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microStretching® - A practical approach for recovery and regeneration

by Nikos Apostolopoulos

ABSTRACT

Intense training and competition regularly expose the athlete'to stresses and strains exceeding the normal capacity to recover. Making sure of recovery and subsequent regeneration is an integral part of maximising the ability to perform to the best of the athletes potential and should be the basis for planning the training programme. microStretching® is a recovery-regeneration technique of the connective tissues. It is a comprehensive approach involving the neural, endocrine and immune systems. The fundamental aim is to correct any negative physical changes created by training loads and previous injuries. After an extensive background section, which includes an outline of how microStretching® addresses the micro-trauma and inflammation created by intense physical activity, the author provides an explanation of the practical application of microStretching® based on the practice at his clinic in Canada. He then gives detailed descriptions of seven key stretches used in microStretching®. This is followed by two case histories, which are practical examples of how coaches, medical support personnel or athletes might use microStretching® guidelines and stretches to develop a recovery and regeneration programme.

AUTHOR

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Introduction

Training an athlete is a complex endeavour. It involves the stimulation and development of numerous allostatic systems and their relationships to the parameters of training (physical, tactical and mental), to the variables of training (intensity, volume and density), and to recovery. Allostatic refers to allostasis, a term that describes the various neurobiological processes in an organism and how they adapt to change and maintain the homeostasis of the individual. It is directly related to the wear and tear (catabolism) and recovery (anabolism) of the body.

Recovery is of particular interest. Intense training and competition regularly expose the athlete's body to stresses and strains exceeding the normal capacity to recover. Making sure that recovery and subsequent regeneration (Rec-Reg) take place effectively is an integral part of maximising an athlete's ability to perform to the best of his/her potential. It is well known that here have been, and continue to be, attempts to shortcut this process with illegal methods that jeopardise the athlete's health as well as the purity and integrity of sport. Therefore it is important that coaches and others who support athletes be given techniques to promote Rec-Reg that are both effective and ethical.

The mentality in the past has been that Rec-Reg is part of training. However, it is now viewed in a different light, particularly at the microStretching® Clinic. The new view is that proper Rec-Reg ensures the restoration of the connective tissue, making maximal performance possible, and that the quality of Rec-Reg actually determines how the parameters and variables of training can be modified. In other words, the planning of training cycles (micro-, meso- and macro-) is based on the results of Rec-Reg and not the other way around.

microStretching® is a Rec-Reg technique of the connective tissues, specifically the osseoligaments, tendons and muscles[1]. It is a comprehensive approach involving the neural, endocrine and immune systems. The manipulation of these systems determines the integrity of the connective tissue.

The purpose of this article is to provide an explanation of the practical application of microStretching® and, in particular, to describe seven key stretches in detail. An understanding of the principles and guidelines microStretching® will help coaches and athletes to develop a suitable Rec-Reg programme, one focused on proper muscle adaptation and minimising the catabolic effects of training.

Background

The acquisition of movement skill begins by introducing the athlete to new physical patterns, involving a complex interaction of structure, function, physiology and behaviour. This process places a great demand on the athlete. The patterns may be tentative at the beginning, however if advantageous and beneficial in maximising the athlete's performance, become inherent and intuitive. This evolution is correlated with changes in connective tissue, blood physiology, metabolism, the endocrine system, nerve circuits and the brain's cortex.

Proper training is a multi-level process, which includes analysis of patterns and their effectiveness with regards to the transfer of energy ("E"). By "E" we are referring to kinetic as well as potential energy, the "E" for an athlete to successfully compete in his/her chosen milieu. Training can be loosely defined as a pseudo-evolutionary process, determined by the repeated cycles of catabolism and anabolism. These cycles are transient in nature, unstable and ever changing, with the sole purpose of refining the physical development of the athlete. In short, the mechanisms responsible for the development of the athlete, physicaly, mentaly and emotionaly, are in essence a pattern of how "E" is efficiently created and transferred throughout the body.

An athlete is trained to develop and distribute "E" in a fluid-efficient manner. In fact, we might ask what is possible with this available "E" and how is it distributed in order to process and create movement? The answer lies in the concepts of adaptation and recovery. From an early age, an athlete is exposed to a plethora of physical patterns slowly transforming the body to specific movement patterns established in response to the efficient coordination and integration of connective tissue and the nervous system.

Connective tissue adaptation to physical stress is significant for normal function and development. Proper recovery of this tissue during and after training is essential for a seamless increase in the level of fitness and performance. Maximal performance depends on a balance between the adaptation to "physical exertion" and "recovery". If training produces an imbalance between these two parameters, athletes will show symptoms of over-training and an impaired coordination of the musculoskeletal and nervous systems, potentially creating micro-trauma to the muscu-

loskeletal system. Micro-trauma is defined as fatigue failures, that is failures in response to repetitive stress or strains. The pathogenesis of these is in direct response to an increase in intensity and functional load and a decrease in recovery pre-, intra-, inter- and post-exercise and training.

Cumulative micro-traumas lead to inflammatory responses due to localised damage to muscle fibre membranes and contractile elements. These responses result in an allostatic load, the constant wear and tear of the body without any relief. This load may be as a result of a single forceful mechanical event, such as lifting, catching or jerking during a maximal lift, or an accumulated strain associated with less forceful but repetitive loading of the musculoskeletal structure.

