ACTIVE RELEASE TECHNIQUE
FOR ILIOTIBIAL BAND SYNDROME: 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 Requirements for the Degree of
Doctor of Science in Physical Therapy in the College of Health Professions

By
Taylor Moore
2014
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.
Table of Contents

Title Page 1
Approval Page 2
Table of Contents 3
Abstract 4
Background and Purpose 5
Case Description: Patient History and Systems Review 9
Clinical Impression #1 9
Examination 10
Clinical Impression #2 11
Intervention 12
Outcomes 16
Discussion 16
Appendix A: Cumulative Injury Cycle 19
Appendix C: Table of Activities 20
References 21
Abstract

Title: ACTIVE RELEASE TECHNIQUE FOR ILIOTIBIAL BAND SYNDROME

Background and Purpose: ITBS is one form of presentation of repetitive strain injury (RSI). There is a gap in evidence based treatment methods for RSI; however ART is one method of treatment with emerging evidence. The focus of this case report is to describe the various mechanisms of injury to the iliotibial band (ITB) and theory behind ART as a successful treatment method. There is a need for additional research on the effectiveness of ART and additional treatment methods for RSI.

Case Description: A 24-year old female triathlete with severe pain (10/10) associated with ITBS and unsuccessful past treatment with corticosteroid injection.

Outcomes: Subjective outcome measures included pain ratings; while objective outcomes measures included the Ober test and range of motion. No changes were made to the case patient’s training load.

Discussion: A patient with ITB syndrome reported decreased pain and demonstrated increased function after a 6-week treatment plan utilizing ART one time per week and a foam roller two times a day.
Background and Purpose

The term repetitive strain injury (RSI) includes multiple dysfunctions such as cumulative trauma disorder, repetitive motion injury, occupational overuse syndrome, work related musculoskeletal disorder, and many others. A RSI is caused by a repetitive movement that results in cumulative damage to soft tissue structures. Causative factors include vibration, extreme temperatures, poor posture, incorrect ergonomics, or inadequate rest. An acute injury causes an RSI and leads to a cycling of events resulting in progressively worsening symptoms. After injury, scar tissue formation causes muscle tightness and leads to decreased muscle length. The accumulation of scar tissue, which causes reduced space and increased pressure near blood vessels, results in cellular hypoxia and swelling from decreased circulation. The affected muscle weakens making it more susceptible to injury and the cycle continues until the repetitive, injury-causing action is discontinued or an intervention is performed. The law of repetitive motion (Appendix B) demonstrates the impact of repetitive motion on tissues. It takes the number, force, amplitude, and relaxation time between each repetition into consideration. A combination of high repetitions and force or low amplitude and relaxation results in high insult to the tissues and can be detailed by the cumulative injury cycle. The cumulative injury cycle consists of a cyclical pattern of weak and tight muscles; increased friction, pressure, and tension; decreased circulation and edema; and adhesions and fibrosis between fascial compartments.

