

**A PHYSICAL THERAPY APPROACH  
TO MANAGEMENT OF  
GRADE I, II BICEP FEMORIS INJURY IN ELITE  
ATHLETES.**

**Mr. Gerard Hartmann  
Hartmann International  
Sports Injury Clinic  
University Arena  
University of Limerick  
Limerick  
Ireland**

**email: [admin@hartmann-international.com](mailto:admin@hartmann-international.com)  
Phone: 00 353 61 371255**

**Physical Therapist**

**Olympic Medical Institute, UK: Athletics,  
English Institute of Sport  
Kodac Lecture Theatre  
University of Westminster  
London**

**Thursday 7th. December  
2006.**

OLYMPIC MEDICAL

INSTITUTE



uk:athletics



**"HAMSTRING INJURIES:  
The First 48 Hours for the Elite Athlete"**

**Thursday 7<sup>th</sup> December 2006**

**2pm – 8pm**

(Registration 1 pm with a light lunch)

Kodak Lecture Theatre  
University of Westminster, Harrow Campus,  
Northwick Park, Harrow HA1 3TP

**Confirmed Speakers**

Professor Martin Schwellnus  
*UCT Sport Science Institute, Cape Town, South Africa*

Dr Bruce Hamilton  
*CMO, UKA*

Dr Bryan English  
*CMO, Chelsea FC*

Glen Hunter  
*Physiotherapist*

Gerrard Hartmann  
*Physical Therapist, Ireland*

THIS SEMINAR IS FREE OF CHARGE. PLACES WILL BE ALLOCATED ON A 'FIRST COME FIRST SERVED' BASIS  
CLOSING DATE IS FRIDAY 24<sup>TH</sup> NOVEMBER 2006

*Please email Jabeen Khan at [Jabeen.khan@boa.org.uk](mailto:Jabeen.khan@boa.org.uk) to confirm your attendance.  
Please state any special dietary requirements when booking.  
Further details to follow.*

Thank you for having me here today to expand on my views and treatment protocol for hamstring injury.

A few months ago an old man stopped me as I exited my practice. He said " I see all these foreign athletes visiting you for treatment, let me tell you, you are either doing something very right or you are fooling the bloody lot of them!"

It made me think. The treatment protocol I employed 15 years ago for hamstring strains is alien to how I treat now. At the time it delivered results and was right for that era. What I am practicing presently is working right for this present time but like each one of you here today I am open to new techniques, new methodologies in an attempt to expedite injury time.

There are many ways to skin a cat, or to peel an orange as it were. The same applies to the treatment of the musculoskeletal system. What I have learned over the years is to be open to all techniques, methodologies and treatment types and discern what techniques to employ based on my own individual capabilities, clinical intuition and what works for me.

Is there really a right way? Or are we all just feeling our way?

Irrespective of what treatment protocol is used it is my opinion that one of the most important requisites for healing is a relationship between patient and therapist whereby the patient trusts and has complete confidence in the therapist. This human element cannot be underestimated. Healing takes place the moment the patient fully believes and trusts the practitioner. Doubt creates a blockage in terms of healing at a cellular level. Belief creates a flow of healing. The mind is such a powerful force in terms of healing that while we must never fool a patient we may use persuasiveness as an ingredient in treating injury.

Persuading a patient to carry out 20 minutes of ice treatment regularly in the acute stage, persuading the patient to elevate the leg, to realize the importance of doing everything prescribed in the critical first 48 hour period etc, etc. Once the patient believes they are healing then on a physiological level healing will progress.

Over the past 17 years I have had the opportunity as a Physical Therapist to work with some of the worlds top athletes.

This includes some 53 Olympic medal winners, numerous world champions and world record holders. In fact I have treated Olympic

medal winners in every running and jump event with the exception of the 400 meters hurdles.

Notwithstanding I have treated many top athletes with hamstring injuries.

It goes without saying that the most common injured tendon in the competitive sports person is the Achilles tendon. The most commonly injured muscle is the hamstring group and the Bicep Femoris is the most commonly injured muscle of the hamstrings. It is well documented that muscles that function over two joints are those most commonly strained.

Because the hamstrings are two-jointed muscles, they rely on external fixation (e.g. the ground), co-contraction, or fixation by other muscles to direct their contraction in a useful, coordinated fashion.

