MAXIMISING YOUR GLUTEUS – PART 2

Many athletes and patients attend the clinic every day with pain somewhere in their body. The question the therapist needs to ask is, 'Can the gluteal muscles be partly or wholly responsible for the pain that the patient is presenting with?' If the answer is yes, then we need to know why this muscle group, out of all the other muscles we have in the body, might be the key to the problem.

This article is split into two parts. Part 1, presented in January's issue, discussed the functional anatomy of the gluteus maximus and described how to identify if weakness or misfiring of the muscles is responsible for the athletes problems. Part 2, presented here, discusses how to correct the misfiring and to re-educate the firing of the Gmax by looking specifically at the antagonistic muscles that become adaptively shortened. Once this process is understood I will then explain and demonstrate using advanced soft-tissue techniques that I use to help correct the malalignment of the pelvis and lumbar spine through the treatment of the soft tissues.

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Let's recap for a moment and think back to Part 1 of this article, where I suggested that the physical therapist should ask themselves if the patient's pain is purely a 'symptom' or whether it is the actual 'cause', before rushing in to treat the area of pain.

Remember Dr Ida Rolf (founder of the technique 'Rolfing') who stated 'where the pain is the problem is not', in my experience this is more often or not true. Think back to Part 1: an athlete can present with any of the following symptoms:

- Tight/painful hamstrings or lumbar erector muscles
- Insufficient forward or upward power production from the legs
- Pelvic position dropped when running
- Tight/painful adductor magnus (inner thigh)
- Asymmetrical body orientation
- Better balance one side than the other
- Excessively tight latissimus dorsi on the contra-lateral side to the weak, misfiring Gmax.

A likely cause for the athlete's symptoms, as previously discussed, could well be gluteus maximus (Gmax) weakness or delayed timing due to the misfiring sequence.

This article will focus on 'maximising' the 'gluteus' through a treatment perspective using muscle energy techniques (METs) to lengthen the shortened and tight antagonistic muscles that are potentially causing the weakness inhibition to the gluteus.

Hopefully after reading Part 1 you will have a better understanding of the role of the Gmax in terms of its function and the effect it potentially has on all areas of the body if the Gmax is found to be weak or misfiring. In Part 1, I looked specifically at a case study of a 24-year-old elite rower, focusing on his weak and misfiring Gmax. Now, we will look at how to correct the misfiring and to re-educate the firing of the Gmax by looking specifically at the antagonistic muscles that become adaptively shortened. Once this process is understood, the advanced soft-tissue techniques that were used to correct the mal-alignment of the pelvis and lumbar spine will be explained and demonstrated.

WHAT ARE MUSCLE ENERGY TECHNIQUES?

METs are an additional tool for the physical therapist's manual-therapy toolbox: this advanced soft-tissue technique can help to release and relax muscles, and also stimulate the body's own healing mechanisms. METs are unique in their application, as the patient provides the initial effort while the physical therapist facilitates the

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> "A TIGHT MUSCLE WILL PULL THE JOINT INTO A DYSFUNCTIONAL POSITION AND THE WEAK MUSCLE WILL ALLOW THIS TO HAPPEN"

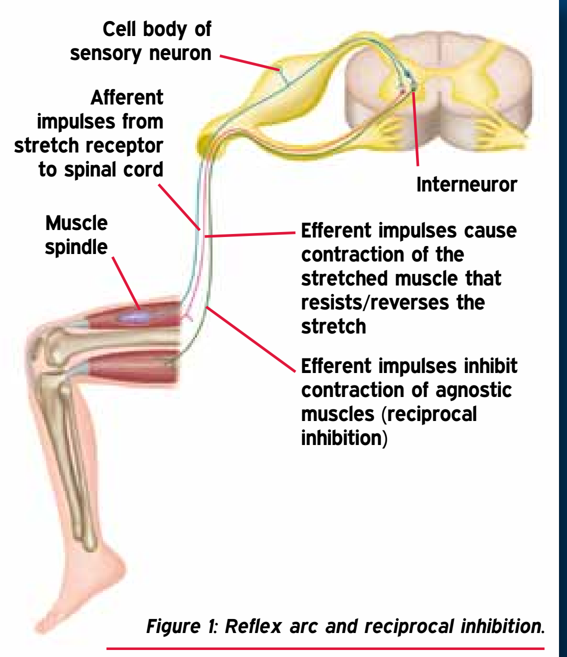


Figure 1: Reflex arc and reciprocal inhibition.