The iliotibial band (ITB) is composed of dense connective tissue that originates at the lateral iliac crest, tensor fascia latae, gluteus maximus, and gluteus medius muscles and inserts at the lateral epicondyle and the Gerdy tubercle. The lateral epicondyle
insertion acts as a tendon and has a layer of adipose tissue underneath the attachment. The layer of adipose tissue, which is highly vascularized and contains pacinian corpuscles, may be the source of pain and inflammation experienced with ITBS. The Gerdy tubercle insertion acts as a ligament in both structure and function; it is on tension during internal rotation of the tibia during the loading phase of the gait cycle. This may explain the connection between toeing in and ITBS. In addition, the ITB has other distal attachments such as the biceps femoris, vastus lateralis, lateral patellar retinaculum, patella (via the epicondylapatellar ligament and patellar retinaculum) and patellar tendon to provide anterolateral support to the knee. The two theories behind ITBS are compression of adipose tissue at the lateral epicondyle or a friction syndrome; inflammation is the main concern despite the etiology. In a literature review (quality score > 60%), ITBS was the most common injury to the lateral side of the knee with an incidence between 5 to 14% and in cyclists ITBS accounted for 15 to 24% of overuse injuries. The etiology of ITBS in runners is unclear and may be due to a variety of factors including hip abductor weakness, hip and knee kinematics, repetition, or lack of knowledge about running shoes and surfaces. Other studies have suggested that ITBS is related to a greater hip adduction angle and greater knee internal rotation angle; these studies also found that females with ITBS presented greater femoral external rotation, which led to respectively increased knee internal rotation. In addition, 55% of individuals with ITBS presented with mild to severe knee varus. With normal single leg stance, the ground reaction force is directed medial to the knee and produces a varus force; with increased hip adduction, the ground reaction force is directed more medially with a greater perpendicular moment arm to the knee which results in increased varus
torque and the elongation of lateral hip musculature; with knee valgus combined with increased hip adduction, the ground reaction force is directed lateral to the knee which results in a compensated trendelenburg sign.\(^8\) Other intrinsic factors related to ITBS include excessive calcaneal eversion, tibial internal rotation, or a leg length discrepancy which results in ITBS on the longer leg.\(^{13}\) In cyclists with a leg length discrepancy, ITBS typically presents on the shorter leg because the lateral side is overstretched when attached to the pedal.\(^{14}\) Excessive hip adduction and knee varus or valgus can be related to muscle imbalances.\(^8\) The tensor fascia latae is a postural muscle and can become shortened and strong, while the gluteus medius and maximus are phasic muscles that are more likely to become lengthened and weak. This imbalance can create a postural pattern, trendelenburg or compensated trendelenburg sign, excessive hip adduction, knee varus, or knee valgus during gait due to poor control.\(^{15}\)

Some factors that contribute to ITBS are modifiable. These factors include rapid mileage increases, hill training, and slow running, and shoe design.\(^8\) Downhill and slow running lead to increased time spent in the impingement zone, which occurs during repetitions at approximately 30 degrees of knee flexion.\(^8\) Excessive friction results in inflammation during repeated knee flexion as the ITB moves over the lateral femoral condyle.\(^9,^{16,17}\)

Rehabilitation phases have been recommended for the acute, subacute, and recovery strengthening phase\(^{18}\) of ITBS. The acute rehabilitation phase consists of limiting running, cycling, and swimming; use of ice, phonophoresis, or iontophoresis; oral NSAIDs; and corticosteroid injection. The subacute phase includes ITB stretching and soft tissue mobilization to reduce myofascial adhesions; the recovery-strengthening
phase includes strengthening exercises for the gluteus medius and gluteus maximus.

RSI account for a large portion of injuries in the athletic and occupational setting, comprising up to 67% of reported injuries\textsuperscript{2,19} and costing the United States 6.5 billion in worker’s compensation each year.\textsuperscript{19} Other sources report the total cost of RSIs totals 110 billion dollars per year when accounting for medical costs, lost wages, and decreased productivity.\textsuperscript{2} The National Institute for Occupational Safety and Health concluded that only 44% of repetitive strain injuries were reported; therefore, the prevalence of these injuries could be 130% greater than suspected.\textsuperscript{2} RSI result in chronic tissue inflammation, scarring, pain, fatigue, muscle spasm, and postural imbalance\textsuperscript{2}; they generally operate in a cyclical pattern known as the cumulative injury cycle. An overused muscle contracts to limit movement and protect the muscle, subsequent scar tissue and muscle shortening occur, and circulation decreases.\textsuperscript{20} Despite the significant effects of a RSI, little research has been conducted to determine the most effective intervention strategy and common interventions include rest, ice, and anti-inflammatories.\textsuperscript{2,18} Other conservative treatment methods for RSI are available and include corticosteroid injection, dry needling, muscle energy technique (MET), Graston technique (GT), manual neuromuscular therapy (MNT), myofascial release (MR), Active Release Technique (ART), and muscle activation technique (MAT). There is limited evidence in the form of randomized controlled studies that indicate the effectiveness of the aforementioned treatment options and rationale for the use of these techniques is mainly anecdotal. The purpose of this case study is to describe the characteristics of a RSI so proper diagnosis and treatment can be initiated, discuss the concept behind ART as a treatment method, and elaborate on the mechanism behind the effectiveness of ART.
Case Description: Patient History and Systems Review

The patient is a 24-year-old female triathlete and graduate student with ITBS. The patient began triathlon specific training in July 2012 and primarily competes in sprint distances triathlons. She has also completed two Half Ironman distance triathlons, with one of those being the 2013 Half Ironman Age Group World Championship in Las Vegas, Nevada. The patient reports a history of ITBS of greater than two years and received a corticosteroid injection at Gerdy's tubercle in April 2012. This injection provided limited pain relief for 2 months; but, caused skin discoloration, which is why the patient did not return for follow-up treatment. The patient has been self-managing the pain with foam rolling, stretching, and occasional rest when the pain prevents her from running.