Two physiological systems playing a prominent role in allostasis are the autonomic nervous system, which comprises the sympathetic nervous system (SNS) and parasympathetic nervous system (PNS), and the Hypothalamic Pituitary Adrenal (HPA) axis. If stimulated in a positive or negative manner, the result may be a pathophysiological consequence leading to the process of "habituation". If the habit formed is beneficial, the athlete will maximise his/her performance; however, if the habit is inadequate and thereby stressing the body, a compensatory response will occur, perpetuating a negative load. This influences the development of a functional movement pattern determining how "E" will be generated and transferred for the maximal execution of a movement.

Proper distribution of the parameters and variables of training and recovery serve as a blueprint for the development of form and function with the intention of maximising the development and efficient transfer of "E". The regular use of a proper recovery routine can correct departures from the normal course of the health of the connective tissue.

Knowledge of the connective tissues and their function, the action of the agonists and antagonists muscles, as well as joint structure and function is necessary for a complete assessment of the athlete. In order to maintain physiological homeostasis, special attention needs to be given to the adaptation of the connective tissues because of their extremely long recovery times (specifically tendons and ligaments) as well as a balance between the antagonists and synergist muscles. Otherwise, a compromised system could develop due to a heightened imbalance between the discrepancies amongst the connective tissues with respect to the load demand.

microStretching® is a systematic recovery routine, a passive flexibility technique developed in response to changes in the biological condition of the athlete and the general balance of the metabolic processes. The adaptations of the connective tissues cannot be stored. They are specific changes due to catabolism – the realm of the SNS - and anabolism – the realm of the PNS. If an athlete is loaded too quickly or is injured, the associated abilities will begin to grow weaker as they are not used regularly. In other words, without proper recovery the benefits of adaptation are minimised both at the micro and macro levels.

microStretching® deals with the clinical manifestation of training stress, and how it affects the allostatic systems - the cardiovascular, immune, endocrine, neural and musculoskeletal systems - manifested by the development and perpetuaion of inflammation. The fundamental aim of microStretching® is to correct any negative physical changes to the athlete's body, created by training loads and previous injuries thereby diminishing inflammation.

The specificity of training defines the development of the physical parameters that the athlete needs to perform. Likewise, the specificity of the Rec-Reg programme enables the athlete to best prepare for the ensuing training load(s). This cooperative is critical and needs to be developed at a young age. By cooperative we are referring to the existence of some feedback loop, the interaction of the athlete with his/her physical state and how a change to this state changes the interaction. This is auto-informative, establishing unification between effort and result.

The stretching protocol used as a pre- and post-method of preparation for physical exertion has changed little over the years. The main

feature is the use of active static stretching after a dynamic aerobic warm-up. Coaches and athletes have been led to believe that this manner best prepares the body for the ensuing activity or activities. In fact, no definitive approach has really been established and the accepted protocol was adopted without any questioning.

Often, we see that after performing a proper dynamic aerobic warm-up, coaches and athletes make a mistake by introducing an active static stretch routine. The issue with such a practice is the relaxation of the nervous system. After investing time and effort to excite the nervous system and subsequently the muscles, it makes no sense to calm them down.

Another practice that can be questioned is the passive stretch routine trainers use on athletes prior to an activity. The intensity of such stretching is aggressive causing pain and discomfort. This results in an increase in motor unit recruitment, which in turn increases the sensitivity of the tendon. More importantly, it will stimulate the SNS resulting in a somatosympathetic response to pain arising from the stimulation of receptive nerve endings in deep tissues, including limb muscles and joints.

So, how can we best prepare the athlete? The answer resides within the interrelationships of the musculoskeletal and neural, endocrine, cardiovascular and metabolic systems. The muscle-tendon units are complex biological actuators. They generate force in order to move, stabilise joints and absorb energy. These units are highly adaptable to changes to environmental stimuli. Their adaptability determines their preparedness.

microStretching® and its Application

Overview

To use microStretching® correctly, it is vital that coaches and athletes familiarise themselves with its concepts and guidelines. Therefore, a brief synopsis principles and stages will be given here. This will focus on the major muscle groups in the lower body that are important to the proper execution of athletic disciplines (for a more thorough explanation see APOSTOLOPOULOS, 2004[2]).

The variables of training (Table 1) are used to define the execution of the microStretching® exercises described below. The aims and objectives of the athletic disciplines determine the order while the correct selection of the exercises ensures the unrestricted development of the potential of the athlete.

Table 1: Summary of the training variables of microStretching®

Training Variables	Explanation
Intensity	30% - 40% of a maximum perceived stretch (very light gentle stretch)
Volume	Each stretch should be held for 60 seconds
Density	Each stretch should be repeated 3 times per muscle group a minimum of once per day

As mentioned above, training can create trauma. Intense training can stimulate the SNS, the system of mobilisation and action. This sympathetic mediated experience is responsible for increased tension in the musculoskeletal system, preparing it for activity. The SNS is also activated when an individual creates pain and discomfort, as the body's mandate is to remove itself from such a stimulus. Therefore, it makes no sense to stimulate the SNS when an athlete is trying to recover and regenerate.

