrist to the elbow by locking in and flexing the wrist. Concentrate on locking between the extensor muscles to stretch the fascia where congestion and adherence are often present.

If there is any form of 'tennis elbow', progress to the CEO and apply a CTM lock as the subject flexes the wrist. Locate points at the back of the wrist, separating the extensor tendons from the retinaculum. Avoid irritating any areas of inflammation, concentrating instead on releasing the congestion around them.

Active STR to the common extensor tendon.

Treat the flexors in the same manner, but lock and extend the wrist to release the tension. Applying pressure between the flexor tendons at the wrist will relieve carpal tunnel syndrome; this release may be enhanced by incorporating either abduction or adduction following the wrist flexion.

Active STR to the common flexor tendon.

THE HAND

The thenar eminence is formed by the flexor pollicis brevis, the abductor pollicis brevis and the opponens pollicis. The hypothenar eminence is formed by the flexor digiti minimi, the abductor digiti minimi and the opponens digiti minimi. The 'anatomical snuffbox' is a depression in the dorsum of the first metacarpal, with the extensor pollicis brevis forming its lateral border and the extensor pollicis longus forming its medial border. De Quervain's syndrome is the name given to tenovaginitis or tenosynovitis affecting the extensor pollicis brevis and the abductor pollicis longus.

Finger Flexion

Major Muscles: Flexor digitorum superficialis, flexor digitorum profundus, lumbricals, interossei and flexor digiti minimi brevis.

Finger Extension

Major Muscles: Extensor digitorum communis, extensor digiti minimi, extensor indicis, interossei and lumbricals.

Thumb Flexion

Major Muscles: Flexor pollicis longus, opponens pollicis and flexor pollicis brevis.

Thumb Extension

Major Muscles: Extensor pollicis longus, extensor pollicis brevis and abductor pollicis longus.

Thumb Abduction

Major Muscles: Abductor pollicis longus and abductor pollicis brevis.

Thumb Adduction

Major Muscle: Adductor pollicis.

Opposing Thumb

Major Muscles: Opponens pollicis and flexor pollicis brevis.

Flexion of Metacarpophalangeal Joints with Simultaneous Extension of Interphalangeal Joints

Major Muscles: Lumbricals and interossei.

Finger Abduction

Major Muscles: Dorsal interossei, abductor digiti minimi and abductor pollicis brevis.

Finger Adduction

Major Muscles: Palmar interossei and adductor pollicis.

Opposing Fingers

Major Muscle: Opponens digiti minimi.

The Hand – Treatment

Sprained fingers and thumbs are typical injuries in ball sports and gymnastics. STR will speed up the healing process and recovery. To address the thenar eminence, lock into it and instruct the subject to straighten the thumb in all directions. For the hypothenar eminence, lock and straighten the little finger. Treat the extensors over the top of the hand by locking across and in between them, and flexing the metacarpals; the finger extensors should be considered in conjunction with the forearm extensors, and the palmar hand together with the wrist flexors.

Active STR at the thenar eminence.

Part 6

Pre- and Post-event Treatment

Event Massage

Event massage means treating an athlete with a particular performance in mind. It can both enhance performance and speed up the recovery processes afterwards. Its benefits have become widely recognised to the point that sports massage therapy is provided alongside other treatments such as physiotherapy at most major events involving strenuous physical activity; these include not only sporting events, but dance and movement. Most professional sporting bodies employ massage therapists, and many elite sports people have their own therapists to travel with them to competitions. Recognition of the value of skilled massage treatment has also infiltrated at club level sports and amateur dance. Overall the demand for sports massage therapy at events has increased enormously in recent years.

Pre-event Massage

Pre-event massage may be conducted a few days before an event; general massage before an event will ensure that the body is functioning freely and that the athlete maintains the physical condition which is essential for 'peaking' at the all-important time. Sometimes a particular area is causing concern and the therapist can use STR to pinpoint and concentrate on this area. Deep, preventative massage can be conducted up to about two days before an event, according to client preference; a much more considered approach must be taken closer to the event, because any structural re-organisation, autonomic responses or minor tissue soreness following treatment, might negatively affect performance.

