THE ROLE OF THE PHYSICAL THERAPIST IN INJURY PREVENTION FOR AN ADULT TRAINING FOR A LONG COURSE TRIATHLON: A CASE REPORT.

A Case Report
Presented to

The Faculty of the College of Health Professions and Social Work
Florida Gulf Coast University

In Partial Fulfillment
of the Requirement for the Degree of
Doctor of Physical Therapy

By
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2014
This case report is submitted in patient fulfillment of
the requirement for the degree of
Doctor of Physical Therapy
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Approved: May 2014

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The final copy of this case report has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.
Acknowledgments

I would like to thank several people for assisting in the development and final completion of this scholarly paper. Firstly, to a wonderful and knowledgeable committee chair Dr. Stephen Black, who provided me with great insight and inspiration as I began to narrow the focus of my Independent Study, and with finalizing this paper, I thank you! To my triathlon friend and training buddy T., who graciously agreed to be a subject for this case report, thank you and good luck with your journey. Finally, the greatest amount of appreciation and thanks goes to Ron Renfroe for always being there for me, and putting up with me as I underwent this great study, and development of this paper. I cannot thank you enough for providing me with the love and support I needed to reach for the stars.
Abstract

**Study design:** Case report.

**Background:** Triathlon is a fast growing sport that combines three disciplines: swimming, biking and running. Approximately 80% to 90% of competing and actively training athletes will have an acute or overuse injury over the course of their training year. Almost half of actively training athletes have severe enough injuries to discontinue training or seek medical care.

The purpose of this case report is to review current literature and to investigate the role of the physical therapy in preventing chronic injuries for an adult training for a long course triathlon.

**Case Description:** A 48-year old recreational female triathlete training for a long course triathlon was seen two times a week for four weeks with complaints of low back pain and radiculopathy in the left lower extremity that is intensified by interval training. The patient presented with reduced lumbar range of motion, hypertonicity of lumbosacral musculature and sensory changes in left lower extremity.

**Outcomes:** Tests and measures following core strengthening, soft tissue mobilization and neuromuscular re-education revealed improvements in low back, sacral and posterior thigh pain, muscle control, gait and function.

**Discussion:** Physical therapists can play a crucial role in preventing recurrence of chronic injuries due to overtraining, faulty biomechanics and soft tissue restrictions by applying Selective Functional Movement Assessment (SFMA) to identify triathlete’s movement deficits, address soft tissue limitations and provide proper exercise prescription. Upon analyzing triathlete’s training plan and the use of equipment, the physical therapist is able to offer a triathlete an individualized maintenance program for injury prevention.

**Key Words:**

triathlon, chronic injury prevention, SFMA, Active Release Technique (ART)®, physical therapy
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Introduction

Triathlon is a fast growing sport that combines three disciplines: swimming, biking and running. There are various distances, such as sprint, Olympic long course and ultra-long distance, but the order is usually unchanged: athletes swim, bike and then run.

The first multisport event was held in San Diego on September 25, 1974. Forty six athletes competed in the first annual Mission Bay Triathlon. In 1982, Triathlon Federation of USA, later changed into United States Triathlon Association (USAT), was founded in order to govern the rapidly developing sport. Originally, USAT consisted of 1,500 members. Since then, as the popularity of sport increased, USAT continued to grow steadily year after year. The Sydney Olympic Games of 2000 spotted triathlon’s first appearance at an international event. This elevated the publicity of the sport on the national level and, as a result, in 2011 there were 146,657 annual members in the USAT. An estimated 250,000 to 300,000 individuals participate in triathlons in the United States every year. According to the USAT, an average triathlete is in late thirties/early forties, motivated by the personal challenge, competes 3 to 4 times a year and has an average income of $126,000. With this growth of participation in the sport, clinicians are seeing a wide range of injuries occurring while training and participating in triathlons (Strock et al., 2006).

Purpose

The purpose of this case report is to portray and identify the role of the physical therapist in preventing overuse injuries for an adult training for a long course triathlon event. Prolonged repetitive motion puts stress and fatigues various
body structures as training volume increases. The athletes with compromised body mechanics are forced to alter their form during swimming, biking or running. Additionally, an incorrect use of equipment, such as wetsuit or improper bike fit, may lead to overuse injuries in the adult population training for long course triathlon race. Upon the current literature review, the investigator puts forward hypothesis that physical therapists can facilitate chronic injury prevention by addressing soft tissue limitations, strengthening weak structures and improving the abnormal body mechanics of the athletes.