Athletes most at risk for bicep femoris muscle strains are speed athletes – track sprinters, hurdlers, long and triple jumpers. Although I have treated many distance runners for hamstring injury, the etiology is usually related to overuse, biomechanical, flexibility and muscle strength imbalances. Hamstring injuries are mainly related to the ballistic action of sprinting, specifically during the late forward swing phase and the take –off phase.

There are two proposals that account for injury. The first is an apparent breakdown in the normal reciprocal action of the quadriceps and hamstring muscle groups. One mechanism involves excessive antagonistic force on a relaxed or lengthened hamstring muscle, which causes overstretching, and injury to the hamstring. The other mechanism is based on a stretch being applied causing the hamstrings to become fully elongated.

The muscle responds to this full rapid stretching with excessive protective contraction, tearing the muscle fibers and intermuscular connective tissues.

Contributory factors include muscle tightness, muscle weakness, power imbalance, overuse, poor conditioning, improper warm up and inadequate healing or inadequate rehabilitation of pre-existing injuries.

### **Etiological Factors in Hamstring Strain**

1. Poor flexibility.
2. Physiologic shortening due to fatigue.

3. Inadequate strength (hamstring, gluteal, adductor)
4. Inadequate endurance.
5. Contra lateral hamstring imbalance.
6. Ipsilateral quadriceps – hamstring imbalance.
7. Insufficient warm up.
8. Inappropriate/incorrect/contraindicated stretching.
9. Dyssynergic contraction of hamstrings.
10. Poor running style.
11. Poor core stability.
12. Inadequate return to activity.
13. Inadequate rehabilitation.
14. L5 – S1 root irritation.
15. Extrinsic factors, i.e. training errors, no progression/adaptation, inappropriate footwear, training surface.

Intensity of training is a major factor in hamstring injury. A rapid increase in intensity can bring about an alteration in muscle integrity. After weight lifting for example there is a regeneration period. During this phase a sprinter who participates in high intensity speed work is particularly vulnerable as the muscle fiber's ability to withstand stress is decreased for a period of time.

\*Note; nutrition and hydration paramount to recovery.

Time and time again I witness the mistreatment of hamstring injuries. Injured athletes are vulnerable. Time is of the essence. How many times have I treated an athlete who already came under the so called treatment of an eager masseuse, sports therapist or physiotherapist who massaged and stretched the injured muscle in the acute phase causing as much damage as the athlete would if he went back out and ran.

The first rule of medicine is: First, do no harm. Secondly with any injury the correct diagnosis is imperative.

I have had the unique privilege over the past 10 years to spend time observing Dr. Hans Muller Wohlfahrt treat international sportspeople. Last week was my 27<sup>th</sup> visit to his practice and I spent a full week with him in his practice in Munich.

Muller Wohlfahrt's premise is that palpation is the key diagnostic tool. He is convinced that physicians and sports physiotherapists should be better trained at diagnostic palpation.

Correct palpation, i.e. tactile perception through the fingertips and functional tests provide the most useful clues about soft tissue injury.

They help to:

1. Pinpoint the site of the injury.
2. Define the extent of the injury (muscle fiber discontinuity in mm) even at a depth of 3 – 4 cm or more.
3. Assess the extent of the associated haematoma (edematous swelling).
4. Establish the severity of the inflammatory reaction.
5. Grade the intensity of the compressive, tensile and contractile pain and it's site.
6. Differentiate the underlying causes: Muscle fatigue due to dry muscle, fibrotic scar tissue, previous injury, neuromuscular disorders and trigger points.
7. Set a time scale for healing.
8. Assess potential scarring.
9. Evaluate the muscle tone proximal and distal to the injury.
10. Establish whether a neighboring muscle shows a compensatory increase in muscle tone, dysfunction and whether it is also in need of treatment.
11. Detect fibrous adhesions.
12. Outline rehabilitation programme.
13. Set a realistic time for return to sport specific training.
14. Outline programme of prehabilitation to prevent further injury or re-occurrence of same.
15. Liaise with athlete – coach if etiology of injury was due to extrinsic factor i.e. training error.

How many times have I been to a world championships or Olympic games and a sprinter injures his hamstring in training or early round of competition but is 100% three days later. Athletes such as Jason Gardner, Nathan Morgan, Tim Benjamin, Ewan Thomas, and Mark Lewis Francis come to mind.

The question is, is the injury a muscle strain, muscle fiber rupture, fascial strain or tethering of the neural structures  
What Dr. Muller Wohlfahrt has taught me is that muscle strains (pulled muscles) and muscle fiber ruptures are two very distinct injuries.