Many sports people in the competitive arena would prefer not to have treatment very close to the beginning of their events if they find that the therapy involved is not conducive to the mental

state required for optimum performance. This may be the case, for example, if they find treatment very relaxing at a time when they are trying to develop a mood of aggression to aid maximum performance. Evidence also suggests that muscle power may be inhibited by traditional massage techniques, such as effleurage, pre-event. There are, of course, no hard and fast rules for this, as each individual is different. Obviously it is better if the athlete and therapist have already worked together so that the therapist understands the mental outlook and individual preferences of the athlete, as well as the physical aspects involved. The two can then work towards the actual event in a partnership based on mutual understanding and trust. If you do not know the person well, you must be aware that psychological as well as physical preparation is important, and accept the athlete's preference about how soon before an event the treatment should be given.

Pre-warm-up Massage

It is becoming increasingly common for pre-event massage to take place at the sports venue prior to performance, but in this case its exact nature will vary widely according to the subject. An experienced athlete who has trained for an event invariably knows exactly how they need to feel, physically and mentally, to perform well. However, this feeling will vary, not only because of individual character differences but also because of the differing demands of various events. Some require the athlete to be keyed up like a coiled spring ready to leap into action; this may be the case prior to explosive-type events such as weightlifting. Others, such as archery or shooting, require a relaxed and calm approach. Thus, some athletes may choose not to have treatment immediately prior to warming up, while others might be keen to have it. The type of treatment will therefore depend on both individual preference and the nature of the event.

Massage After Warm-up or as Part of the Warm-up

Given the constraints and drawbacks of conventional massage immediately prior to an athletic performance, STR has several advantages to offer. For one thing, it can be done actively. Most competitions require a high degree of physical activity, in which case warm-up procedures involve a progression to

dynamic movement. Whereas a relaxing massage using deep, slow effleurage and kneading could be mentally inappropriate and might physically make an athlete feel lethargic, weak or too relaxed, STR can be done very dynamically. The therapist can use active functional work while the athlete performs the required movements; this participation gives the feeling of control that is so important in preparation and warm-up, and avoids the disadvantage of a massage being too mentally relaxing. It empowers the athlete, as it uses movements within the functional range that is generally included in the routine dynamic preparation.

Another advantage of STR treatment at an actual competition event, where there may be minimal facilities, is its versatility. It is so easy to improvise with STR and give useful treatment without a couch. Treatment can quite easily be carried out sitting, kneeling, or on the ground and this informality mixes well with the mounting excitement that is part of working and competing at an event. STR can be conducted, for example on the calves, with the athlete standing and weight bearing. It can also be administered through clothes without using oil or lotion; this has obvious benefits, particularly in cold weather when no shelter is available.

Yet another advantage of STR in a pre-event situation is its economy of time. In team sports it would be impossible to give everyone in the squad a general pre-event massage if you were the only therapist. By using STR, attention can be given to all team members, if necessary, as key areas can be treated quickly and precisely without any time wastage.

Lastly, prior to competition, many sports people would not want oil or lotion on their skin, and STR is a useful technique for warming up or releasing the soft tissues without the application of a lubricant; in racquet sports and kayaking, for example, a good grip is essential, so having residual lotion on the hands would be detrimental to these activities.

Pre-event Massage and Injury

Sometimes an athlete may suffer from a minor injury and be faced with the difficult decision of whether or not to compete

or perform. For someone at the pinnacle of a career, it can be devastating to miss an important event because of a minor injury. Often the decision is made to compete anyway, even if this means aggravating the injury or giving a disappointing performance.

The final decision lies ultimately with the physiotherapist, the coach, the athlete and maybe even the doctor. Once the decision has been made to go ahead, STR may have an important role to play alongside other interventions, such as taping. The aim of the treatment is not to cure but to enable the athlete to perform more comfortably with reduced risk of worsening the injury. The therapist must help the athlete to manage and alleviate the symptoms. Exactly which treatment is given will depend on how imminent the event is. Complete healing needs time, as it involves biological processes. In many cases the body can react to initial treatment negatively, as the breakage of scarring and the separation of adhesions can leave residual discomfort or inflammation. By definition, time is exactly what is not available in a pre-event treatment.

If treatment for an injury is administered prior to an event, it should be made clear to the athlete that the treatment is not a cure but only an interim measure to help alleviate symptoms. A controlled approach, rather than a treatment approach, is therefore adopted.