Clinical Impression #1

A physician previously diagnosed the patient with ITBS; but additional tests and measures were conducted to rule out any other differential diagnosis. These tests and measures included subjective pain, true leg length test, Noble compression test, palpation, Ober test, and running gait analysis. The patient is a good candidate for ART as her ITBS pain can be classified as a RSI that did not improve to corticosteroid injection. The patient's ITBS is a chronic injury as it has persisted greater than six weeks. The patient reports 10/10 pain with running and is unable to complete the prescribed training for her triathlon. The patient is unable to miss additional training for her upcoming world championship race; therefore, treatment options other than rest and ice are necessary.
Examination

Examination data collected included the following that will be described below: subjective pain, history, true leg length test, Noble compression test, palpation, Ober test, and running gait analysis. Subjective pain measures were taken with a 0-10 scale, with 0 being the least amount of pain and 10 being the worst amount of pain. Pain ratings were taken orally each week prior to performing the intervention. Patients reported pain measures varied depending on the training volume prescribed and competitions prescribed for each week; however, reported pain measures decreased over time. Prior to treatment, the patient reported 10/10 pain at the distal portion and insertion of the ITB. In the history portion of the examination, the patient reported that she experiences the worst pain when walking down stairs or sitting for extended periods of time. A true leg length test was conducted to rule out structural causes for the reported pain. The patient was instructed to lie supine in a hook position. The patient was asked to bridge up at the hips to reset the pelvis. True leg length was measured using a tape measure from the ASIS to the medial malleolus and from the umbilicus to the medial malleolus. The patient presented with leg-length difference of 1 cm, which is insignificant. The Noble compression test was done to rule in the ITB as the cause of the patient’s pain. The patient was instructed to lie supine with the knee bent to 90 degrees. Compression was applied over the lateral femoral condyle while the patient actively extended the hip and knee. The patient described a reproduction of symptoms between the range of 90 and 30 degrees of knee extension; therefore indicating a positive test and ruling in the ITB as a cause of the pain. Palpation was performed along the length of the ITB and surrounding structures to identify any other contributions toward the patient’s pain. The patient
described tenderness when the examiner was palpating along the lateral epicondyle of the femur and Gerdy's tubercle. The examiner also identified areas of restriction and adhesion between the ITB and the vastus lateralis musculature. The Ober test was performed to measure ITB length. The patient was instructed to lie in side-lying position with the pelvis stabilized and affected leg up and passively flexed 90 degrees. The examiner abducts and extends the hip until it is aligned with the trunk before allowing the leg to adduct. The patient’s leg did not reach horizontal during the adduction portion of the Ober test; this represents maximal shortening of the ITB. A running gait analysis and training history questionnaire was administered to identify potential causes for the ITB pain. During the running gait analysis, no significant differences were identified between the patient’s painful and non-painful leg and the patient was wearing neutral footwear with no gait pattern deviations. The training history questionnaire confirmed that the patient had not increased training volume too quickly and was training on a variety of surfaces. The patient was unable to rest as she has her last triathlon of the season in 6 weeks. In addition, the patient has an extremely busy schedule with graduate level course work, training, and teaching; therefore, ART treatment protocols will be used once per week for 6 weeks leading up to her final triathlon of the season.