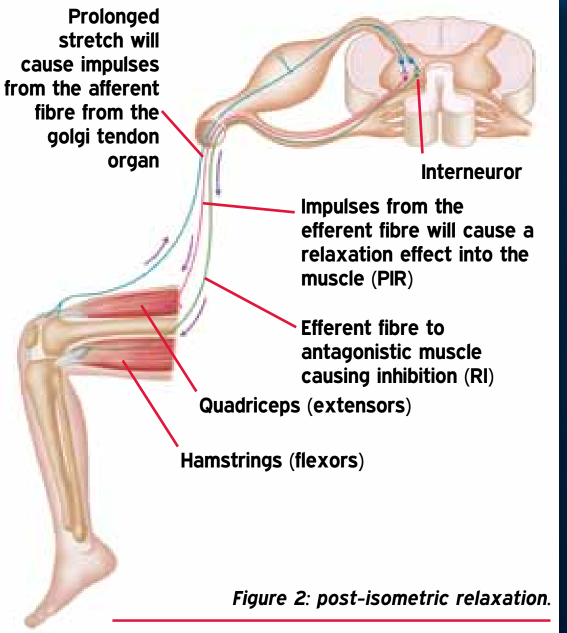


Figure 2: post-isometric relaxation.

process. The primary force originates from the contraction of soft tissue; this force is then used to assist and correct the presenting musculoskeletal dysfunction. One of the main uses of these methods is to normalise joint range of motion (ROM), rather than increase flexibility, and METs can be used on any joints with restricted ROM that are identified during the subjective passive assessment.

BENEFITS OF METS

Restoring normal tone in hypertonic (short/tight) muscles

Physical therapists regularly use METs to try to help relax the hypertonic shortened muscles. If a joint has limited ROM, then, through the initial identification of the hypertonic structures, appropriate techniques can assist in reaching normality in the tissues. METs applied in conjunction with massage therapy can be very beneficial in helping to achieve this relaxation effect.

Strengthening weak muscles

METs can be used to help strengthen weak, or even flaccid, muscles: the client is advised to contract the muscle classified as weak against a resistance applied by the therapist (isometric contraction). Timing of techniques can be varied: for example, the patient resists the movement to approximately 20–30% of their capability for 5 to 10 seconds, rests for 10 to 15 seconds, and then repeats the process five to eight times. This can be improved over time.

Preparing muscle for subsequent stretching

In some circumstances, the sport in which a client participates may affect joint ROM. Most people can benefit from improved flexibility, and, although the focus of METs is to reach normal ROM, a more intensive MET approach can be employed to improve flexibility beyond this. The procedure might involve the client contracting beyond the standard 10–20% of the muscle's capability. Once METs have been incorporated into the treatment plan, a flexibility programme could follow.

Improved joint mobility

One of my favourite sayings when I teach muscle testing courses is: 'A stiff joint can cause a tight muscle and a tight muscle can cause a stiff joint'. Does this not make perfect sense? When used correctly, METs can improve joint mobility even when the muscles are relaxing initially. A relaxation period follows the muscle contraction, which then helps to achieve the new ROM.

PHYSIOLOGICAL EXPLANATIONS FOR THE EFFECTS OF METS

Two distinct physiological processes can explain the main effects of METs; these are post-isometric relaxation (PIR) and reciprocal inhibition (RI). Certain neurological influences occur during METs, but before considering PIR/RI, it is useful to take into account the two types of receptors involved in the 'stretch reflex' (Fig. 1), which are:

- Muscle spindles sensitive to change in length and speed of change in muscle fibres
- Golgi tendon organs that detect prolonged change in tension.