The first training variable (intensity) pertains to the subtle manipulation of the SNS. When an athlete is microStretching® the sensation should be as if he/she is placing a hand in lukewarm water. This metaphor is the closest definition of the intensity of the microStretch exercises. Remember, the mandate is to relax the SNS thereby activating the PNS - the system of recovery and healing. Objectively, on an intensity scale of 0% (no stretch sensation) to 100% (aggressive pull sensation) the microStretch should be between 30% or 40%.

This is a perception scale, for all athletes differ with regards to their perception and tolerance of pain and discomfort. It is important to note that if the athlete creates pain and discomfort while having a pre-existing injury or trauma, the result could be further protection, a somatosympathetic response, thereby increasing and intensifying the compensation for the injury.

The variables of volume and density define both the duration and frequency of microStretching®. Mobility is about load bearing and adaptation. Skeletal connective tissues are load-bearing structures that adapt to meet functional demands placed upon them. Exposure to physical, mental and emotional stress leads to various degrees of wear and tear. Repetitive stress or strain influences and is influenced by both the muscle spindles and the Golgi Tendon Organs. These proprioceptive tissues influence the athlete and his/her response to the environmental cues. The duration and frequency of exposure to any amount of stress can change these neurobiological structures and processes, negatively affecting arousal thresholds and the ability to cope with subsequent stress or stresses.

In order to facilitate full recovery, athletes need to be exposed to anabolic stressors (i.e. relaxation response (RR), active recovery (AR) and PNS) repeated for a reasonable amount of time. This is in accordance to the paradox recognised by SELYE, (1956)[3] that the physiologic systems activated by stress can protect and restore as well as damage the body. Physical exercise exerts physiological effects as reflected by the activity levels of creatine kinase (CK) and lactate dehydrogenase (LD). These enzymes indicate the extent of cell membrane damage, and their activities are known to increase in response to strenuous exercise. The gradual stress deactivations of these enzymes coupled with the disappearance of blood lactate (La) are important factors to consider when designing a Rec-Reg protocol for the athlete.

Active recovery (AR) helps speed up the process of Rec-Reg. An example would be a light concentric exercise such as cycling on a stationary bicycle, or very light jogging after intense training or competition. AR continues blood circulation with a diminished production of La. At the microStretching® Clinic this is referred to as an aerobic flush (AF). This prepares the athlete for the ensuing stretching exercises.

We have noticed maximal benefit from microStretches when the athletes held each stretch for 60 seconds, repeated three times per muscle group once per day. This anecdotal evidence has been confirmed empirically in a study by FELAND et al. (2001)[4]. The authors compared the duration of 15, 30 and 60 second passive stretches repeated five times per muscle group. The subjects using the 60-second stretches showed the greatest gain in range of motion (ROM). If the stretch is held for longer, an increase in tension due to the Golgi Tendon Organ's sensitivity to local tension may result in an increase in the contracting motor units affiliated with a fatigue response during the stretch. In other words, the athlete will feel tighter holding a stretch for more than 60 seconds.

The difference between the study protocol and the recommendation at the microStretching® clinic is that the athlete is only required to repeat each stretch three times, the issue being one of compliance. We are aware that athletes will often neglect the Rec-Reg portion of their programme, unless they are recovering from an injury. They often complain about how mundane, boring and monotonous the stretching can be. Coaches and support personnel need to make their athletes aware of the importance of Rec-Reg with regards to muscle adaptation and maximal performance, particularly how proper Rec-Reg will diminish the onset of injury and the length of time needed to recover.

In order for an athlete to properly microStretch he/she should be in a position eliminating muscle contraction. Stretching is rarely applied to a relaxed muscle as this connective tissue has an inherent stiffness associated with it. The degree of stiffness is a function of the stimulation reflexes, active contraction or structural changes due to a compromised tissue about a joint. By controlling the environment (stretching position) you can control the influence (the stretch force) and ultimately the outcome (decrease in stiffness or increase in ROM). This is in accordance with the microStretching® principle of stability balance and control (SBC®).

Pre- and post-workout stages

Proper function of connective tissue is related to the transfer of "E" from the muscle to the tendons. The functional ROM of the muscle groups related to an athletic discipline and how they relate to one another determines their ability to accelerate through the full ROM. The nervous system provides the input signal to modulate the timing and intensity of the activation signal to the muscle. The function of a muscle is to contract. An effective contraction utilises all the muscle fibres from the origin to the insertion. If this contraction is impeded by any means, full functional range is not achieved and the athlete will not maximise his/her performance.

Athletes at the microStretching® Clinic are discouraged from doing any form of static stretching after their warm-up. They progress from a dynamic flexibility regime (hopping and bounding, arm twists, ABCs, etc.) straight into their training or competition. In fact, pre-training can be used as a means of increasing the athlete's physical abilities, the only mandate being that the dynamic flexibility exercises used in the warm-up phase should be simple and not complex in nature. Proper pre-training, with the use of dynamic flexibility provides a gradual stimulus of the connective tissue priming it for the ensuing activity. If the athlete proceeds into static stretching after a warm-up it defeats the purpose of the warm-up. He/she may exhibit a greater range of motion of the connective tissue because of warming up but this stimulus may in turn relax the tissues. In essence, it may have the effect of "putting the nervous system and ultimately the muscle to sleep". Worse, this archaic procedure may predispose the athlete to injury.