As an example, consider a middle-distance runner competing at a top-level competition. The athlete is expected to reach the final, but a painful condition presents itself, suggesting possible medial tibial stress syndrome. The cure for this condition could involve a course of treatment and exercises aimed at the deep posterior compartment; each of these treatments could leave the athlete feeling initially sore and unable to run well. In this case, as an interim measure, careful use of STR could relieve some of the pressure from the tibia and its inflammation, thus alleviating the pain, though not actually removing the cause. In conjunction with periodic icing, gentle treatment to the whole lower leg around the adhesive tissue would ensure maximal release and minimal aggravation, which will give the athlete a chance of running as well as possible. More work should be conducted in and after the

cool-down, and the athlete should be made aware of what needs to be done for an actual cure in the long term.

In brief, pre-event massage for injury involves a management approach: it should be non-invasive and non-aggravating, with the aim of decongesting and aiding movement and function where possible. It can be used in conjunction with specialised taping such as unloading techniques which are designed to compress and protect fibres from overuse. The subject must understand the limitations of what is being done.

Post-event Massage

The main objectives of post-event massage are to speed up the subject's recovery and to ensure maximum return to full function. It should not be seen as an alternative to cool-down procedures, although post-event massage will be a good substitute if an athlete is so exhausted or injured that cool-down exercise is impossible; this is because massage gently stretches the tissues, and, like a cool-down, removes waste products from the muscles by enhancing circulation.

As well as affording both mental and physical relaxation, post-race massage helps reduce the possibility of injury and enables an athlete to return to training more quickly than would otherwise be the case.

It is important that the subject should understand that post-event massage is not curative. Immediately after an event is not the right time to delve into the tissues; the athlete may be exhausted with micro-traumas and is possibly dehydrated and susceptible to cramp. Instead, muscles need to be gently relieved of their congestion by elongating and stretching fibres. The therapist applies soothing and recuperative massage that makes the muscles pliant and soft. If there is an actual injury, it is better to simply apply ice, leaving specific treatment until after recovery from the event. Use of STR may be minimal or very gentle; effleurage and kneading strokes should dominate the post-event massage. This type of post-event massage is often termed as a 'flush'. If the athlete chooses to have an ice bath to aid recovery, the massage flush should be conducted first.

To cope with post-event massage, as with pre-event massage, improvisation, versatility and expertise are necessary because unpredictable factors invariably arise. For example, weather conditions may bring about additional problems, and time management is almost bound to be difficult; sometimes the therapist may be trying to cope with a queue of cold athletes with very little shelter available. It is all part of the challenge of event massage.

Between-event Massage

Occasionally, a therapist is asked to help someone in a situation that is a combination of post- and pre-event conditions. Examples of this include: between scenes at a dance performance, a decathlon competition, and between an individual race and a team relay. In such cases, a combination of recovery and preparatory techniques is required. Obviously the therapist will need to use judgement and experience to assess physical factors and will also need to be sensitive to the mental state of the subject.

Event massage can be extremely exciting and rewarding; it can also be emotionally draining, as the therapist shares the athlete's hopes, anxieties and anticipations. Ultimately, it is one of the most rewarding aspects of sports massage.

Part 7

STR and the Young Athlete

Observing young children in natural play is fascinating. They unselfconsciously utilise many aspects of fitness and conditioning that promote good overall fitness and balance. This includes producing bursts of effort, jumping over things, climbing in playgrounds and up trees, balancing on logs, skipping and hopping, to name a few. When they fall and hurt themselves, they generally bounce back very quickly and easily because of these preventative and re-educational exercises that they perform without realising their physical value. So, if children are allowed to enjoy themselves by continuing with varied activities, they are unlikely to develop chronic pain patterns. It is not advisable for children to be encouraged into repetitive movements or to be put under too much emotional pressure.

As they become older, children often become involved with formal training and coaching in specific sports or other activities such as dance. This is good for mastering the technical aspects of a particular activity and for developing the specific physical attributes needed to perform the activity well; for example, flexibility is a prerequisite for gymnastics. This early coaching may mean that they will reach high standards in their given sports or activities, or that they reach skill levels that bring them lifelong joy in performing. Good technique also minimises the risk of injury. It is essential, however, that the coach has a good knowledge and understanding of the developing body. Too much force through muscular contraction and impact can have a detrimental effect on the soft tissues and on the growing skeleton. Serious signs of pain must be heeded. Good coaches should also be knowledgeable about when their young athletes are likely to be going through a growth spurt; training should possibly be eased off at this time, and more emphasis placed on co-ordination and recovery. Observing the early signs of growing pains or overtraining, both physically and mentally, will reduce the time needed for total rest.