Stretching a muscle causes an increase in the impulses transmitted from the muscle spindles to the posterior horn cell (PHC) of the spinal cord. In turn, the anterior horn cell (AHC) transmits a greater number of motor impulses to the muscle fibres, which creates a protective tension to resist the stretch. However, increased tension maintained for a few seconds is sensed within the Golgi tendon organs, which transmit impulses to the PHC and have an inhibitory effect on the increased motor stimulus at the AHC. This inhibitory effect causes a reduction in motor impulses and consequent relaxation (Fig. 2).

The net effect is that the prolonged muscle stretch will increase overall stretching capability due to the protective relaxation of the Golgi tendon organs overriding the protective contraction. However, a fast stretch of the muscle spindles will cause immediate muscle contraction and – if not sustained – there will be no inhibitory action.

When an isometric-contraction prolonged stretch is sustained, neurological feedback through the spinal cord to the muscle itself results in PIR, causing a reduction in tone of the contracted muscle. This lasts for approximately 20 to 25 seconds, during which the tissues can be more easily manipulated to a new resting length (Fig. 2).

During RI (Fig. 1), the reduction in tone relies on the physiological inhibiting effect on antagonists during the contraction of a muscle. When the motor neurons of the contracting agonist muscle receive excitatory impulses from the afferent pathway, the motor neurons of the opposing antagonist muscle receive inhibitory impulses from their afferent pathway. It follows that contraction or an extended stretch of the agonist muscle must elicit relaxation or inhibit the antagonist, and that a fast stretch of the agonist will facilitate a contraction of the antagonist. The refractory period also lasts for approximately 20 seconds but, with RI, it is thought to be less powerful than PIR. In certain circumstances, use of the agonist may be inappropriate due to pain or injury.

METHOD OF TREATMENT

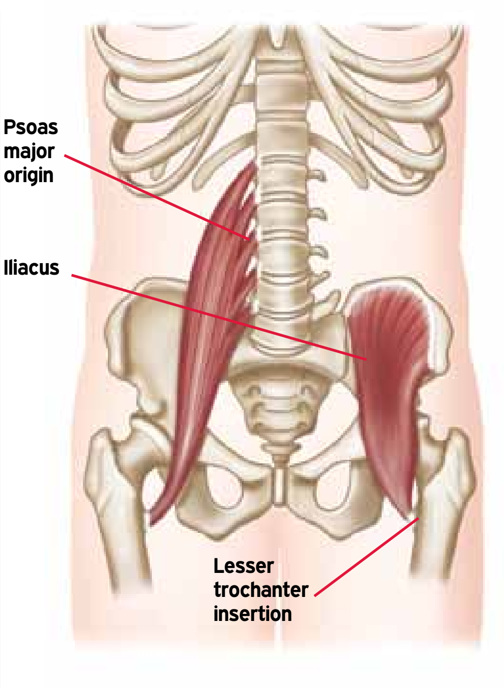
The following list defines the method of treatment:

- The therapist guides the muscle to the point of resistance (point of bind), before releasing slightly from that position (especially if the tissue is tender).
- Against a resistance, the patient isometrically contracts the affected muscle (PIR) or the antagonist (RI) to approximately 10–20% of its strength capabilities.
- The patient holds the contraction for 10 to 12 seconds.
- By taking a deep breath in, the patient relaxes fully and, as they breathe out, the therapist passively guides the specific joint that lengthens the hypertonic muscle into a new position, effectively normalising joint ROM.
- The process is repeated until no further progress is made (normally three to four times), and the final stretch is held for approximately 20 to 30 seconds.

METs are quite a mild form of stretching when compared to other techniques, such as proprioceptive neuromuscular facilitation (PNF); METs are, therefore, more appropriate for rehabilitation. Most conditions involving muscle shortening will occur in postural muscles, since they are composed predominantly of slow-twitch fibres, so a milder form of stretching is perhaps more suitable.