The synergy of all these structures is also key focus for a proper Rec-Reg programme. As mentioned above, for athletes to recover properly they need to diminish pain or discomfort during recovery. This is achieved by introducing them to the microStretching® five stage process (mS5-Sp) after strenuous training or competition (see Table 2).

After intense exercise, the muscles and nervous system are fatigued with a greater concentration of lactic acid. Stage one involves the removal of as much of this from the body as possible. The body will naturally remove lactic acid 30 – 60 minutes post training. By performing light aerobic work, such as light jogging or cycling (aerobic flush), the body's ability to remove these products is enhanced. This AF should be at least 15 to 20 minutes in duration. Stages two and three are quite similar to each other. Intense training and competition results in the depletion of glucose from both the nervous and muscle systems. Therefore, after the AF phase the athlete needs to replenish this glucose. This may be in the form of a sports drink or a complex carbohydrate food. Stage four, if available, involves the use of contrast baths or showers. We have found the use of 30 seconds of cold followed by two minutes of heat repeated five times to be most effective. Stage five, the final stage, is the use of a proper Rec-Reg technique such as microStretching®.

Table 2: Summary of the microStretching® 5-Stage Process (mS5-SP) post-training protocol

Stages	**Description of the *microStretching® 5 Stages Process (mS5-SP)***
Stage One	Aerobic Flush
Stage Two	Glucose replenishment – Nervous System
Stage Three	Glucose replenishment – Muscle System
Stage Four	Contrast Baths
Stage Five	microStretching®

Our practice has been to introduce microStretching® exercises two hours after intense physical activity. This ensures that the body has fully cooled down. An athlete does not need to warm up in order to do the microStretches. The intensity of the stretches is quite low (see Table 1). It has been suggested that the best time to stretch is just before the athlete goes to sleep, ensuring a greater re-

covery from training or competition due to the natural activation of the PNS.

We have noticed that sequencing, proper body position and progression of the microStretches are very important. Movement is associated with a certain kinetic chain. As the athlete generates force from the ground up, the summation of the muscle groups would be calves, hamstrings, glutes, adductors, iliotibial band and hip flexors. However, opposite to this kinetic chain is the microStretching® chain. The stretches progress from a calf, followed by a glute-piriformis then by a hamstring stretch. The remaining sequence will then follow that of the kinetic chain with adductor, Iliotibial band and then hip flexor stretches.

No muscle group can be stretched in isolation. In order for an athlete to properly stretch the hamstring muscle he/she would need to focus on stretching one of the calf muscles *(gastrocnemius)* followed by the *glute-piriformis*. This ensures that the origin and insertion of the hamstring muscles will be indirectly stretched during the stretching of the other muscle groups *(calf and glute-piriformis)* facilitating a greater stretch of the hamstring muscle group. The placing of the body in the proper position will maximise the length of the muscle being stretched (microStretching® principle SBC®). We have found that the most effective way to stretch is to place the body in the anatomical position. This position requires that the shoulders and hips are square and the legs are shoulder width a part.

Analysis of most athletic disciplines shows that six main muscle groups are over-emphasised and therefore over-worked. These are the calves, hamstrings, *glute-piriformis*, adductor group, iliotibial band and the hip flexors.

Optimisation of Rec-Reg with microStretching®

The optimisation of the Rec-Reg of the connective tissues between strenuous training and competitions is crucial in order to successfully reapply the frequent workouts necessary to improve and maximise performance. Improving muscle force, velocity and power is of great importance. However, other muscle adaptations are important in order to contribute to the increased work ability of the muscle. These include neuromuscular adaptations such as increased inhibition of antagonist muscles after training, better co-contraction or increased activation of synergistic muscles, inhibition of neural protective mechanisms and increased agonist motor neuron excitability.

The equation below summarises the relationship of the various facets of training and Rec-Reg. In the past Rec-Reg was thought to be part of training, however, we have recently realised that in fact it determines training. Without proper Rec-Reg, the musculoskeletal system will not be ready for the next training session or subsequent competition(s):

(Improved Muscle Force, Velocity, and Power)
+ (Neuromuscular Adaptations)
+ (Body Awareness)
+ (Coordination)
+ (Endurance training)
+ etc

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microStretching® (proper Rec-Reg)

Adherence to the guidelines and the mS5-SP after training (Tables 1 and 2) enables proper Rec-Reg of the connective tissue. The deactivation, limitation and influence of the SNS, the rapid removal of lactic acid with AR and AF and the subsequent activation of the PNS increases the capacity to recover and it will improve and maximise the efficient creation, distribution and use of “E”. This, in turn, is necessary to maintain the athlete’s ability to train and compete at a high level.