STR Is a Valuable Technique to Use on Children

1. STR can educate the young person in body awareness. It helps the person to tune in and locate where a restriction may be, and to understand that any pain or tightness experienced may be due to a restriction located more distally. It may also help with the person's skill acquisition and the development of motor co-ordination.

2. STR can provide relief from psychological or emotional stress. This may be due to being anxious over a competition, worrying about exams or being concerned about friendship groups at school. STR can also provide relief from physiological stress, such as a build-up of tension in the neck and shoulders from too much texting or carrying heavy school bags!

3. Caught early, STR can help with 'growing pains'. Sometimes children develop tight muscles from being very active, and certain muscles can just ache, particularly at night; STR can provide fast relief by releasing this tension.

4. With conditions such as Osgood–Schlatter's and Sever's diseases, STR can be used to lengthen and ensure good muscle group separation, thus easing the traction at the tendon attachment. In the case of Osgood–Schlatter's disease, STR is administered to the quadriceps and patellar tendon; for Sever's disease, STR is performed on the gastrocnemius, soleus and Achilles.

Part 8

STR and Pregnancy/ Post-pregnancy

STR can very beneficial for the pregnant woman – the dynamic nature of the technique makes it easy to use in side-lying and seated positions. The changing biomechanics as the baby grows, and adaptation to an altered centre of gravity, mean that the musculature of the mother-to-be will be susceptible to imbalance. This tendency is exacerbated by the soft tissue laxity to allow for childbirth. Labour may also be traumatic, and she is likely to have weakened abdominals following the birth. Liaise with the midwife or doctor on any necessary treatment.

STR Is a Useful Technique Through Pregnancy and Early Parenthood

1. STR can address muscle imbalance and provide re-education in a neutral posture.

2. The common aches and pains of pregnancy, such as in the lower back and lumbosacral junction, can be easily relieved. An extremely useful technique is the 'angry cat' stretch in conjunction with STR (see page 98).

3. STR of the lower back and hips, particularly the adductors and hip flexors, can help SPD.

4. STR can help in restoring muscle balance following labour. It can also help in addressing all the early pains of physically adapting to a newborn baby, such as protracted shoulders from feeding and lifting, and asymmetrical problems from carrying the baby on a preferred hip.

Part 9
STR and the Older Person

As we get older our connective tissues harden: water molecules no longer combine easily with collagen in the connective tissue matrix and it becomes more dehydrated. Old traumas, repetitive strains and the growing number of years of adapting to the postural stresses of life all contribute to the stiffening of the connective tissues.

Aging Athletes

Many active people quite happily reduce their training, certainly the intensity of it, as they acquire more pains and restrictions; they accept the old adage 'I'm getting older and it is to be expected.' However, it should be remembered that movement is an essential component in maintaining the lubrication of the connective tissues. Moreover, micro-tearing and repair is how muscles maintain strength for a particular activity, so movement should not be discontinued. There is research to indicate that the older athlete slows down dramatically mainly because the intensity of training has dropped.

It is therefore advisable to maintain a good level of training, although it may be wise to reduce some of the more vigorous contact sports or activities that involve a lot of impact or twisting and turning. With the older athlete, more emphasis should be placed on recovery, and STR is a valuable tool for enhancing tissue repair. The aging athlete should perhaps consider reducing not so much the intensity of training as the overall amount of training. For example, reduce the number of actual training sessions and allocate more time for rest and recovery; this may include stretching and subtle strengthening such as appropriate exercises in Pilates.

STR and General Aging Problems

Many movement restrictions accepted as 'old age' can be alleviated. A common age-related symptom that an older person may notice is a difficulty in turning the head without rotating the trunk; this can become apparent, for instance, when reversing the car. This restriction is usually of gradual onset and is commonly linked to shortening of the shoulder girdle protractors and neck flexors, following a lifetime of sitting for long periods with the shoulders and head protracted. Treatment with STR to the shortened muscles, along with re-education in postural awareness, can significantly improve the range of movement and reduce any associated pain; if caught early, degenerative changes in the neck can be minimised.