- (1) Muscle strains are characterized by neuromuscular impairment rather than disruption of muscle fibers. Strains take 2 – 5 days to heal.

- (2) Muscle fiber ruptures are characterized by disruption of muscle fibers of several millimeters, i.e. tissue damage.

Muscle strains (pulled muscle) are caused by an impairment of the muscle spindles controlling the muscular tonicity rather than by disruption of musculo-cellular activity.

The muscle involved loses its elasticity with increasing crampy pain so that the athlete can no longer perform. The pain is probably hypoxic in nature. Untreated and disregarded, i.e. if the athlete were to try to compete they could cause fibers to rupture. These strains generally affect the muscle belly while tears are usually located at the muscle tendon junction.

The incidence of muscle strain can be reduced greatly with appropriate pre-event stretching i.e. targeted elastic exercises without major static elements i.e. static stretching, but rather short intermittent stretching i.e. active isolated stretching.

Muscle strain impairs muscle function but leaves the underlying anatomy intact.

Why do muscle strains occur?

- (1) Abrupt changes of loading patterns, sharp changes in rhythm.
- (2) Agonist/antagonist imbalance or inadequately trained.
- (3) Inappropriate warm up.

### **Treatment of Muscle Strains**

**Objective:** To eliminate the neuromuscular disorder and reduce the de-ranged muscle tone.

#### **First Line Management.**

Immediate action - ice for 20 min. After 20 min ice treatment do a systematic examination.

If it is confirmed to be a muscle strain the following treatments:

- (1) Muscle release via PNF stretch. Stretch the muscle to the point of pain perception. Contract against therapist resistance 6 – 8 seconds and repeat 6 times.
- (2) Strain – Counter strain. Patient assumes position where myofascial structures at injured site are relaxed. Therapist applies pressure to the muscle belly for 30 – 60 seconds

followed by compression to the musculo-tendinous junction for 60 –90 seconds.

- (3) Active release Technique.
- (4) Stretch and Ice. This produces nociceptive inhibition by the free nerve endings of the skin.
- (5) Classical massage for relaxing the muscles proximal and distal.
- (6) Ointment dressing applied Traumeel, Zeel, Profelan.

Following day do manual resistive testing of involved muscles and if firing properly allow athlete do easy 15 – 20 min run training.

**Muscle Rupture – muscle fiber rupture, muscle bundle rupture.** - Muscle rupture is characterized by spontaneous, mostly acute stabbing pain. First line management is decisive for the healing time.

Muscle fiber rupture is associated with tissue bleeding which should be controlled by ice applications, ideally, 20min – 30min of ice application followed by compression bandage. The compression bandage can be repeatedly wetted with ice water. The patient should ensure that the injured muscle is not loaded and is elevated.

**Phase One – days 1 – 3**  
**Acute Phase 24 – 72 hrs.**

Physiotherapy has top priority. The treatment protocol may involve two treatments daily.

1. Laser treatment for promoting cell regenerating.
2. APS microcurrent to increase protein synthesis, increase energy for cell metabolism to facilitate repair ATP (adenosine triphosphate).
3. Manual lymph drainage for removing haematoma debris and preventing compromised blood flow caused by increased tissue pressure.
4. Classical massage for releasing reflex contractions in the entire kinetic chain.
5. Stretching – reciprocal inhibition.
6. Remedial exercises to stimulate the pain related motor patterns.
7. Molecular Treatment.  
Molecular treatment with natural products promotes healing without the use of synthetic substances.

The goal is to create the optimal conditions for rapid muscle regeneration.

- Oral fibrinolytics, Wobenzym, such enzymes minimize the release of aggressive interleukins and mediators of phagocytosis by granulocytes and macrophages migrating to the site of injury and contain the inflammatory response. Reparil, which seals the cell membrane and provides anti-edematous and inflammatory effects serve the same purpose.
- Use of antioxidants such as vitamins A, C and E improve free radical scavenging locally and systemically. Such antioxidants taken in the acute and sub acute phase help to scavenge electronegative particles released after injury and minimize cell membrane damage.
- Zinc and magnesium taken immediately post acute injury and used for the following days have multiple effects. Zinc ions promote healing and play an important role in the synthesis of proteins from amino acids by stabilizing pro-synthetic RNA (ribonucleic acid), act as radical scavengers and contribute to granulocyte phagocytosis. High-energy muscle phosphate metabolism would be impaired without magnesium replacement with resultant delayed healing.