The microStretching® exercises

This section contains the core seven exercises for the lower body that are used at the microStretching® Clinic. We make the assumption that an athlete is able to perform the exercises described without any chronic pain, discomfort or muscular tension. For situations where this assumption is not the case see the following section.

microStretching® Exercise #1 – Soleus Stretch (sitting down)

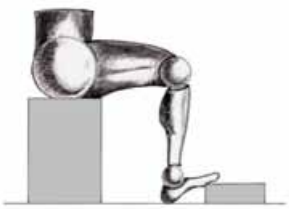
Muscle(s) being stretched
Primarily the *Soleus* muscle group of the lower leg

Description of how to microStretch
Sitting down in a chair make sure that your feet are shoulder width apart and you are sitting squarely on the chair. Place the ball of one of your feet on the edge of an object (in the clinic use a thick book, we allowing us the ability to vary the height). With the ball of your foot on the edge of the object, position your lower leg in a manner that the heel of your foot is touching the ground. By changing the angle of the ankle (bringing the foot closer to you or away) you will begin to perceive a stretch in the calf region. Hold this stretch for 60 seconds switch legs and repeat the stretch 3 times per leg.

Variables of microStretching® training

Intensity	30 – 40 percent of a maximum perceived stretch
Volume	60 seconds
Density	3 times per muscle group once per day

Diagram



** this microstretch is extremely helpful with an athlete who has extreme tightness in the Soleus. It makes no sense to try to stretch such a muscle standing up for the Soleus muscle is activated in the standing position and how can one stretch a muscle - that is also active?*

microStretching® Exercise #2 – Gastrocnemius Stretch

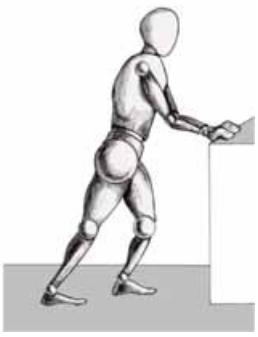
Muscle(s) being stretched
Gastrocnemius

Description of how to microStretch
Facing a bench or a chair, make sure that your hips and shoulders are square, with your feet shoulder width apart. Move your right foot backwards while still maintaining contact with the ground ensuring that your leg is still shoulder width apart and has not strayed inwards medially towards the medial side of the other leg. Once your leg is behind you bend at the knee of the leg in front while the rear leg is kept straight. Lower yourself towards the ground. Make sure that you support yourself with your hands on a bench (see diagram) or a chair in front of you. This is to relieve tension on the *gastrocnemius* muscle. Once you have this position hold the stretch for 60 seconds and then slowly switch legs and repeat the stretch on the opposite leg. Repeat this stretch for a total of 3 times per leg.

Variables of microStretching® training

Intensity	30 – 40 percent of a maximum perceived stretch
Volume	60 seconds
Density	3 times per muscle group once per day

Diagram



microStretching® Exercise #3 – Glute – Piriformis Stretch

Muscle(s) being stretched

Gluteus maximus, medius, minimus and *piriformis*

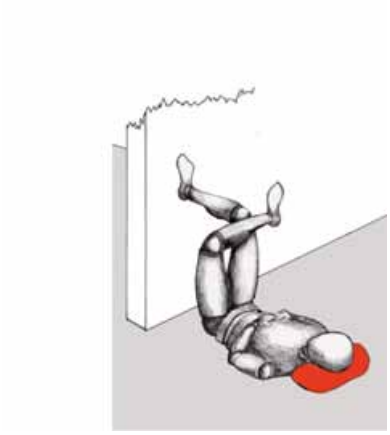
Description of how to microStretch

Place both your feet on the wall making sure that your hip and pelvis are firmly on the ground and not floating in the air. Place a pillow underneath your head ensuring the flattening of the lumbar spine. Cross one leg over the other making sure that your ankle is passed the knee joint and hold the gentle stretch for 60 seconds. Switch legs and repeat the stretch for the other side. Repeat each stretch 3 times per side.

Variables of microStretching® training

Intensity	30 – 40 percent of a maximum perceived stretch
Volume	60 seconds
Density	3 times per muscle group once per day

Diagram



microStretching® Exercise #4 – Hamstring Stretch

Muscle(s) being stretched

Biceps Femoris (long and short head), *semi membranosus, semi-tendinosus*

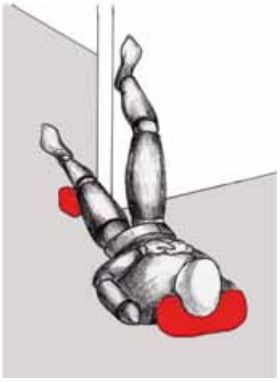
Description of how to microStretch

Place one leg through a door jam and the other onto the wall. Place a pillow underneath your head to facilitate a flat lumbar. The leg up on the wall should have a slight bend in the knee and the stretch should be felt in the middle of the muscle belly. If there is a sensation in the hip flexor region of the straight leg on the ground place a pillow underneath the knee to alleviate this sensation. Hold the stretch for 60 seconds and then switch sides and repeat the stretch for a total of 3 times per side.

Variables of microStretching® training

Intensity	30 – 40 percent of a maximum perceived stretch
Volume	60 seconds
Density	3 times per muscle group once per day

Diagram



microStretching® Exercise #5 – Groin Stretch

Muscle(s) being stretched

All 5 groin muscles (*Gracilis, Pectineus, Adductor Magnus, Adductor Brevis, Adductor Longus*)

Description of how to microStretch

Sitting on the floor place your back (upper and lower) up against a wall making sure that it is supported from the lower back up towards the shoulders. Sitting in this position place the soles of your feet up towards you until you feel a gentle stretch on the inside of the thighs. At this point hold the stretch for 60 seconds and then extend your legs out for 20 seconds and repeat the stretch a total of 3 times. If during the stretch you are experiencing discomfort within the groin muscles place pillows under each knee and ease into the stretch. The pillows provide support and stability.

Variables of microStretching® training

Intensity	30 – 40 percent of a maximum perceived stretch
Volume	60 seconds
Density	3 times per muscle group once per day

Diagram

microStretching® Exercise #6 – IT Band Piriformis Stretch

Muscle(s) being stretched

Piriformis and the iliotibial band as well as the other external rotators of the hip (Superior and Inferior *Gemelli*, Internal and External *Obturators* as well as *Quadratus Femoris*)

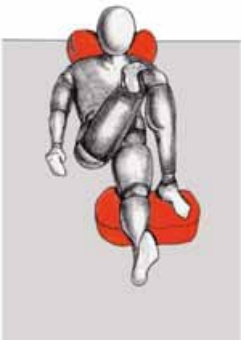
Description of how to microStretch

Start with several pillows under both knees. Bring one leg over the other side of the other knee and place it on the pillow. If you find that you have to strain in order to reach the knee of the leg being stretched (in diagram the right leg) place more pillows under the knee of the leg not being stretched. You will need a pillow underneath your head in order to flatten out your lumbar. Gently pull the leg over and hold the stretch for 60 seconds repeat on the other side. Make sure that each stretch is repeated 3 times per side. This stretch is particularly beneficial for athletes suffering from sciatica.

Variables of microStretching® training

Intensity	30 – 40 percent of a maximum perceived stretch
Volume	60 seconds
Density	3 times per muscle group once per day

Diagram



microStretching® Exercise #7 – Hip Flexor Stretch

Muscle(s) being stretched

Psoas Major (minor) and *Iliacus*. This stretch is sometimes referred to as *iliopsoas* stretch

Description of how to microStretch

Start with both knees on the ground making sure that your hips and shoulders are square and that your knees are shoulder width apart. Place a chair on the side of the hip flexor that is going to be stretched. In the diagram this will be the right side. Place your right hand on the chair. While supporting yourself with your right hand, extend your left leg away from your body. Make sure your lower back and upper body are straight and you are not leaning forward. From this position lower your body to the ground making sure that your left leg forms a 90° angle at your knee. You should begin to feel a gentle stretch in the right upper thigh hip region. Hold the stretch for 60 seconds and then switch legs repeating the stretch a total of 3 times per side.

Variables of microStretching® Training

Intensity	30 – 40 percent of a maximum perceived stretch
Volume	60 seconds
Density	3 times per muscle group once per day

Diagram

Treating Athletes Unable to Perform microStretching® Exercises Properly

If an athlete is unable to perform the exercises described above properly, that is, if he/she is in pain and discomfort, is very tight or is unable to place his/her body in the required stretch position, it is indicative of a chronically compromised system. In other words, he/she is in constant sympathetic mode - the sympathetic nervous systems are on more than they are off. Such extreme cases need to be progressed in a manner emphasising range of motion (ROM) with the initial exclusion of any other form of training. Once the athlete has shown a slight increase in ROM then a trainer and therapist may introduce other forms of training but in a slow and progressive manner. (changed)

We do this with a six-stage process throughout which the athlete is treated by a therapist who guides the Rec-Reg, the use of the microStretching® technique and the assignment of microStretching® exercises. The main aim is to reach a point where it is possible to complete the given microStretching® exercises without any pain or discomfort.

Stage One of the process involves the treatment of the athlete with the microStretching® technique. After each treatment, the athlete is required to do cold-hot contrast baths to modulate any inflammation that might have occurred during the exercises. As the ROM increases, the athlete is moved to Stage Two - water therapy. The intent is to introduce some weight bearing exercises, encouraging the athlete to move through a full ROM. Stage Three consists of active ROM exercises, none weight bearing but with some tension. These exercises, usually in the form of cycling, are designed to continue active movement of the joint(s) through their full ROM. In this stage we begin to introduce the core microStretching® exercises as described above. Stage Four comprises weight bearing exercises in the form of treadmill work or walking on a track to have the athlete actively move his/her joints through the full ROM. In Stage Five the athlete starts running and strength and conditioning exercises with body weight for resistence. For Stage Six we add strength training exercises with weights.

Table 3: Six-stage process for treating athletes unable to perform microStretching® exercises properly

Stages of Progress	**Description of Stage**
Stage One	microStretching® therapy
Stage Two	Water therapy
Stage Three	Active ROM non-weight bearing
Stage Four	Weight bearing exercises – treadmill work (body weight)
Stage Five	Strength Exercises – body weight resistance
Stage Six	Strength training exercises with weights

This process has been used to treat many athletes with chronic pain. It is a vital tool for the proper Rec-Reg of the connective tissue, and diminishing the effect of the SNS while stimulating and activating the PNS. By removing the protective intent inherent in a compromised or chronically injured body, we decrease the muscle tension that predisposes the body to an allostatic load as described above.

Case histories

The two case histories below provide practical examples of how coaches, medical support personnel or an athlete might use the microStretching® guidelines and stretches to develop an appropriate Rec-Reg programme.

Case 1: Young Female Middle-Distance Runner

A young female who competed in middle-distance events had increased muscular tightness and pain in her right knee, which was associated with a recent growth spurt. In addition to these symptoms, she also experienced fatigue during and after workouts. This may have resulted from an inability of the connective tissues to flush out the metabolic wastes created during training, and then absorb oxygen and nutrients. Associated with this fatigue was a decrease in power and strength. In summary, both the circulatory and neural systems where effected.

She was diagnosed with Osgoode-Schlaters Syndrome and the increased tightness was associated with a decrease in flexibility and range of motion (ROM) about the joints of the lower body. A stretching routine and strengthening programme were recommended to deal with the acute onset of her knee pain. After several weeks there was a slight decrease in the sensation of pain in the knee and a slight decrease in muscle tightness coupled with a minimal increase in ROM. However, the problem of fatigue did not change.

When she presented to the microStretching® Clinic, neither the pain in her right knee nor the physical fatigue had been alleviated. She appeared to be mentally and emotionally distressed. Such a situation is a very critical stage for an athlete and coach. How the athlete is manipulated throughout such period of frustration could determine whether he/she will continue to train and compete or quit.

Upon examination, the athlete exhibited very tight hip flexors, hamstrings and IT bands bilaterally, with the left side greater than the right. Her right leg was slightly shorter than her left. This is indicative of a functional but not a structural shortness. She commented on how her running gait had been affected and she did not have the ability to generate enough strength and power to train and compete. We also noticed that she was compensating to the left side, protecting the right knee, therefore her sensory input with regards to locomotion was skewed. The chronic injury affected her ability to generate, adapt and predict her automatic musculoskeletal response to the training and competitive environment. She was unable to properly compensate for any load as her bodily motion affected the proper functioning of her stretch reflexes.

Upon reviewing the athlete's case history our immediate recommendation was the removal of the strength component of her training in order to alleviate muscle tightness and increase ROM. Why should we develop more tightness in the athlete through the use of strength training exercises? In order to develop the body awareness needed to process

the sensory inputs properly, she was introduced to microStretching® to develop a proper Rec-Reg restorative approach for the musculoskeletal system.

We noticed several inherent flaws with her old stretch routine that contradicted the procedure for Rec-Reg outlined in this article. In fact, her old programme may have contributed to her chronic condition. Each stretch was held for a minimum of 15 and a maximum of 30 seconds with no particular sequencing. The intensity of each stretch was slightly below pain and discomfort. As mentioned above, when the SNS is activated through pain, it does not help the body heal but keeps it in a perpetual state of catabolism and anabolism. In other words, the athlete continues to exhibit inflammation and an inflammatory response with an increase in tension of the musculoskeletal system.

The old stretch routine did not conform to the microStretching® principle of stability, balance and control (SBC®). This principle recommends that in order to effectively stretch the muscle-tendon system, one must eliminate muscle contraction during the stretch. In other words, if the athlete has a very tight calf region it makes no sense to stretch the calf muscle standing up. During a standing stretch, the calf muscles (soleus, gastrocnemius and plantaris) are contracting to keep the athlete in the upright position. Therefore in order to stretch a tight calf the recommended exercise would be the sitting down calf stretch (Exercise #1). This will ensure that the calf muscle will be relaxed and stretched effectively. Table 4 summarises the differences between the stretch routine given to the athlete and the microStretching® routine recommended at the clinic.

Proper sequencing of stretches is very important. In this case, the athlete had issues of tightness in her lower body combined with an issue in her right knee. The recommended microStretching® routine shown in Table 5 was assigned. She was instructed to perform the stretches prior to sleep. It was noticed that her hip flexor region was very tight and sensitive to discomfort when performing the recommended IT Band stretch (Exercise #6 – Piriformis IT Band Stretch). Based on the hypersensitivity of the hip flexor, she was instructed to perform a Hip Flexor Stretch (Exercise #7 – Hip Flexor Stretch) prior to the IT Band Stretch. The principle of sequencing is based on the viewpoint that if a particular muscle group is targeted during a stretch routine, another muscle group is activated. Until this second muscle group is addressed and stretched it will impede progress in the target group.

Table 4: Comparison of stretch routines

Variables of Training and Principles	Old Stretch Routine	microStretching®Routine
Intensity of Stretch	70% or 80% out of 100% (very aggressive pulling sensation)	30% to 40% out of 100% (very gentle stretch)
Volume of Stretch	15 – 30 seconds	60 seconds
Density of Stretch	Before or after training once per day	Once per day three times per muscle group
Stability, Balance and Control (SBC®)	No	Yes
Proper sequencing of Stretching	No	Yes

After several weeks of microStretching® therapy and the use and proper sequencing of the recommended exercises the athlete was back to training. In addition, through this process she was given the tools to monitor and help to continue her recovery in conjunction with the treatment at the clinic. The inherent compensation experienced by the body was reversed and the athlete developed a higher sense of body awareness.