**Literature Review**

**Triathlon Injuries**

Approximately 80 to 90% of competing and actively training athletes will have an acute or overuse injury over the course of their training year (Tuite, 2010). Almost half of actively training athletes have severe enough injuries to discontinue training or seek medical care. It is a common assumption that numerous ailments experienced by triathletes are secondary to overuse and fatigue. To successfully treat the triathlete, clinicians need to understand the patient’s training regimen, as the “average” triathlete spends approximately 800 hours per year participating in some type of training (Strock et al., 2006). The majority of the long distance training plans are based on the theory of periodization to avoid overtraining and ensure “peaking” during the race. It has been estimated that long course triathletes (Olympic distance or greater) train an average of 10 times per week and that short-course triathletes (Olympic distance or less) train an average of 8 times per week (Strock et al., 2006).
Several studies point out that triathletes spend more time training per week than any other athlete involved in individual sport, such as cycling, swimming, or running, and, therefore, have a higher incidence of injury than any of the single-sport participants (Vleck, 2010; Strock et al., 2006). However, anecdotal evidence suggests that training for the multi-sport event can be beneficial due to the cross training. Many triathletes have grown up participating in the individual sports, therefore their potentially faulty biomechanics in each of the disciplines must be considered as a most probably source of injury (Strock et al., 2006). Insidious onset of overuse injuries during training represent 75 to 80% of all injuries; while 15 to 25% of injuries occur or are exacerbated during the race to the point that it forces the athlete to withdraw from the event (Tuite, 2010). Vleck et al. (2013) found many injured athletes continue training, making likelihood of injury recurrence very high. Furthermore, McHardy, Pollard and Fernandez (2006) pointed out that incidence of injuries during the competition is six-fold higher compared to the injuries sustaining during training, which implies that triathletes tend to push their limits a bit harder (run at a faster pace, for example) during the race. This observation is supported with the study conducted by USAT that indicated an aptitude for “personal challenge” as a primary motivator for adults participating in multisport events (http://www.usatriathlon.org). The sport of triathlon is rapidly growing, and the ability to recognize the unique aspects of these injuries can help the multisport athlete to train properly, be healthier and more successful (Strock et al., 2006). Summarizing the Triathlon Injury Review:
Most injuries appear to be gradual onset or overuse, training related, lower limb injuries, occurring during running. Catastrophic injuries occur, usually ‘as a result of failure to adjust pace within safe limits for specific environmental conditions’ or inadequate implementation of safety guidelines, but are largely unreported. (Vleck, 2011).

**Swimming**

Although most triathletes are inexperienced in swimming, the incidence of injuries is quite low. Overuse injuries from swimming account for about 5 to 10% of injuries in triathletes. Typically, such ailment involves the shoulder exhibiting symptoms of tendinitis and impingement (Tuite, 2010). Due to the overhead nature of the freestyle swim stroke, the rotator cuff (especially supraspinatus tendon), as well as the long head of biceps, are at risk of repetitive overhead stroke activity. (McHardy et al., 2006). Several authors agree that analysis of the swimming technique is a major factor in designing rehabilitation or injury prevention program (Strock et al., 2006; McHardy et al., 2006).

The kick component of the swim consists of a downbeat (propulsive) and upbeat (recovery) phases. The upbeat phase consists of hip extension with fully extended knee and slightly plantar flexed ankle. During the downbeat phase the hip is flexed at first, while the foot is lagging behind due to the knee flexion at the beginning of the phase, with knee extension at the end, while the ankle stays plantar flexed (McHardy et al., 2006). This sequence of muscle actions results in shortening of gastrocnemius and soleus muscles and Achilles’ tendon, which can cause overuse
injury to the calf, which is mostly concentric in the bike component and largely eccentric during the run (McHardy et al., 2006).