Inflammatory tissue is always acidic. For optimal healing we use Rayobase to normalize the pH value.

### **Phase II – Days 4 – 5 Sub acute Phase.**

1. Electrotherapy.
  - \* High voltage current, interferential for restoring neuromuscular balance.
  - \* Ultra sound for cellular massage and prostaglandin production.
  - \* APS microcurrent to increase ATP, increase protein synthesis.
2. Deep muscles at the injured site are addressed by classical massage techniques (kneading and squeezing); unwinding techniques (cross fiber and with the fiber) are applied to the injured muscle distal and proximal to the tear.

On day 5 transverse friction applied to the center of the injury is started. Active stretching is initiated with a passive stretch at the end of the cycle i.e. Active Isolated Stretching.

This brings the muscle almost back to normal. Remedial exercise is replaced by therapeutic training in terms of sports specific loading via closed chain exercises. Full therapeutic training is started between days 5 – 7 depending on healing status.

An easy run of 15 minutes non-fatiguing the muscles (on flat surface) is done. Early run training promotes muscle regeneration helping growth of new muscle fibers.

During the following days pre-habilitation exercises are progressed, core training, closed chain exercises and run training increased and intensified.

Progressive – effort runs, sprints and exercises for co-ordination – speed agility quickness are started about 14 days post injury.

Obviously training intensity is determined by the progress of healing and the athlete's response to the phases of re-adaptation to exercise.

The therapist must re-assess the muscle regularly both by palpation and testing it with manual resistive tests.

Although often assumed, freedom from pain is not equivalent to complete healing. Re-rupture, which would take much longer to heal than primary injury, should be avoided at all costs.

### **The Global View.**

How many therapists treat hamstring injury attempting to recoup hamstring flexibility and strength as the primary goal?

My philosophy is that structure governs function. When structure is out of balance then function is compromised. Compromised function leads to altered mechanics and compensatory movement patterns.

It is my view that therapists should analyze structural imbalances and treat accordingly.

Specific muscles that are hypertonic should be treated with manual techniques and isolated stretching exercises to normalize and recoup extensibility.

Muscles that present as hypotonic should be stimulated with strength exercises to recoup agonist, antagonist integrity.

How many athletes injure their hamstring only to re-injure the same hamstring at a later stage?

Band aid therapy, i.e. only treating the hamstring has no place in present day musculoskeletal traumatology.

A global view must be taken. Flexibility of structures that affect the biomechanics of the hamstring should be considered as very relevant.

For example, a tight psoas muscle results in anterior tilt of the pelvis, throws havoc with the biomechanics and function of the hamstring. Gluteal tightness can indirectly restrict hamstring stretch. Tight external rotators particularly the piriformis muscle can compromise the output in the neuromotor system causing decreased muscle recruitment in the hamstrings especially under load when great forces are required such as in sprinting.

"Clinical experience and especially therapeutic results, support the assumption that, (according to Sherrington's law of reciprocal innervation), tight muscles act in an inhibitory way on their antagonists.

Therefore it is not reasonable to start with strengthening of the weakened muscles, as most exercise programmes do.

It has been clinically proven that it is better to stretch tight muscles first. It is not exceptional that, after stretching the tight muscles, the strength of the weakened antagonists improves spontaneously, sometimes within a few days, without any additional treatment". (Vladimir Janda from Muscle Energy Techniques, Leon Chaitow.)

The most prevalent pattern of dysfunction that I witness in athletes leading to bicep femoris injury is what is termed the lower crossed syndrome.

When a chain reaction evolves in which some muscles shorten and others weaken predictable patterns involving imbalances develop.

The lower crossed syndrome is a chain reaction which presents with the pelvis tipping forward on the frontal plane, flexing the hip joints and producing lumbar lordosis and stress at L5 - S1. Further stress

manifests in the saggital plane where the quadratus lumborum tightens and the gluteus maximus and medius weaken.

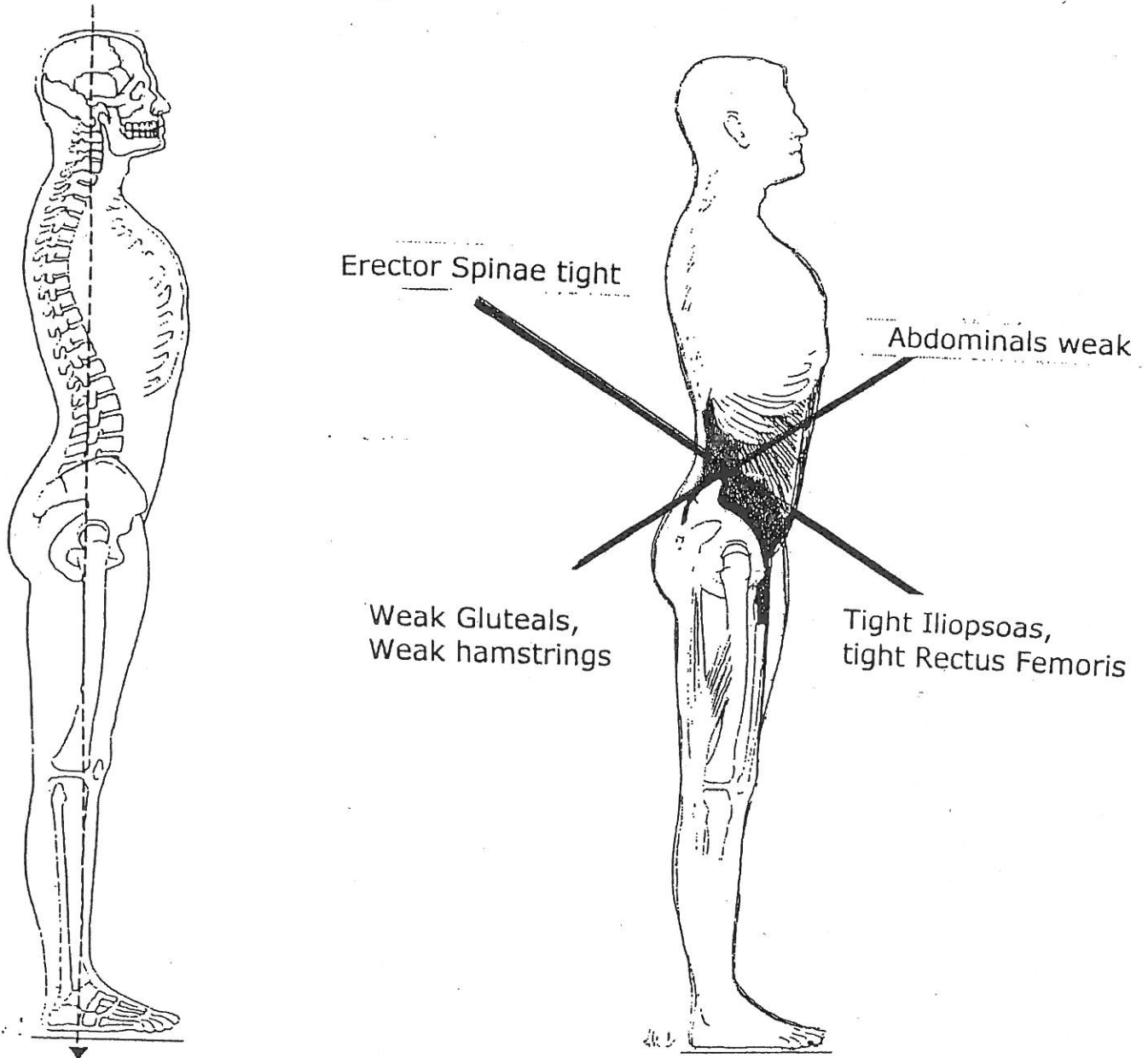
When the "lateral corset" becomes unstable, the pelvis is held in increased elevation resulting in L5 – S1 stress.

The combined stresses produce instability at the lumbodorsal junction. The vertebral column must always be treated in conjunction with soft tissue injury of the lower extremity. By including the vertebral column in the management strategy it will promote healing in the extremity.

Also commonly involved are the piriformis muscles.

Dysfunctional hypertonic piriformis muscles can produce direct sciatic pressure and arterial involvement produces ischaemia of the lower extremity which I am sure accounts for dyssynergic contraction of the hamstrings.

# Lower Crossed Syndrome



All tighten and shorten: - Hip flexors Iliopsoas, Rectus Femoris, TFL, Short Adductors, Erector Spinae.

All weaken: - Abdominal, Gluteal and Hamstrings.

- 1 When tense, tight muscles are released and stretched, antagonists will regain tone and balance restored.

In my practice I carry out what I term a Kinesiological Evaluation.