**Clinical Impression #2**

The patient is appropriate for the use of ART as she has a RSI. The patient presents with fascial restrictions, determined via palpation. The patient has tried other intervention methods; including corticosteroid injection, rest, ice, and foam rolling; with little long-term pain relief. She has her final triathlon of the season in 6 weeks and is unwilling to rest before the event. With the use of ART as an intervention, the goal is to
reduce restrictions between the ITB and surrounding musculature, normalize tissue length, which may reduce pressure placed on the ITB during training. Decreased patient reported pain measures, reduced pain during Noble compression test, increased adduction during Ober test, and elimination of adhesions would be indications of a successful treatment method using ART.

**Intervention**

Active Release Technique (ART): ART was developed by Dr. Michael Leahy; he correlated patient symptoms to changes occurring in the soft tissue after different soft tissue manipulation techniques. ART consists of two basic steps: “shorten the tissue and apply a contract tension to either lengthen the tissue or make it slide relative to the adjacent tissue.” ART consists of over 500 treatment protocols specific to multiple soft tissue dysfunctions; case studies utilizing ART have shown improvements in function and mobility, structural dysfunction, and pain measures. Despite the potential benefits of ART, it is yet to be a widely utilized treatment option, possibly due to the lack of research available. A detailed description of ART, the principles behind the approach, and its efficacy is presented below.

ART is a form of tissue manipulation aimed at treating soft tissue injuries that include, muscle weakness, tendonitis, and nerve entrapment. Overuse injuries cause changes in the muscle that lead to an accumulation of scar tissue. Scar tissue exhibits different properties than the surrounding structures; in both ligaments and tendons, scar tissue contains more Type III, V, and VI collagen fibers with a decreased proportion of Type I collagen fibers. Type III collagen fibers are arranged in a random pattern rather than along the lines of tensile strength as seen in Type I fibers. The tensile strength of
the scar matrix can be up to 30% weaker than that of un-injured, healthy tissue; this makes areas with scar tissue more likely to become reinjured under normal stress loads.

There are a variety of case and pilot studies that imply the value of ART as a treatment method for soft tissue injuries. ART was used to treat nerve entrapment, tendonopathy, muscle strain, snapping hip syndrome, lateral epicondylitis, impaired range of motion, overuse syndrome, and improve performance and contributed to faster return to activity and decreased treatment time. Although these case studies imply a benefit of ART, information regarding the mechanism of action, specific ART treatment protocols, number of passes per treatment session, total treatment sessions, and duration of intervention were lacking during my literature review. A few studies hypothesized that the potential benefit of ART stems from the stimulation of golgi receptors or ruffini organs. The cumulative injury cycle results in increased tissue tension, leads to decreased circulation (chronic) or inflammation (acute), and causes scar tissue, adhesions, and trigger points.

Myofascial trigger points (MTrPs) commonly occur with chronic musculoskeletal conditions caused by acute and repetitive microtraumas and can be palpated in individuals with a RSI. The etiology of MTrPs is lacking in evidence; however, one theory suggests a cyclical pattern correlating with the cumulative injury cycle. An automatic nervous system response causes the abnormal acetylcholine (Ach) is released into the synaptic cleft, muscle fiber tension increases, arterial blood flow is restricted, metabolism is increased, and local hypoxia occurs. Glycolytic and aerobic energy supply cause a reduction in ATP production and the release of bradykinin, 5 hydroxytryptamin, prostaglandins, potassium, and protons. Prostaglandins contribute to inflammation and
protons create an acidic environment that activates muscle nocioceptors, induces the release of a calcitonin gene-related peptide, and results in the additional release of ACh.\textsuperscript{38} ATP regulates the sarcoplasmic reticulum calcium pump; therefore, reduced ATP leads to sarcoplasmic reticulum dysfunction and increased calcium.\textsuperscript{35} Increased calcium sustains the muscle contraction which results in the contracture found at MTrPs.\textsuperscript{35} Sarcoplasmic reticulum dysfunction and sensitizing substances are the primary source of pain.\textsuperscript{36} Therefore, stretching the affected muscle could break the cyclical pattern because the contractile strength of the sarcomere decreases when the actin and myosin are not in contact.\textsuperscript{36} The basic concept of ART is to take the muscle from a shortened position to a lengthened position and hold at the lengthened position.\textsuperscript{4,18} Additional theories suggest that abnormal depolarization occurs at presynaptic, synaptic, and postsynaptic junctions.\textsuperscript{37} Presynaptic junctions result in an excessive release of ACh, synaptic junctions release a defective version of acetylcholinesterase; and post synaptic junctions up regulate nicotinic ACh receptor activity.\textsuperscript{37} This results in a muscle spasm that impairs arterial blood flow and restricts oxygen and calcium supply necessary for muscle relaxation.\textsuperscript{37} The relatively similar effectiveness of lidocaine injection versus dry needling suggests that increased blood flow and mechanical disruption of muscle fibers is necessary to deactivate MTrPs.\textsuperscript{38} Manual therapy techniques (stretching muscle to normal range of motion, ischemic compression, transverse friction massage) can be used to deactivate MTrPs and cause short-term pain reductions.\textsuperscript{37} A treatment program consisting of ischemic compression followed by sustained stretching produced greater decreases in pain than active range of motion exercises alone;\textsuperscript{37} this technique is similar to ART as both involve tissue contact (compression) and lengthening the tissue (stretching).\textsuperscript{4,37} An alternate study
states that active rhythmic release, a modified version of peripheral neuromuscular facilitation, can be used to deactivate MTrPs. It utilizes post-isometric relaxation by stretching the muscle to initial discomfort, having the patient perform a submaximal isometric contraction, and finally utilizing reciprocal inhibition by having the patient actively contract the antagonist muscles during the release phase. Treatment of MTrPs aims to reduce pain, eliminate adhesions, and regain normal range of motion.