The focus of this article is to identify relative shortness and subsequent tightness patterns within soft-tissue structures, ie. specific muscles that are prone to shortening and becoming tight that can cause a weakness inhibition to the Gmax. Part 1 discussed why the Gmax muscles can become lengthened and weakened, and the answer is not to strengthen the so-called weak Gmax muscle, since encouraging strength-based exercise will not assist these specific muscles in regaining their muscular strength as they are held in a weakened position by the short and tight antagonists. The treatment is to lengthen these tight structures by using specific METs.

As the Gmax is a powerful hip extensor, the antagonistic muscles are the hip flexors – the main muscles



Origin

Psoas major: transverse processes of all lumbar vertebrae (L1-L5). Bodies of twelfth thoracic and all lumbar vertebrae (T12-L5). Intervertebral discs above each lumbar vertebra.

Iliacus: superior two-thirds of iliac fossa. Anterior ligaments of the lumbosacral and sacroiliac joints.

Insertion

Lesser trochanter of femur.

Action

Main flexor of hip joint and assists in lateral rotation of hip. Acting from its insertion, flexes the trunk, as in sitting up from the supine position.

Nerve

Psoas major: ventral rami of lumbar nerves (L1, L2, L3, L4).

Iliacus: femoral nerve (L1, L2, L3, L4).

Figure 3: The psoas and iliacus.

Figure 4: The knee is below the level of the hip, indicating a normal length of the psoas.

Figure 5: A tight right iliopsoas.

> "A STIFF JOINT CAN CAUSE A TIGHT MUSCLE AND A TIGHT MUSCLE CAN CAUSE A STIFF JOINT"

Figure 6: Abduction to indicate tight adductors.

Figure 7: Adduction to indicate tight tensor faciate ligament/iliotibial band.

responsible for hip flexion being the psoas, rectus femoris and adductors. One way of encouraging a correct firing pattern is to identify the length of the hip flexors: if they are tested as short, an MET can be used to assist in normalising the resting length of these shortened structures. This theory of lengthening the shortened structures can be applied for a period of approximately two weeks. If the firing pattern has not improved in this two-week period, strengthening protocols for the Gmax can then be incorporated into the treatment plan.

The following muscles are antagonists to the Gmax and will be discussed in this article (there are other associated muscles, however, they will not be covered here):

- Psoas and Iliacus
- Rectus femoris
- Adductors.

PSOAS AND ILIACUS

The anatomy

The anatomy of the psoas and iliacus is shown in Figure 3.

Assessment of iliopsoas – modified Thomas test

From this modified Thomas position, the therapist looks at where the patient's right knee lies, relative to the right hip. The position of the knee should be just below the level of the hip, which will indicate a normal length of the iliopsoas.

In Figure 5 the therapist is demonstrating with their arms the position of the right hip compared to the right knee. You can see that the hip is held in a flexed position, which confirms the tightness of the right iliopsoas in this case. A tight rectus femoris is also demonstrated here as the lower leg is seen to be held in an extended position. I will cover this muscle later in the article.

Also from the position of the modified Thomas test, the therapist can apply an abduction of the hip, as demonstrated in Figure 6, and an adduction of the hip, as demonstrated in Figure 7. A ROM of 10–15° in both planes is commonly accepted to be normal from the modified Thomas position.

If the hip is restricted in abduction, ie. a bind occurs at an angle less than 10–15°, the muscles of the adductor group are held in a shortened position; if the adduction movement is restricted, the iliotibial band (ITB) and the tensor facia ligament (TFL) are held in a shortened position.

MET treatment of iliopsoas

The patient adopts the same position for the test as described earlier. After placing the patient's foot into their side, the therapist applies a pressure that induces full flexion of

Figure 8: The patient flexes their right hip against the therapist's resistance. The therapist is stabilising the right hip with their right hand.