Case 2: Adult Male Javelin Thrower

A javelin thrower suffered a broken right ankle during the approach run before a throw. His right ankle was casted for eight weeks. Upon removal of the cast he was introduced to rehabilitation work. This consisted of light cycling with some weights in order to begin to encourage weight bearing. The work progressed to the stage where he was able to run on the treadmill and then the track. Throughout the process he was introduced to some active static stretching. Everything was going well until he began experiencing pain in the anterior region of his right hip. He was examined for hernia as well as sports hernia. The results from both the CAT scan and the ultrasound were negative. The pain was more pronounced after sitting for extended periods, or after doing lunges and other forms of exercise involving flexion of the hip region. In fact, the symptoms appeared to be consistent with a hip flexor strain. The range of motion about the hip region was quite limited with pronounced tightness in the IT Band, glutes, hamstring and the external rotators of the lower leg.

A review of the exercises recommended for both stretching and core stability suggested that these might have been responsible for the chronic pain. Some of the exercises consisted of the athlete stimulating his core while balancing. One of the stretches given for the lower back - bringing the knees to the chest while lying in the supine position - created pain and discomfort, irritating the region.

Table 5: Recommended microStretching® exercises for a young female middle-distance runner

Recommended microStretching® Exercise	Variables of Training		
	Intensity	Volume	Density
Exercise #1 - Sitting down soleus stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #3 – Glute-Piriformis Stretch	30 - 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #4 – Hamstring Stretch	30 - 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #5 – Groin Stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #7 – Hip Flexor Stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #6 – IT Band Piriformis Stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day

Table 6: microStretching® routine addressing the right hip flexor issue of an adult male javelin thrower

Recommended microStretching® Exercise	Variables of Training		
	Intensity	Volume	Density
Exercise #7 – Hip Flexor Stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #3 – Glute-Piriformis Stretch	30 - 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #4 – Hamstring Stretch	30 - 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #6 – IT Band Piriformis Stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #7 – Hip Flexor Stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day

The review also suggested a constant stimulation of the hip flexor region. The exercises targeted mainly the hip flexor to the exclusion of the other muscle groups involved in conjunction with the issue of the right hip flexor. Some of the recommended exercises appeared to be counter productive. The exercise of greatest concern involved the athlete lying in the supine position at the edge of a plinth with his right leg hanging over the edge. The left leg is flexed at the knee with the hands wrapped around the belly of the hamstring muscle group with the athlete pulling the left thigh towards the chest. The issue with this stretch is that the right hip flexor is contracting in order to support the hanging leg. This constant stimulation of the hip flexor muscle may cause further inflammation.

When we studied how the athlete compensated for his injury, we noticed that there was an increase in tension in other muscle groups, particularly the IT Band, glutes, hamstrings adductors external rotators and the quadriceps. In addition, there was involvement of the lower back muscles (*quadratus lumborum* (QL), *erector spinae*) as well as the lower leg muscles. The left hip and lower limb were also involved in response to the injury.

Our rehabilitation of the athlete focused on limiting the core stability work and removing the stretches that activated the hip flexor muscles. The athlete was treated with microStretching® and prescribed microStretching® exercises (Table 6). The sequence of the stretches given was important. The purpose was to modulate the inflammation prevalent in the muscle group. It was also important for the routine to be bilateral in nature. In other words, the muscle groups of both the right and left side both needed to be stretched in order to reverse the inherent compensation of the body in response to the injury. After following the routine for several weeks, an increase in ROM and a decrease in the chronic discomfort of the right hip flexor region was noticed. At this point the routine was altered (Table 7) to address the increased working capacity of the athlete prior to increasing the intensity, volume and density of his training.

Table 7: General microStretching® routine addressing the increased work capacity an adult male javelin thrower with a right hip flexor injury

Recommended microStretching® Exercise	Variables of Training		
	Intensity	Volume	Density
Exercise #2 – Gastrocnemius Stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #3 – Glute-Piriformis Stretch	30 - 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #4 – Hamstring Stretch	30 - 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #5 – Groin Stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #6 – IT Band Piriformis Stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day
Exercise #7 – Hip Flexor Stretch	30 – 40% of a maximum perceived stretch	60 seconds	3 repetitions per muscle group once per day

Conclusion

The development and the transfer of "Energy" are paramount for success in athletics. Every neurobiological process is designed to support such an endeavour for maximal performance. Since training can be defined as a form of trauma, it makes sense that we need to aid the athlete in fully recovering from training. Therefore a proper recovery and regeneration protocol needs to be introduced to the athlete, ideally during the formative years.

The recovery programme should not cause pain and discomfort for this will result in tissue damage with the subsequent development of scar tissue. Scar tissue will affect the proper mobilisation of the connective tissue affecting its ability to move through a full range of motion about a joint. This will affect the ability a muscle to accelerate. Pain is a sympathetic nervous system response, one that primes the body for action increasing tension in the connective tissue, the exact opposite response needed for recovery and regeneration of the connective tissue.

The use of microStretching® as well as the proper preparation before and after training and competition will provide the coach and the athlete with a recovery regeneration programme aimed at increasing the integrity of the connective tissue. The ability of the tissue to recover and regenerate quickly will ensure that the coach can confidently increase the training load of the athlete. If the athlete has an injury, which may have caused a compromise in the musculoskeletal system, it needs to be addressed and brought back to "balance". This is established with the athlete focusing on increasing the range of motion before being introduced to a strength training regime. From this balanced position, the athlete will be able to generate a greater amount of force for they will be able to move through a full range of motion thereby increasing the acceleration of the muscle about a joint. Ultimately, this translates into the ability to maximise performance.

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NOTES

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