Self-educated triathletes with swimming background tend to minimize their kick by reducing lower extremity involvement in order to conserve energy and have “fresh legs” for biking and running. This alteration in body mechanics, however, comes at the cost of the higher probability of shoulder tendinopathy. Involving a swimming coach may assist the triathlete in modifying his/her swimming stroke depending on the distance and type of swimwear (tri suit, short sleeve or long sleeve wetsuit). Emphasizing body roll, for example, will help to avoid overuse of rotator cuff tendons and thus, minimize trauma to upper extremity. According to coach Michael Collins of Nova masters swimming (2012), there are three critical technique changes that need to be done to maximize performance while competing in a long sleeve wetsuit: (1) lighter kick, (2) straighter arm recovery, (3) use of slower stroke (http://www.usms.org/articles/articledisplay.php?a=349).

Based on the site of injury and clinical presentation, physical therapists can provide triathletes experiencing cumulative, repetitive trauma while swimming with training regimen modifications, pain modulation modalities, soft tissue manipulation, strength training and functional range of motion therapeutic exercises. Incorporating different joint position eccentric exercises may exert more controlled stresses on the affected tendon, and possibly, allow for better maintenance of the mechanical strength of that particular part of the tendon, and therefore, reduce the risk of overuse injury (Maganaris et al., 2004).
Cycling

Triathlon has a relatively low incidence of acute trauma, and the most common race injuries are contusions/abrasions, blisters and muscle strains. However, the most number of serious acute injuries occurs due to falls during cycling in training or competition. Some falls are accidental in nature and involve other athletes or road traffic; while others are due to the technical errors during mounting or dismounting, for examples, are more typical in novice and inexperience triathletes, and could have been avoided (Migliorini, 2011).

Chronic injuries from the cycling leg are relatively uncommon, considering the number of hours each athlete spends on the bike. Cycling injuries represent approximately 10 to 20% of all injuries occurred during training and racing. A careful history taking usually reveals a significant change in training regimen that precedes the chronic injury.

It is common for the triathlete to have pain in the neck or low back. Holding the trunk in aerodynamic flexed position for an extended period of time can induce lumbar pain during cycling. Following a cycling portion of the race, low back pain can intensify during running and limit ability to train in both disciplines. Such pain typically has muscular or ligamentous origin, because in 75% of athletes it resolves within few weeks (Tuite, 2010). Anecdotally, athletes with poor hip and lumbar flexion capabilities appear to be at a greater risk of injury (McHardy et al., 2006).

The existing data on epidemiology and pathological mechanics responsible for lower back pain in cyclists are limited and often anecdotal in nature. In their review, Marsden and Schwellnus (2010) analyzed several existing hypotheses (the flexion-
relaxation, muscle fatigue, over-activation of spinal extensors, mechanical creep and disc ischemia), cyclist’s position and bicycle set-up, as well as risk factors associated with lower back pain. They summarized that correct bicycle fit when the pelvis is tilted anteriorly may reduce tensile forces on lumbar-sacral spin, and therefore, reduce risk of low back pain (Marsden and Schwellnus, 2010).

The neck is a common site for pain in single-sport cyclists. Since triathletes spend two thirds of their training and racing time on the bike, this is a common experience. New aerodynamic tail-shaped helmets can improve performance of professional cyclist by reducing drag by 14% (Garcia-Lopez, 2008). However, if the new helmet is used during training or racing, the most desirable position of the head from the aerodynamic standpoint is at 45°, which requires constant co-contraction of cervical extensors and deep neck flexors. Neck pain and cervical disk disease from cycling is, most probably, caused by maintaining hyperlordosis of the neck while riding in the aerodynamic position with the trunk low and the head looking forward (Tuite, 2010). Constant contraction of the cervical extensors, suboccipital group in particular, have been known to contribute to cervicogenic headaches (McHardy et al., 2006).

Another common site of the overuse injury during cycling is the knee (Tuite, 2010). One of the reasons for chronic injury on the bike is the improper fit, such as the seat position too low, too far forward or improperly angled. If the seat is too high, it could result in tight hamstrings or posterior knee pain; if the seat is too low – the triathlete can develop patellofemoral stress syndrome (PFS), patella tendonitis, or
illiotibial band syndrome (ITBS). These conditions are prevalent overuse injuries during cycling (Strock et al., 2006).

Ankle overuse injuries can be caused by cycling. Achilles tendinosis makes up to about 5% of all triathlete’s injuries. Achilles tendinosis in the triathletes is thought to be exacerbated by having to cycle for several hours immediately after the foot has been held in plantar flexion during the swim portion of the race (Tuite, 2010).

The majority of triathletes do not come from a cycling background. Therefore, to achieve speed they are more likely to use heavy gears, instead of increasing the cadence (number of crank revolutions per minute). Using heavier gears results in greater stress on the patellofemoral joint and quadriceps tendons; which, in turn, increases the probability of an overuse injury during the running leg of triathlon. (Strock et al., 2006, McHardy et al., 2006). According to Many Marsden (2010), much of advice on “optimal” bike fit is based on anecdotal evidence of performance and power output, rather than injury prevention. Therefore, referral to a qualified cycle shop for proper fitting and working on correction of the riding technique with a cycling coach will prevent most probable cause of the common overuse injuries while cycling. Gregor and Conconi (2000) and Buschbacher et al. (2009) synthesized common location of pain based on the improper bicycle fit and necessary adjustments.

Based on the persistence and site of pain, the physical therapist can provide a comprehensive rehabilitation plan that includes activity modification, correction of biomechanical stresses and external factors. Ulnar neuropathy, carpal tunnel syndrome and other upper extremity nerve entrapments overuse injuries can be
addressed through the reduction of the training load, using padded gloves, treating nerve entrapment sites with soft tissue movement techniques and strengthening the wrists, arms and shoulders.

**Running**

The running leg is the last part of the event. It is often said that the run time is the best predictor of the overall success in triathlon (Tuite, 2010). The triathlon cycle-run transition (T2) holds a particularly higher risk for knee and lower back injury (Migliorni, 2011). The running portion is the most common leg of the triathlon when the athlete is forced to drop out from an overuse injury. Running is associated with the most injuries during training as well. Often triathletes experience decrement in running economy and a perception of incoordination when running after cycling (Bonacci et al., 2010). Shorter stride, slower pace and subjective feeling of a harder run are commonly described by the long distance triathletes. Fatigue, potential muscle tightness from swimming and cycling, warmer outside temperature can play a role in overuse injuries in running; however, the primary factor sited is related to running biomechanics and inadequate training schedule (Strock et al., 2006). Epidemiological studies reveal the majority of triathlon injuries occurred during running and maybe due to the high impact loads the legs and feet experience while pounding on the road (Strock et al., 2006).

Many overuse injuries from running are similar to cycling: PFS, ITBS, and patella tendinosis. Meniscal tears (usually overuse) in triathletes almost exclusively occur as a result of their run training (Tuite, 2010). Such injuries are predominant in older athletes who have started to develop myxoid change within meniscus (Tuite,
2010). Plantar fasciitis, tendinopathy or partial tearing of the medial plantar aponeurosis, is a typical overuse injury and accounts for half of all running foot and ankle ailments. Common lower extremity injuries are medial tibial stress syndrome (shin splints) and stress fractures that account for 10% of all triathlete injuries. (Tuite, 2010).

Upper leg, hip and groin injuries account for 10 to 20% of overuse injuries occurring during run training. Posterior thigh pain in triathletes can result from overuse injuries of the hamstrings, typically tendinopathy at the hamstring origin (Tuite, 2010). Gluteus medius pain from distance running is more common in women. Osteitis pubis is a common cause of the groin pain. Osteitis pubis occurs due to the shear forces across the pubic symphysis that are created with each alternating foot strike during distance running (Tuite, 2010).

Taking extensive history, analyzing training schedule, and videotaping running gait or performing more sophisticated forms of evaluation, such as motion analysis, will ensure proper assessment of the triathlete’s treatment/rehabilitation needs. Additionally, it is necessary to analyze shoe design with regard to shoes and in-shoe orthoses (Bonacci et al, 2009). Running on uneven surfaces or up and down hills should be avoided before issues of biomechanics are addressed.

Summary

The reviewed literature reveals that chronic injuries acquired by triathletes training and participating in long distance course events are most likely overuse injuries that relate to overtraining, improper training or faulty body mechanics. However, due to the retrospective nature, many studies sustained recall bias,
differences in interpretation of “injury” and “injury site,” and cannot be confirmed by medical diagnosis.

**Case Report**

**Case Description**

This case report is a retrospective review of the physical therapy management of the low back and hip pain in 48 year-old female training for a long course triathlon. The patient was referred to outpatient physical therapy on July 17, with diagnosis of lumbago and low back pain. The patient works as a dental hygienist and her job requires prolonged periods of sitting and twisting at her waist while working on a patient. During the first visit, the patient stated that over the past four months her low back pain has been getting worse. The last couple of weeks she started experiencing radicular pain into the left hip and leg. She described her pain as deep ache with shooting patterns down the left leg at times. The pain is exacerbated by sitting, cycling, walking and running. Using an 11-point numeric rating scale, with 0 as no pain and 10 as maximum tolerable pain, low back pain was rated 2/10 at best and 6/10 with activity. Radicular left leg pain was rated as 1/10 with rest and 6/10 when sitting or running. At the time of evaluation, the patient reported pain level of 5-6/10. The patient did not recall any particular injury, but she reported increasing her training volume and intensity during last four weeks.

Previous surgical history is remarkable for right knee arthroscopic surgery, right rotator cuff surgery and hysterectomy. Patient reports receiving physical therapy in the past following her orthopedic surgeries. Patient stated that she
“believes that it helps a ton”. Patient’s past medical history is significant for lumbar degenerative disc disease and multiple sclerosis that has been in remission for the past 17 years. Present medications are Interferon, Cloxapen, Tramadol and Vivelle patch. Patient’s goal was to return to pain free working and training. Physical therapy would address the deficits mentioned above for the patient to return to normal activities safely, pain free and without difficulty.

**Examination**

A thorough global examination was performed by the physical therapist with the following findings described below. Reduced lumbar range of motion and reduced lower extremity active range of motion (AROM). Lumbar spine AROM Forward Flexion 30°, Extension 10°, Right Side Bending (RSB) 15°, Left Side Bending (LSB) 15°. The patient has good hamstrings length bilaterally as evidenced by the active knee extension. Hip scouring revealed bilateral tightness with the left lower extremity (LLE) worse than the right lower extremity (RLE) in all directions. Palpation revealed tenderness and muscular hypertonicity in the lumbosacral region, especially, in the area of left lumbar paraspinals, quadratus lumborum, gluteal muscles and the piriformis musculature. Patient has postural deficits and sensory changes in the left lower extremity that are affecting her functional activities, work duties and recreational activities. Manual muscle testing (MMT) of the B LE is 4+/5 all planes of motion, with the exception of L gluteus medius of 4-/5. Patient had no positive joint signs noted with posterior/anterior (PA) grade III mobilizations. Gait pattern is normal with slight shift to the right and decreased weight bearing on the LLE. Patient
reports pain with running. Patient has a slightly kyphotic posture and increased flexed forward trunk when running.

Selective functional movement assessment (SFMA) was performed to examine functional limitations and found several faulty postures, especially with forward bending, see Table 1 for more details. Patient reports numbness and tingling in the left lower extremity, more posterior-lateral than anterior, but no specific dermatome distribution. Functional deficits consists of not being able to perform work duties, such a sitting and turning, difficulty when performing recreational activities including yoga, biking and running. The symptoms are affecting her sleep and work activities which include a lot of bending, reaching, pulling, lifting and carrying.

**Interventions and Plan of Treatment**

Patient was seen twice a week for four weeks. Patient was re-evaluated on the 8\textsuperscript{th} visit and was discharged. The following short term and long term goals were established in collaboration with the patient.

**Short Term Goals (1 to 2 weeks):** (1) Patient will be independent with initial exercise program. (2) Patient will have good safety, joint protection and postural awareness 100\% of the time. (3) Patient will increase forward bending in lumbar spine for improved functional mobility. (4) Patient will reduce maximum pain level by 50\% or more for improved functional mobility.

**Long Term Goals (3 to 4 weeks):** (1) Patient will be independent with the advanced HEP. (2) Patient will have full AROM in lumbar spine. (3) Patient will
decrease postural imbalances to minimal. (4) Patient will report no pain in low back for improved functional mobility.

Table 1. *Selective Functional Movement Assessment (SFMA) of the lumbar spine.*

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Functional No pain (FN)</th>
<th>Functional with Pain (FP)</th>
<th>Dysfunctional with Pain (DP)</th>
<th>Dysfunctional No Pain (DN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-segmental flexion</td>
<td></td>
<td></td>
<td></td>
<td>DN</td>
</tr>
<tr>
<td>Multi-segmental extension</td>
<td></td>
<td></td>
<td></td>
<td>DN</td>
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<tr>
<td>Multi-segmental rotation:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>FN</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Single leg stance L/R:</td>
<td>FN</td>
<td></td>
<td></td>
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<tr>
<td>Overhead deep squat</td>
<td></td>
<td></td>
<td>DP</td>
<td></td>
</tr>
<tr>
<td>UE Pattern 1 (MR) (IR):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>FN</td>
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<td></td>
<td>DN</td>
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<tr>
<td>Right</td>
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<td></td>
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<tr>
<td>UE Pattern 2 (LRF) (ER):</td>
<td></td>
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<tr>
<td>L/R</td>
<td>FN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impingement sign: L/R</td>
<td>FN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal adduction</td>
<td>FN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Cervical Flexion</td>
<td>FN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active cervical extension</td>
<td>FN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cervical Rotation-Lateral bend L/R</td>
<td></td>
<td></td>
<td></td>
<td>DN</td>
</tr>
</tbody>
</table>
Plan of treatment included the following interventions:

1. Manual therapy for improving tissue and joint mobility in lumbosacral region. Techniques to be used are posterior-anterior (P/A) spine mobilizations grades II-IV; myofascial release (MFR); deep tissue massage (DTM); trigger point release (TrPR); mobilization with movement (MWM)/Mulligan technique; dynamic mobilizations.

2. Neuromuscular re-education for improving postural musculature and reducing postural muscles imbalances.

3. Therapeutic exercise for stretching and strengthening of trunk and extremities, such as assisted and resisted dorsiflexion/plantar flexion wall slides; toe touch progressions, assisted deep squat; standing stance chop, tall and half kneeling chops, lunge stance chops; “cats and dogs”; stabilized reverse crunch, reverse crunch with the stick, “deer in the headlights” glute activation exercise.

4. Modalities to control pain and muscle tightness such as ultra sound (US), infrared therapy, electrical stimulation, diathermy, cryotherapy and kinesio taping (KT).

5. Gait and running training on the treadmill using metronome technique.

6. Patient education on safety joint protection, postural awareness and home exercise program (HEP).

Treatment visits timeline and interventions are summarize in Table 2.
### Table 2. Summary of Interventions.

<table>
<thead>
<tr>
<th>Visit</th>
<th>Patient’s Comments</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/17</td>
<td>Initial evaluation</td>
<td>MMT, SFMA, patient education, AROM</td>
</tr>
<tr>
<td>7/23</td>
<td>Low back is always stiff/sore. Painful L hip and ITB.</td>
<td>Central P/A to lumbar spine (L-spine), L facet glides, spinal table side bending (SB) facet gapping, ITB decompression. SFMA – failed forward flexion. Home exercise program (HEP) established. Modified 2x4 finger squat.</td>
</tr>
<tr>
<td>7/28</td>
<td>Good improvement, but pain with HEP.</td>
<td>Central P/A to L-spine, L facet glides, spinal table SB facet gapping to improve limited rotation. TherEx for hip mobility, ROM and core stability.</td>
</tr>
<tr>
<td>7/31</td>
<td>Bilateral ITB pain into hips</td>
<td>Myofascial release (MFR) for B hips, ITB and glutes, lumbar mobilization with movement (MWM). Stretches for hip musculature.</td>
</tr>
<tr>
<td>8/6</td>
<td>Feel much better, only slight L hip flexor pain</td>
<td>B hip mobilization in all planes, MFR to glutes. AROM is within normal limits. Neuromuscular re-education for mobility, planks.</td>
</tr>
<tr>
<td>8/20</td>
<td>Feel much better – ready to be done.</td>
<td>Re-evaluation. Discharge to self and independent HEP. Follow up as needed.</td>
</tr>
</tbody>
</table>

**Outcome measures and Follow up visits.**

At the time of discharge, the patient was able to work full day without pain and train more than 60 minutes with slight increase of tightness in the left gluteal region.
Patient was encouraged to call if she has any questions or concerns. Patient’s outcomes are summarized in Table 3.

Table 3. Outcome Measures at the Beginning and End of the Episode of Care.

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Start of Care (7/17/13)</th>
<th>Time of Discharge (8/20/13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numeric Pain Scale (0-10)</td>
<td>Low back pain 6/10 with L LE radiculopathy</td>
<td>No low back pain reported</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Denies radicular symptoms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gluteal pain/tightness of “not quite 1/10”</td>
</tr>
<tr>
<td>Back Index (Appendix 1)</td>
<td>49% impairment</td>
<td>6% impairment</td>
</tr>
<tr>
<td>AROM in Lumbar spine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward Flexion</td>
<td>30° + pain</td>
<td>60°</td>
</tr>
<tr>
<td>Extension</td>
<td>10° + pain</td>
<td>20°</td>
</tr>
<tr>
<td>Right side bending</td>
<td>15° + pain</td>
<td>20°</td>
</tr>
<tr>
<td>Left side bending</td>
<td>15°</td>
<td>20°</td>
</tr>
</tbody>
</table>

Patient called at six-weeks follow up and reported “tightening of the muscles on the buttocks when riding longer than 25 miles”. Patient was advised to come for the maintenance visit in order to avoid possible exacerbation of the symptoms. The follow up visit revealed decreased mobility in L hip joint, bilaterally hypertonic external hip rotators, bilaterally shortened psoas muscles and L posterior sacral rotation on the innominate. The soft tissue symptoms were addressed using active release technique® (ART®) to bilateral psoas, rectus femoris, quadratus lumborum, piriformis, gemelli, pectineus, and sartorius. Muscle energy technique and mobilization with movement were used to correct left posteriorly rotated innominate and to improve hypomobility of hip joints.
Additionally, patient was educated in proper bike fit and was advised to visit local bike store for re-fitting since hip or low back pain on the bike can be the result of too stretched out position (Buschbacher, 2009). The home exercises program was updated with foam roller exercises twice a week for soft tissue mobility of hip and thigh musculature.

The patient called for ten week follow up. She asked for an appointment herself. She reported that she has been increasing her training volume as indicated in her training plan. Also, she got new shoes about three weeks ago and now has “pain and tightness in piriformis area when running more than eight miles”. The quick screen revealed hypertonic hip musculature that was very tender to palpation; single leg squat displayed bilateral weakness of gluteus medius, which was confirmed by the running video gait analysis. Since patient responded very well to ART® during last visit, the same protocols were applied. Mobilization for bilateral gluteus medius and iliolumbar ligaments was performed as well. Patient was advised that her zero drop neutral running shoes is not the best option at this time due to the over pronation and Trendelenburg sign when running. She was recommended to return back to stability running shoes such as Asics Kayano® and Mizuno Wave Inspire.

The home exercise program was updated with daily stretches: pigeon for piriformis and standing stretches with the towel under the 1st and 2nd ray and a half of the arch for gastrocnemius and soleus. Patient was advised that if footwear modifications did not resolve the symptoms, the possibility of foot orthoses will be investigated (Stefanyshyn, 2006). Patient was encouraged to follow up by November 20th or sooner if needed.
Discussion

This case study indicates that an adult triathlete training for a long course triathlon can benefit from regular physical therapy visits in order to increase training volume and correct faulty body mechanics. While creating the rehabilitation or prevention program for multisport athletes, it is important to understand biomechanical needs of swimming, biking and running, as well as unique aspects of injuries as related to the combination of the three individual sports, including compounding factors that make overuse injuries common in triathlon (Strock et al., 2006).

Limitations

One of the limitations of this case study was a lack of patient compliance. She reported that she did not follow HEP instructions 100% of the time and trained more than it was stated in her training. Another limitation is a monetary aspect, since the follow up visits had to be covered by the patient out of pocket, it can present an extra financial burden.

Conclusions

Physical therapist can play a role in identifying and treating overtraining, faulty biomechanics and soft tissue restrictions in the adult population training for a long course triathlon. Upon analyzing triathlete’s training plan and the use of equipment (bike fit, footwear, wetsuit), the physical therapist is able to offer an individualized maintenance program for injury prevention that includes regular maintenance visits for adjusting the exercises prescription, updating HEP and addressing any soft tissues or mobility impairments. Additional knowledge and
proficiency in selective functional movement assessment will help to efficiently identify and address muscle imbalances and faulty postures. Performance maintenance program provided by the physical therapist with extensive knowledge of biomechanics of all three aspects of the sport (swimming, biking and running), can be a key to an injury free high volume and high intensity training.

There is a great need for further analysis with respect to the long and short term outcomes, treatment and prevention of chronic injuries occurring during training for an endurance multisport event. Future research is necessary to identify best protocols for maintaining optimal performance and preventing overuse injuries.
References


Chronic Injuries


Appendix 1.

BACK INDEX

This questionnaire will give your provider information about how your back condition affects your everyday life. Please answer every section by drawing a circle around the number that corresponds with the one statement that applies to you. If two or more statements in one section apply, please mark the one statement that most closely describes your problem.

**Pain Intensity**
0 The pain comes and goes and is very mild.
1 The pain is mild and does not vary much.
2 The pain comes and goes and is moderate.
3 The pain is moderate and does not vary much.
4 The pain comes and goes and is very severe.
5 The pain is very severe and does not vary much.

**Sleeping**
0 I get no pain in bed.
1 I get pain in bed but it does not prevent me from sleeping well.
2 Because of pain my normal sleep is reduced by less than 25%.
3 Because of pain my normal sleep is reduced by less than 50%.
4 Because of pain my normal sleep is reduced by less than 75%.
5 Pain prevents me from sleeping at all.

**Sitting**
0 I can sit in any chair as long as I like.
1 I can only sit in my favorite chair as long as I like.
2 Pain prevents me from sitting more than 1 hour.
3 Pain prevents me from sitting more than ½ hour.
4 Pain prevents me from sitting more than 10 minutes.
5 I avoid sitting because it increases pain immediately.

**Standing**
0 I can stand as long as I want without pain.
1 I have some pain while standing but it does not increase with time.
2 I cannot stand for longer than 1 hour without increasing pain.
3 I cannot stand for longer than ½ hour without increasing pain.
4 I cannot stand for longer than 10 minutes without increasing pain.
5 I avoid standing because it increases pain immediately.

**Walking**
0 I have no pain while walking.
1 I have some pain while walking but it doesn’t increase with distance.
2 I cannot walk more than 1 mile without increasing pain.
3 I cannot walk more than ½ mile without increasing pain.
4 I cannot walk more than ¼ mile without increasing pain.
5 I cannot walk at all without increasing pain.

**Personal Care**
0 I do not have to change my way of washing or dressing in order to avoid pain.
1 I do not normally change my way of washing or dressing even though it causes some pain.
2 Washing and dressing increases the pain but I manage not to change my way of doing it.
3 Washing and dressing increases the pain and I find it necessary to change my way of doing it.
4 Because of the pain I am unable to do some washing and dressing without help.
5 Because of the pain I am unable to do any washing and dressing without help.

**Lifting**
0 I can lift heavy weights without extra pain.
1 I can lift heavy weights but it causes extra pain.
2 Pain prevents me from lifting heavy weights off the floor.
3 Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned (e.g., on a table).
4 Pain prevents me from lifting heavy weights off the floor, but I can manage light to medium weights if they are conveniently positioned.
5 I can only lift very light weights.

**Traveling**
0 I get no pain while traveling.
1 I get some pain while traveling but none of my usual forms of travel make it worse.
2 I get extra pain while traveling but it does not cause me to seek alternate forms of travel.
3 I get extra pain while traveling which causes me to seek alternate forms of travel.
4 Pain restricts all forms of travel except that done while lying down.
5 Pain restricts all forms of travel.

**Social Life**
0 My social life is normal and gives me no extra pain.
1 My social life is normal but increases the degree of pain.
2 Pain has no significant affect on my social life apart from limiting my more energetic interests (e.g., dancing, etc).
3 Pain has restricted my social life and I do not go out very often.
4 Pain has restricted my social life to my home.
5 I have hardly any social life because of the pain.

**Changing degree of pain**
0 My pain is rapidly getting better.
1 My pain fluctuates but overall is definitely getting better.
2 My pain seems to be getting better but improvement is slow.
3 My pain is neither getting better nor worse.
4 My pain is gradually worsening.
5 My pain is rapidly worsening.

Index Score = [Sum of all statements selected / (# of sections with a statement selected x 5)] x 100

**Back Index Score** = __________