Figure 9: The therapist passively extends the hip to lengthen the iliopsoas, assisted by gravity.

Figure 10: From the flexed position, the patient is asked to resist hip flexion.

TIP

The psoas major is also known as filet mignon, which is a piece of beef taken from the tenderloin. A bilateral shortness of the psoas can cause the pelvis to anteriorly tilt and cause the lumbar spine to adopt a position of hyperlordosis. This can cause compression of the facet joints and the patient will present with lower back pain.

the patient's left hip. Stabilising the patient's right hip with their right hand, the therapist puts their left hand just above the patient's right knee. The patient is asked to flex their hip against a resistance for 10 seconds, as shown in Figure 8.

After the isometric contraction and on the relaxation phase, the therapist slowly applies a downward pressure. This will cause the hip to passively go into extension and will cause a lengthening of the right psoas, as shown in Figure 9. Gravity will also play a part in this technique, as it will assist the lengthening of the iliopsoas.

An alternative way of contracting the iliopsoas is possible from the flexed position shown in Figure 10. This is normally used if the original way of activating the iliopsoas causes discomfort to the patient. Allowing the hip to be in a more flexed position will slacken the iliopsoas – this will assist in its contraction and help reduce the discomfort.

The patient is asked to flex their hip against a resistance applied by the therapist's left hand, as shown in Figure 10. After a 10-second contraction, on the relaxation phase the therapist lengthens the iliopsoas by taking the hip into an extended position, as demonstrated in Figure 9.

Note

If full sit-ups are performed on a regular basis, the psoas muscle is predominantly used. Repeated sit-ups will make the psoas stronger and tighter, and result in weakness of the abdominals; this can maintain a patient's lower back pain as discussed in Part 1.

To prove the involvement of the psoas, have your patient lie on their back with their knees bent. Hold the patient's ankles and ask them to dorsiflex their ankles while you resist the movement. This will stimulate the anterior chain musculature, including the psoas, which is part of this chain. The patient then performs the sit-up movement (most fit individuals will be able to do many sit-ups).

To deactivate or switch off the psoas, we ask the patient to plantar flex their ankles (instead of dorsiflexing them), or to squeeze their gluteals. Either of these actions stimulates the posterior chain musculature, causing the psoas to switch off, as activation of the gluteal muscles results in a relaxation of the psoas through reciprocal inhibition. When the patient is now asked to perform the sit-up, the movement will prove to be impossible, confirming that the psoas is generally the prime mover in a full sit-up.

RECTUS FEMORIS

The anatomy

The anatomy of the rectus femoris is shown in Figure 11.

Origin

Straight head (anterior head): Anterior inferior iliac spine. Reflected head (posterior head): Groove above acetabulum (on ilium).

Insertion

Patella, then via patellar ligament to tuberosity of tibia.

Action

Extends the knee joint and flexes the hip joint (particularly in combination movements, such as in kicking a ball). Assists iliopsoas in flexing the trunk on the thigh. Prevents flexion at knee joint as heel strikes the ground during walking.

Nerve

Femoral nerve (L2, L3, L4).

Figure 11: Rectus femoris.

Assessment of rectus femoris – modified Thomas test

Figure 12: The knee is held in extension, indicating a tight rectus femoris.

This test is an excellent way of identifying shortness not only in the rectus femoris but also in the iliopsoas as described earlier. The patient adopts the position demonstrated in Figure 12, where they are holding onto their left leg initially, as the right rectus femoris will be tested first.

In Figure 12, the therapist demonstrates the position of the right knee compared to the right ankle. Here, the lower leg is seen to be held in an extended position, which confirms the tightness of the right rectus femoris.

In Figure 12, you will also notice that the hip is held in a flexed position. This indicates a tightness of the iliopsoas and has already been discussed.

MET treatment of rectus femoris

The patient is asked to adopt a prone position, and the therapist passively flexes the patient's right knee until a bind is felt. At the same time, the therapist stabilises the sacrum with their right hand, which will prevent the pelvis from rotating anteriorly and stressing the lower lumbar spine facet joints (Fig. 13).

Note

If you consider the patient to have an increased lumbar lordosis, a pillow can be placed under their stomach (Fig. 13). This will help flatten the lordosis and can help reduce any potential

Figure 13: The patient extends their knee while the therapist stabilises the lumbar spine.

Figure 14: Lengthening of the right rectus femoris.

Figure 15: The therapist palpates the rectus femoris, and the patient is asked to extend their knee.

Figure 16: The therapist passively flexes the knee to lengthen the rectus femoris.

discomfort that they might experience.

From the position of bind, the patient is asked to extend their knee against a resistance applied by the therapist as seen in Figure 13. After a 10 second-contraction, on the relaxation phase the therapist encourages the knee into further flexion, which will lengthen the rectus femoris (Fig. 14).

Alternative MET treatment of rectus femoris based on the modified Thomas test

Some patients may find that the previous MET for the rectus femoris puts a strain on their lower back. An alternative and possibly a more effective MET for the rectus femoris is based on the modified Thomas test position.

The patient adopts the position of the modified Thomas test as described earlier. The therapist controls the position of the patient's right thigh and passively flexes their right knee, slowly, towards their bottom (Fig. 15). There will be a bind very soon from this position, so take extra care when you are performing this technique for the first time.

From the position of bind, the patient is asked to extend the knee against a resistance applied by the therapist as seen in Figure 15. After the 10-second contraction, on the relaxation phase the therapist passively takes the knee into further flexion (Fig. 16). This is a very effective way of lengthening a tight rectus femoris.

TIP

Bilateral hypertonicity of the rectus femoris will cause the pelvis to adopt an anterior tilt, resulting in lower back pain due to the fifth lumbar vertebra facet joints being forced into a lordotic position.

ADDUCTORS

The anatomy

The anatomy of the adductors is shown in Figure 17.

Assessment of adductors – hip abduction test

The patient adopts a supine position on the couch. The therapist takes hold of the patient's left leg and passively abducts the hip while palpating the adductors with their right hand (Fig. 18). When they feel a bind, the position is noted; the normal ROM for passive abduction is 45°. If the range is less than this, a tight adductor group is indicated.

However, there is an exception to the rule. If the ROM is less than 45°, it could be that the medial hamstrings are restricting the movement of passive abduction. To differentiate between the short adductors and the medial hamstrings, the knee is flexed to 90° (Fig. 19); if the range now increases, this indicates shortness in the medial hamstrings.

So to recap, to identify if the hamstrings are the restrictive factor, the therapist passively flexes the knee and then continues with the passive abduction, as shown in Figure 20. If the range of motion improves, the hamstrings are the restrictive tissues and not the short adductors.

Note

The term short adductors refer to all of the adductor muscles that attach to the femur, the exception being the gracilis. This muscle attaches to a point below the knee, on the pes anserinus area of the medial knee, and acts on the knee as well as the hip.

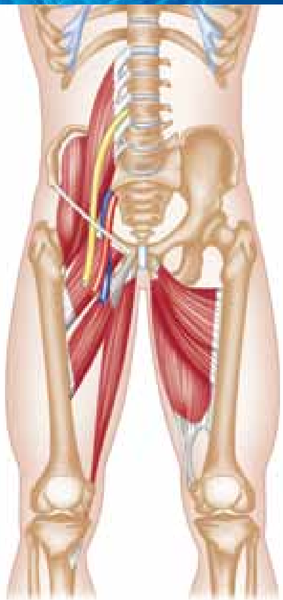
MET treatment of adductors

One of the most effective ways of lengthening the adductors (short) is to use an MET from the position that is demonstrated in Figure 20. The patient adopts a supine position with knees bent and heels together; slowly, the hips are passively taken into abduction by the therapist until a bind is felt in the adductors.

From the position of bind, the patient is asked to adduct their hips against resistance applied by the therapist, to contract the short adductors as seen in Figure 20. After a 10-second contraction, on the relaxation phase the hips are then passively taken into further abduction by the control of the therapist.