In simple terms it evaluates:

1. Balance, single leg stance, eyes closed. Functional balance tests
2. Alignment, checking for leg length discrepancy, pelvic obliquity and pelvic tilt.
3. Feet alignment, candidate for orthotics or prescribed exercise i.e. tibialis anterior, tibialis posterior.
4. Flexibility – muscles that are hypertonic address with isolated stretching. Muscles that are hypotonic refrain from stretching until kinetic balance recouped.
5. Neural tissues, address where involved.
6. Strength – muscles, prime movers, agonist – antagonist taking sports specific into account, i.e. soccer player, sprinters. Look for parity in quadriceps to hamstring ratio. Synergistic and stabilizing muscles, address imbalances.
7. Functional tests, single leg hops, single leg step-downs, etc., observe locomotion.

### **Demonstration of Techniques to Prevent – Treat Hamstring Injury**

\*Note, Stretch (1) (hamstring stretch) not to be done in first 24 – 48 hrs phase of injury.

- (A) Active Isolated Stretching Technique
- Target the hypertonic muscle
  - Hamstrings (\*Omit in first 24 – 48 hours of injury)
  - Gluteals
  - Long adductors
  - Quadriceps
  - Psoas
  - Neural Stretch
  - Gastrocnemius
  - Soleus

(B) Neural stretching where indicated

(C) Manual Techniques

- Release and normalize dysfunctional or hypertonic tissues
- Iliotibial band
- Adductor magnus
- Psoas
- Piriformis
- Popliteus
- Gastrocnemius (medial and lateral origin head)
- Quadratus Lumborum
- Treat Hypomobility in any segment Lumbar spine

(D) Therapeutic Exercises: Gluteis Medius insufficiency:

- (1) Exercise, single leg step down
- (2) Single leg balance – ball throw
- (3) Leg balance – ball throw from side
- (4) Ankle weight abduction

(E) Core exercises: Lumbo-Pelvis stability

- (1) Step downs
- (2) Prone Stabilizer
- (3) Bridge
- (4) Side Stabilizer
- (5) Fire Hydrant
- (6) Supine Stabilizer

(F) Eccentric Strength Exercises.

It can be concluded that there are many factors predisposing to hamstring injury.

The global view with treatment addressing any imbalances, i.e. alignment, flexibility, strength along with addressing extrinsic factors is the best way to avoid hamstring injury.

*Gerard Hartmann.*

*The views in this presentation are the views of the author.*

*I wish to acknowledge and thank Dr. Hans Wilhelm Muller-Wohlfahrt for his input to my career development and allowing use of information from his library particularly; "Diagnosis and treatment of muscle strain and muscle fiber rupture in elite-level athletes." 03/02/06, Dr Hans Wilhelm Muller Wohlfahrt.*

### Closing Note

When it comes to understanding the etiology and pathophysiology of injury I believe we are only touching the iceberg in terms of what we know.

I do my best with the knowledge and skills I possess but at times I get frustrated because I know so little.

Yes I am grounded in sound physiological principles of how the neuro-musculoskeletal system works, how important neuromuscular function is, agonist – antagonist balance is, synergistic activity is and how an imbalance within the kinetic chain can throw the wonderful musculoskeletal machine into disarray. Yes we know how to re-educate and re-establish muscle balance.

But do we understand what the connection is between every organ, every fascia, every tooth, and each gland of the body is and how it communicates with the musculoskeletal system?

Do we know the relationship between a diseased organ, diseased tooth and what relationship it has with the muscular system?

I don't know, but I truly believe every organ, each tooth, each gland and the other structures have a direct link to a specific contractile structure (muscle) in the body.

From a locomotive perspective we understand the musculoskeletal system in its own entity. But do we know really. It is my opinion that there is so much more to this unique machine.

I believe that when a specific organ is out of ease (diseased), maybe not clinically but where there are morphological changes taking part, that out of ease organ, tooth, gland etc. can inhibit the very function of the muscle it relates to.

It may be that in the future global therapy will not only relate to treating the injured muscle and its related neuromotor imbalance but treatment of the prime culprit, the diseased organ may be primary to resolution of musculoskeletal pain and dysfunction and treatment of the injury secondary.

My belief is that once we penetrate the iceberg we will source a new level of understanding of the functional and dysfunctional human machine.

We must go outside the box, practice what we know now by all means, but search outside the box for new methodologies, new techniques, a new understanding in our quest to provide the best treatments for our patients.

*Gerard Hartmann.*