Many older people suffer with osteoarthritis, which is inflammation of the joints, caused by wearing away of the articular cartilage. It is worsened by excessive wear, previous injury and muscle imbalance. There is also a hereditary link, so some people may be more predisposed to developing the condition.

Movement and addressing muscle imbalance can prove invaluable in reducing joint pain. Movement encourages the secretion of synovial fluid. Addressing restrictions in the soft tissues that act on a joint will help restore improved movement, which will in turn help with secretion of synovial fluid – a cycle which will keep the cartilage nourished.

Often someone develops osteoarthritis because of a long-term imbalance around a joint. A common example is at the knee, where the quadriceps, primarily the rectus femoris, can become chronically shortened, a condition exacerbated by a sedentary lifestyle. Shortened quadriceps restrict knee flexion, and over a prolonged period of time this altered biomechanics will cause uneven pressure and wear on the joint surface at the knee, leading to inflammatory changes. If caught early, and the tension in the quadriceps is released, future pain from osteoarthritis can be minimised. If detected later, there is much anecdotal evidence to support treatment of the quadriceps prior to surgery, to enhance recovery following a knee replacement.

STR and Osteoarthritis

1. Do treat all associated muscles that affect movement of the joint; in particular release hypertonic tissue.

2. During an acute phase, avoid treating the inflamed area at the joint itself.

3. Do treat around the joint after a period of inflammation, to release any scar tissue, adhesion and thickened connective tissue.

Part 10
Self-treatment

Correct use of self-treatment will aid in recovering from the stress of intense training or a tough day at the office! Often a therapist may not be available, or the lack of time and/or money makes it impossible to have regular treatment. Frequent short sessions of self-treatment can make a huge difference in minimising the risk of injury by easing muscle tension and releasing tissue restrictions.

STR is easier to administer on yourself than many other massage techniques because the muscles do not have to be totally relaxed for treatment to take place. Moreover, because much of the technique is active, all the subject has to do is locate the problem area and move into a stretch. The dynamic nature of STR makes it simple to perform on yourself.

In fact, the treatment is almost instinctive. Someone with a stiff neck may clutch at the upper trapezius and move the head from side to side or shrug the shoulder. A little guidance would actually make this reaction quite effective for relieving the adherence and hypertonicity. Use of a massage tool, such as a thera cane (like a shepherd's crook), can make the self-treatment easier: hook the thera cane over the shoulder to target the area between the scapulae as you protract the shoulder girdle.

Self-treatment is also a must for any therapist who is at risk of developing overuse injuries in the elbows, wrists and thumbs. These areas are not difficult to reach, so maintenance should be easy!

The following figures show a few examples of self-treatment, but they are by no means exhaustive.

Rest the hamstrings on up turned fingers to maintain a deep lock as the knee is extended.

Use fingers to drop in off the clavicle into pectoralis major or lock deeper into pectoralis minor as the shoulder is horizontally abducted.

Use fingers to hook into the middle fibres of the trapezius and the rhomboids as the shoulder girdle is protracted.

Hook into the upper fibres of the trapezius as the neck is side flexed.

Use knuckles to lock into the erector spinae as the spine is flexed.

Appendix I
Anatomical Movements

Flexion	Reduction in joint angle during movement.
Extension	Increase in joint angle during movement.
Abduction	Movement away from the midline of the body.
Adduction	Movement towards the midline of the body.
Medial Rotation	Rotation around a longitudinal axis towards the midline of the body.
Lateral Rotation	Rotation around a longitudinal axis away from the midline of the body.
Circumduction	Combination of flexion, extension, abduction, adduction, and medial and lateral rotation.
Elevation	Movement upwards.
Depression	Movement downwards.
Retraction	Movement of the scapulae backwards towards the midline of the body.
Protraction	Movement of the scapulae or the head forwards.
Lateral Rotation of the Scapula	Movement of the inferior angle of the scapula laterally as the acromion moves into elevation.
Medial Rotation of the Scapula	Return of the inferior angle medially as the acromion moves into depression.
Supination	Movement of the palm to face upwards.
Pronation	Movement of the palm to face downwards.
Plantar Flexion	Movement of the sole of the foot downwards.
Dorsiflexion	Movement of the top of the foot towards the anterior of the tibia.
Eversion	Turning of the sole outwards so that the weight is on the inside edge of the foot.
Inversion	Turning of the sole inwards so that the weight is on the outside edge of the foot.
Toe Flexion	Movement of the toes downwards.
Toe Extension	Movement of the toes upwards.