CASE STUDY CONCLUSION

If you remember from the case study in part 1, the athlete demonstrated some of the exercises he was doing in his strength training programme. His



Origin
Anterior part of pubic bone (ramus). Adductor magnus also has its origin on the ischial tuberosity.

Insertion
Whole length of medial side of femur, from hip to knee.

Action
Adduct and medially rotate hip joint.

Nerve
Magnus: Obturator nerve (L2, L3, L4). Sciatic nerve (L4, L5, S1). *Brevis*: Obturator nerve (L2, L3, L4). *Longus*: Obturator nerve (L2, L3, L4).

Figure 17: Adductors.

Figure 18: The therapist abducts and palpates the adductors for bind.

TIP

Overactivity of the adductors will result in a weakness inhibition of the abductors, in particular the gluteus medius (Gmed). This weakness can result in what is known as a 'Trendelenburg' pattern of gait.

Figure 19: The knee is bent to isolate the short adductors.

Figure 20: The patient adducts their legs against the therapist's resistance.

knees medially deviated on a squat and a lunge and he looked generally unstable throughout the movement pattern. His Gmax when tested was also found to be misfiring with over activity compensation in his hamstrings and ipsilateral lumbar erectors. This increased compensatory pattern was more than likely to be the culprit of his presenting symptoms.

I treated the patient with two sessions a week of physical therapy focusing on lengthening the shortened tight muscles of the psoas, rectus femoris, adductors with METs, and I also focused on treating the lumbar spine erector muscles with specific soft-tissue techniques (massage) work to help release and relax these shortened tissues. I also advised the practice of some basic stretching of the shortened muscles on a daily basis.

After two weeks I decided to reassess the hip extension firing pattern and the length of the shortened muscles. I was very happy to find that the Gmax was showing signs of switching back on in the correct order as explained in Part 1. It was not yet a perfect firing system but I was pleased that there was an initial improvement in his firing sequence and that the hamstrings were not as active as previously tested.

The psoas, adductors and rectus femoris also showed improvement in their overall resting length.

The athlete was advised to supplement full abdominal curls with anterior and posterior oblique sling exercises using a pulley system, as these are more functional towards abdominal and outer core stability training.

After 4 weeks the patient, when reassessed, had a normal hip extension firing pattern and improved length of the muscles, but as there was still room for improvement he was advised to maintain the lengthening exercises

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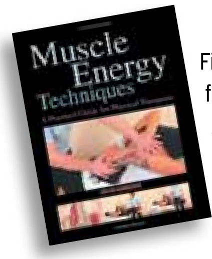
as shown. His squat and lunge had better control with no knee deviation.

Once these musculoskeletal mechanisms have been implemented he was then recommended to add Gmax exercises into his weekly training programme, as the Gmax and Gmed work synergistically together as a team.

I still see Mr Fit on a regular basis but this time when we do meet up, it is for a social event rather than him popping in to my clinic for a treatment. . .



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He has written many articles on various aspects of physical therapy, which have been published through many international publications. John has also written the highly successful book called '*Muscle Energy Techniques, a practical guide for physical therapists*'.

He is in the process of writing his second book, which is due for publication in early 2013; the book is called '*Maximizing your Gluteus, a practical guide for physical therapists*'.

- Discuss how an athlete can present with any of the following symptoms through weakness or misfiring of their glutei:
  - – Tight/painful hamstrings or lumbar erector muscles
  - – Insufficient forward or upward power production from the legs
  - – Pelvic position dropped when running
  - – Tight/painful adductor magnus.
- Discuss the benefits of Muscle Energy Techniques (METs) and explain the difference between PIR and RI.
- Discuss the origin, insertion, action and nerve innervations of the following muscles:
  - – Psoas
  - – Rectus femoris
  - – Tensor fascia latae
  - – Adductor magus
  - – Gluteus maximus
  - – Gluteus medius.