The ART protocol involves taking the tissue from a shortened to a lengthened position while holding the soft tissues longitudinally in place. Case studies demonstrate success with ART as a treatment method, but represent only a small sample; however, these provide reasonable support for the use of ART as a treatment method.

The ART treatment protocols utilized in each session include 5 passes of the ITB side-lying treatment protocol and the ITB with vastus lateralis treatment protocol (ART protocol 62 and 63). Treatment sessions were conducted once per week due to the patient’s busy schedule. To supplement ART, the patient was advised to continue her foam rolling routine, which she had been doing since starting triathlon specific training.

Foam rolling is a form of self-myofascial release (SMF); individuals can self-treat areas of restriction by using their body weight to apply pressure over an area of restriction onto a myofascial foam roller. For an area of restriction in the ITB the patient was instructed to lie on her side with the lateral portion of her leg resting on the myofascial foam roller. The patient then supported her upper body with her hand or elbow while using her body weight to apply pressure through her ITB and onto the myofascial foam roller. The patient was advised to complete at least 60 seconds of myofascial foam rolling on the ITB pre and post exercise each day.
Outcomes

After 6 weeks of treatment, subjective patient measures had improved with a reported decrease in pain to 4/10 from 10/10 before initiating treatment. The patient reported that she was able to maintain training volume throughout treatment with weekly averages as follows: 15,000 yards swimming, 15 miles running, 40 miles biking, and 2-3 30 minute exercise videos. The patient reported a decrease in symptom replication during the Noble compression test and with palpation of the lateral epicondyle and Gerdy's tubercle. The Ober test confirmed minimal ITB shortening with adduction past horizontal. All outcome measures revealed improvement; however, additional research is needed regarding the specificity and the sensitivity of the Noble compression test and Ober test.

Discussion

The use of ART was a successful intervention for ITBS and allowed the patient to continue training while reducing subjective reported pain measures and improvement in objective special tests. ART aims to break the RSI cycle described earlier and restore normal length and motion in the treated muscle. Long-term beneficial outcomes have been achieved using non-invasive conservative management without the risk of adverse effects related to invasive treatment methods for RSI. Conservative treatment options are non-invasive, relatively painless, safe, easy to administer, and cost effective in comparison. Individuals are able to achieve positive results while still performing the repetitive motion as part of their work or fitness routine. Providers should consider this before initiating non-conservative management of repetitive strain injuries.