Appendix 2
Common Postural Deficiencies

SIDE VIEW

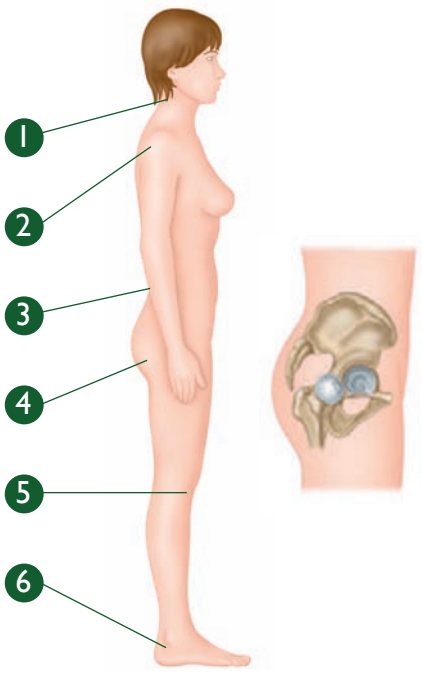
Head Position	Excessive inward curve (convex) of the cervical spine, or poking the chin forwards.
Thoracic Kyphosis	Exaggerated concave curve of the thoracic spine.
Straight Back	Reduction in the concave curve of the thoracic spine.
Lumbar Lordosis	Exaggerated convex curve of the lumbar spine.
Flat Back	Reduction in the convex curve of the lumbar spine.
Pelvic Position	Anterior or posterior tilt of the pelvis.
Sway Back	Forward position of the pelvis, in either a neutral or a posteriorly tilted position, in relation to the back and legs.
Genu Recurvatum	Sway-back knees.
Pes Planus and Pes Cavus	Flat foot and high arch.

POSTERIOR VIEW

Head Position	Head turned to one side.
Scoliosis	Lateral deviation or curve of the spine.
Scapulae Positions	Level of inferior angles of scapulae. Level of acromion processes. Scapulae winging.
PSIS Positions	Level of posterior superior iliac spines.
Genu Valgum Varum and Genu	Knock-knee and bow-leg.
Foot Position	Excessive eversion (pronation) of the mid-foot, calcaneal eversion or inversion.

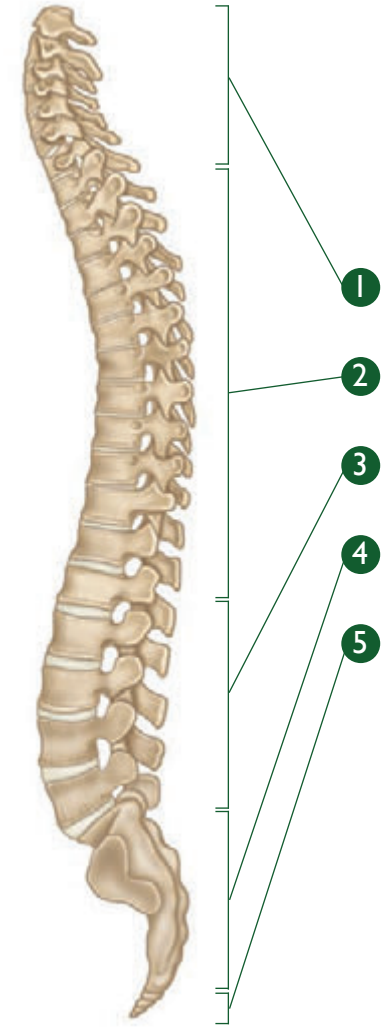
Postural balance.

1. *Neck*
2. *Shoulder girdle*
3. *Lumbar*
4. *Pelvis*
5. *Knees*
6. *Feet*



The spine.

1. *Cervical curve*
2. *Thoracic curve*
3. *Lumbar curve*
4. *Sacral curve*
5. *Coccyx*



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