Despite the reported benefits of ART in case studies, the literature is lacking
randomized controlled studies to support this intervention. Randomized controlled studies are needed to support ART as an intervention technique supported by evidence-based practice. Evidence based practice is not always attainable in manual therapy settings as it fails to recognize the individual's response to specific treatment interventions. Therefore, evidence informed practice that integrates the research into a comprehensive treatment program is recommended.
Appendix A: Cumulative Injury Cycle

1. Acute Injury
2. Repetitive Injury
3. Constant Pressure or Tension

(Nullated Spinal Segment)

Weak & Tight

Adhesion / Fibrosis

Inflammation

Tear or Crush

Decreased Circulation, Edema

Friction, Pressure, & Tension

Inflammation Cycle

Chronic Cycle
Appendix B: Law of Repetitive Motion\textsuperscript{4}

\[ I = \frac{NF}{AR} \]

- \( I \) = insult to tissues
- \( N \) = number of repetitions
- \( F \) = force or tension of each repetition as a percent of maximum muscle strength
- \( A \) = amplitude of each repetition
- \( R \) = relaxation time between repetitions
### Appendix C: Table of Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Learning Outcomes</th>
<th>Evaluation</th>
<th>Date Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request committee chair</td>
<td>Affective</td>
<td>Assignment of Committee chair</td>
<td>04-15-11</td>
</tr>
<tr>
<td>Submit Written Proposal</td>
<td>Cognitive</td>
<td>Returned copy.</td>
<td>08-22-11</td>
</tr>
<tr>
<td>Revised Written Proposal</td>
<td>Cognitive</td>
<td>Committee comments on proposal and plan of study.</td>
<td>09-06-11</td>
</tr>
<tr>
<td>Oral Defense</td>
<td>Cognitive Affective Psychomotor</td>
<td>Committee approval.</td>
<td>09-12-11</td>
</tr>
<tr>
<td>Shadow an ART certified PT (Dr. Black)</td>
<td>Cognitive Affective Psychomotor</td>
<td>Feedback from PT.</td>
<td>Throughout</td>
</tr>
<tr>
<td>Build a research library.</td>
<td>Cognitive Affective Psychomotor</td>
<td>Inclusion of resource in final paper.</td>
<td>Throughout</td>
</tr>
<tr>
<td>Presentation to exercise science and athletic training students</td>
<td>Cognitive Affective Psychomotor</td>
<td>Feedback from class evaluation. Presentation material.</td>
<td>10-15-11</td>
</tr>
<tr>
<td>Attend Lower Extremity ART Certification course in Orlando, FL</td>
<td>Cognitive Affective Psychomotor</td>
<td>Inclusion of learned material in final paper. Seminar manual and DVD</td>
<td>May 2013</td>
</tr>
<tr>
<td>ART Network Provider Ironman Florida</td>
<td>Cognitive Affective Psychomotor</td>
<td>Photographs</td>
<td>November 2013</td>
</tr>
<tr>
<td>Present to 1st year PT students and undergraduates on ART Technique</td>
<td>Cognitive Affective Psychomotor</td>
<td>Feedback from class evaluation. Presentation materials.</td>
<td>May 1, 2012</td>
</tr>
<tr>
<td>Renew APTA Membership</td>
<td>Cognitive</td>
<td>Membership card and inclusion of additional resources in final paper.</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Submit scholarly paper draft</td>
<td>Cognitive</td>
<td>Committee approval for defense</td>
<td>December 2013</td>
</tr>
<tr>
<td>Post Notice of Defense</td>
<td></td>
<td></td>
<td>March 2014</td>
</tr>
<tr>
<td>Final Oral Defense</td>
<td>Cognitive Affective Psychomotor</td>
<td>Committee approval of completion and edited paper.</td>
<td>April 2014</td>
</tr>
<tr>
<td>Submit Edited Final Paper</td>
<td>Cognitive</td>
<td></td>
<td>February 2014</td>
</tr>
<tr>
<td>Submit material to print poster</td>
<td></td>
<td></td>
<td>February 2014</td>
</tr>
<tr>
<td>Print copies for FGCU</td>
<td></td>
<td></td>
<td>February 2014</td>
</tr>
<tr>
<td>Enter competition section of FGCU’s Research Day</td>
<td></td>
<td></td>
<td>March 2014</td>
</tr>
<tr>
<td>Present at Research Day</td>
<td>Cognitive Affective Psychomotor</td>
<td>Research day attendance</td>
<td>04-18-14</td>
</tr>
</tbody>
</table>
References:


