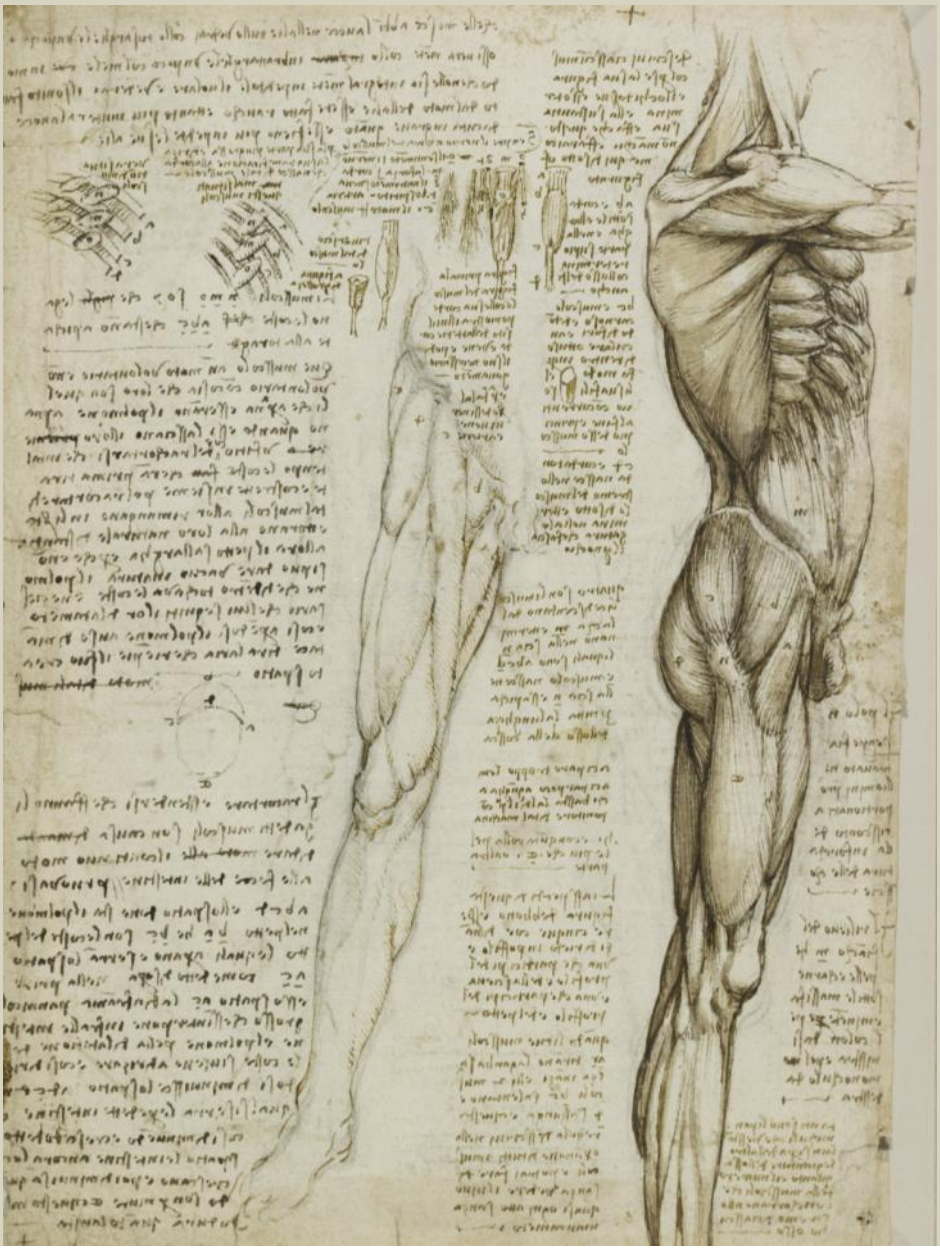
Iliotibial Band Syndrome

There is a view that ITB cannot be stretched and current treatment strategies are outdated, we asked experts on their opinions and treatment options.

Contributions from:

Whitney Lowe, Joe Muscolino, Til Luchau, Robert Baker & Art Riggs



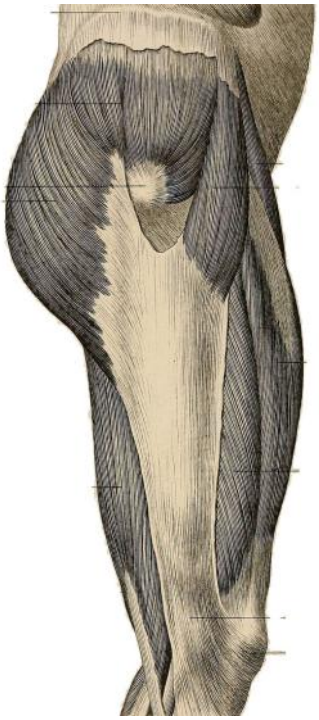


Photo by Patty Kousaleos

Iliotibial Band Syndrome (ITBS) is a common overuse injury common with runners and cyclists, especially when their training levels have recently intensified. It was reported as the second most common running injury and most common reason for lateral knee pain in runners. ITBS can also be associated with court sports, strength training (especially from weight-bearing squats), and even pregnancy. Other contributing factors can be leg length differences. ITBS produces burning pain on the lateral aspect of the knee, and exacerbated by running, especially downhill.

It is conventionally believed that the pain is caused by the repetitive movement of the "cabled" iliotibial band (ITB) sliding back and forth across the outer surface of the lateral epicondyle. This mainly occurs in 25° to 30° of knee flexion, irritating the ITB or its associated bursa during repetitive activities such as running. Conventional treatment often locates the sore spots around the condyle and performs cross-fibre friction with the aim to break down the adhesions, which will enhance fibroblast generation and encourage tissue remodelling.

Fairclough *et al*. questioned this notion that the ITB moves with respect to the lateral epicondyle during knee flexion-extension. In a study published in the Journal of Science and Medicine in Sport in 2007, they stressed that there are several basic anatomy of the ITB that had been overlooked:

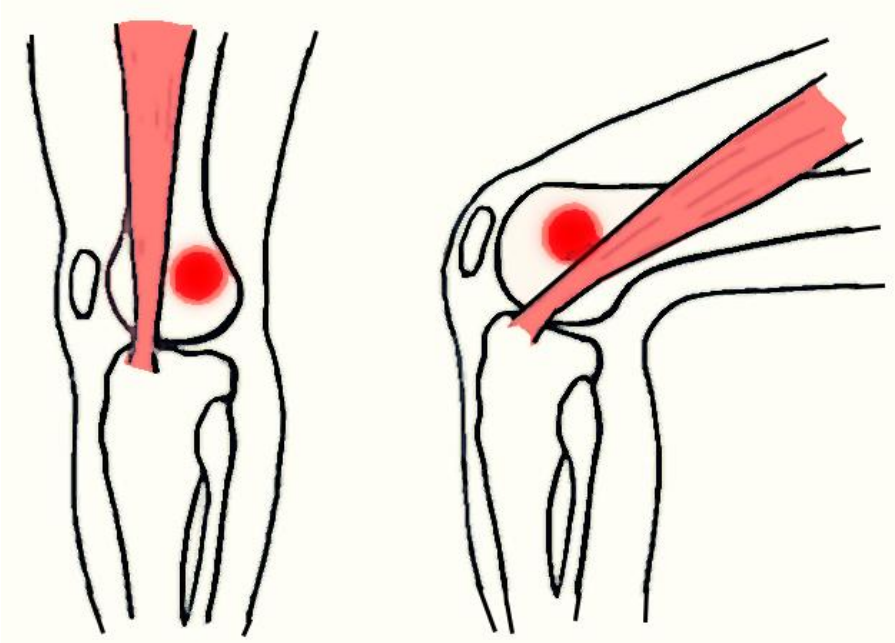
(1) The ITB is not a discrete structure but a thickened part of the fascia lata which envelopes the entire thigh;

(2) It is connected to the linea aspera by an intermuscular septum and to the supracondylar region of the femur (including the epicondyle) by coarse, fibrous bands which are not pathological adhesions; and a bursa is rarely present but can be mistaken for the lateral recess of the knee.

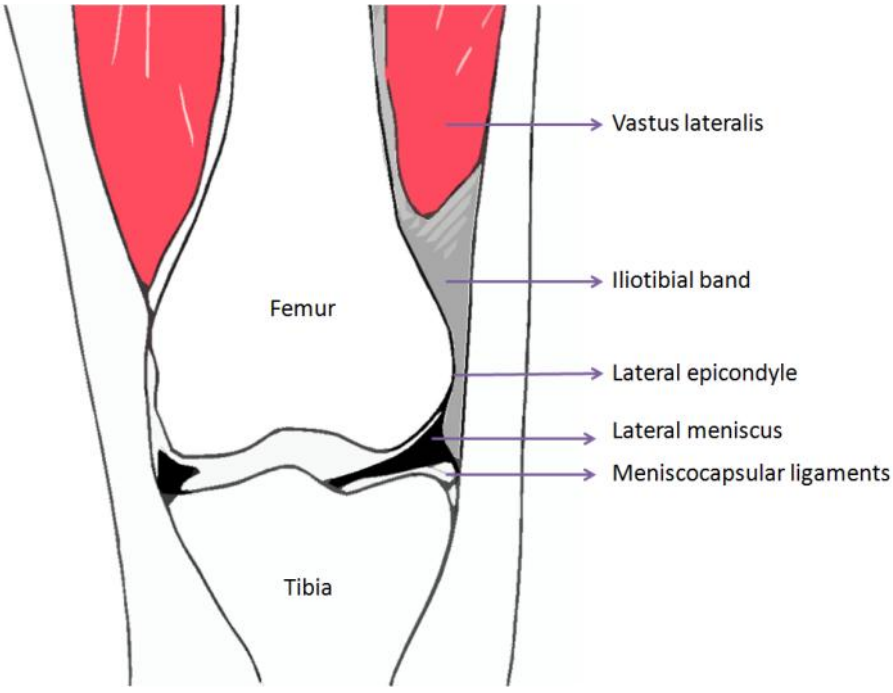
As ITB is a whole structure, the authors believed that ITB cannot create frictional forces by sliding back and forth over the epicondyle during flexion and extension of the knee. This "illusion of motion" was created by the reciprocal tightening of the anterior and posterior portions of the ITB during knee flexion-extension. They proposed that ITBS is caused by increased compression of the highly vascularized and innervated layer of fat and loose connective tissue that separates the ITB from the epicondyle. The pain can be related to a chronic increased tension of the ITB caused by increased tension of the TFL or gluteus maximus muscles.

The authors concluded that "*ITB syndrome is related to impaired function of the hip musculature and that its resolution can only be properly achieved when the biomechanics of hip muscle function are properly addressed*."

Another study by Falvey *et al*. (2012) conducted an anatomical examination of the ITB on cadavers. They tested stretching routines for ITB, and measuring the actual lengthening of the ITB by implanting strain gauges in the cadavers' ITB. They concluded that ITB is very resistant to stretch since it lengthened less than 0.2 percent with a maximum voluntary contraction. Thus, they challenged the idea of stretching the ITB as a treatment for ITBS. They suggested treatment of ITBS should treat the muscular components of ITB and TFL complex.



The conventional view of the iliotibial band friction syndrome. (Illustration based on: Nicholas & Hershman. The Spine and Extremity in Sports Medicine. Mosby, 1995.)



A diagram of compartment-like space around the ITB. Based on Muhle et al. (Radiology, July 1999).

Many sceptics and internet gurus hailed this study as the definite, claimed that "*IT Band Stretching Does Not Work*", "*Stop abusing your IT band*", "*You can't stretch the ITB*", "*It can not lengthen and it is NOT tight*", "*there is no scientific or anatomical reason to believe that any kind of IT band stretch is even possible, let alone an effective treatment*"

We asked experienced teachers and manual therapists on the implications of these studies, and treatment strategies for ITBS.

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ITB: Be flexible in our theories—Whitney Lowe

One of the key hallmarks of practice in musculoskeletal healthcare is the necessity of being flexible in our theories. We must admit that our understanding of biomechanics and pathology may change as research emerges. This concept has been illustrated very well with emerging research about the structure and function of the iliotibial band.

It has become quite popular to treat the iliotibial band with all sorts of the pressure applications, tools, or the latest craze which appears to be foam rolling of the iliotibial band. These concepts have all been built upon the premise of tightness in the iliotibial band contributing to knee or hip pain. Unfortunately, research has demonstrated that these treatments are based on a flawed model of iliotibial band function and pathology.

The most common error that seems to be continually perpetuated by many in the massage and manual therapy communities is the idea of tightness in the iliotibial band which is relieved by extensive pressure applications. These soft-tissue treatments run the gamut from small focused stripping techniques with a thumb, elbow, or pressure tool, to the broad pressure applications applied during foam rolling. Yet in all of these approaches the idea is that deep pressure applied to the iliotibial band will help relax tightness in the iliotibial band, reduce pain, and improve function.

Yet this philosophy ignores key components of anatomy and biomechanics. The iliotibial band functions predominantly as a tendon. Also, the connective tissue that composes this dense band, has very little elasticity. Consequently, the iliotibial band is not designed to stretch and elongate like many people propose. Because the iliotibial band acts as the tendon for two primary muscles, the gluteus maximus and tensor fasciae latae, its primary function is to transmit the tensile forces generated by those muscles. Attempting to get the iliotibial band to feel loose like muscle tissue is like trying to get the patellar tendon to feel loose like the muscle tissue comprising the quadriceps or hamstring muscles.

Recent biomechanical studies such as the one by Fairclough have also shed new light on pathological conditions which have formerly been blamed on the iliotibial band. For many years the orthopaedic literature has suggested that iliotibial band friction syndrome is a pathology caused by repeated rubbing of the iliotibial band across the lateral femoral condyle during flexion and extension of the knee.

These recent biomechanical studies have shown that the iliotibial band is not as mobile across the epicondyle as once described. The result suggests that the lateral knee pain associated with iliotibial band tightness may have more to do with other motions such as internal tibial rotation than the once described friction from rubbing back and forth across the condyles during flexion and extension.

Our fields of massage and manual therapy are constantly subjected to new fad treatments for addressing a plethora of musculoskeletal pain complaints. In many of these cases there is some initial excitement and success reported with these treatments, which may often be attributed to the treatment as a novel experience and early placebo effects. When time has passed and demonstrated that anatomical or biomechanical models may be flawed, it's time to re-evaluate and possibly abandon them in favour of more accurate explanations for what we are attempting to do.

Whitney Lowe has been a massage educator for over 20 years. He researches and authors articles on pain and injury assessment techniques in numerous publications.. See his website for more information www.omeri.com

Our methods still get results; it's our explanations that need updating —Til Luchau

Thanks for the opportunity to comment on the ITB studies and controversy. I've been watching this debate from a distance since the shrill social media posts about it began to appear a few years ago, and now that you've called me out, I enter the fray with a bit of caution, since I am a practitioner and trainer of practitioners, and not a researcher or academic per se. But here's what stands out to me in reading over the studies, posts, and comments:

1. It's interesting (though not exactly revolutionary) that the Falvey study described the ITB as a thickening of the leg's surrounding fascia latae, "rather than a discrete entity." (Of course fascial anatomists have been saying this about all fascial structures for quite some time now, but great to see it in a non-manual therapy study).

2. Similarly, it's interesting that the ITB was found to attach to the femur along its entire length. This is different from the impression gained from conventional 2-dimensional anatomy illustrations, but is consistent with what can be seen in 3D imagery, such as the Visible Human Project's data set (Figure 2, used in our trainings as well as in Tom Myers' and others), and with cross-sectional images going back to Grey's 1918 anatomy atlas (Figure 1). In cross-section, the ITB is barely visible, and is seen as the surfacing of a deep inter muscular septum, rather than a discreet band on the side of the leg.

3. It's fascinating that no ITB bursas were found in any of the cadaveric specimen. If this holds true for living bodies (and in those younger than the study's average age of 76 years old), then it suggests that explaining lateral knee pain as bursal irritation needs re-thinking.

4. Like Joe Muscolino says in his comments, I'm not uncertain if results from tissue-stretching and strain experiments on elderly cadavers can be directly applied to living bodies of all ages. But it is not surprising that the ITB was found to be impossible to lengthen much by stretching. The ITB is a tendon, its thus its function is probably to transmit or to store tension, rather than modulate tension by lengthening as a muscle belly would. (Interestingly, here is a small study that suggests foam rolling decreases jump performance, at least in the short term: http://digitalcommons.sacredheart.edu/masterstheses/2/, though it does conclude that ITB rolling can be beneficial in injury recovery.)

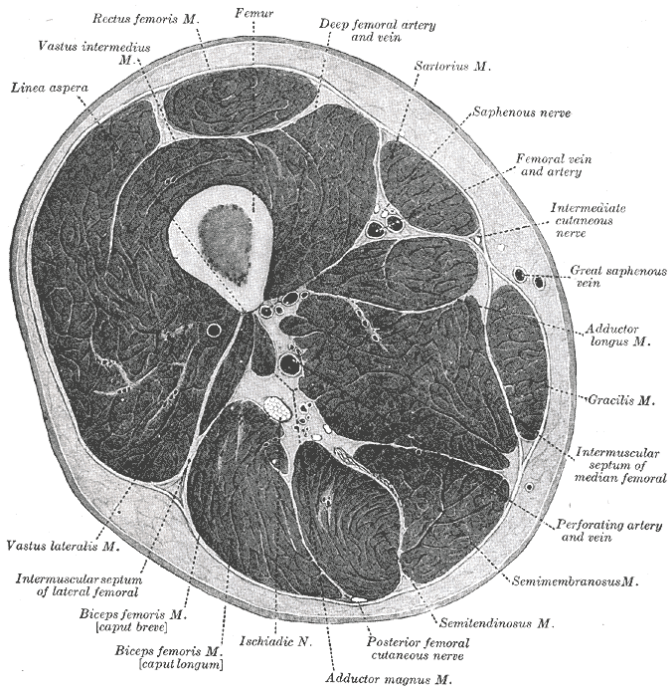

Figure 1. Cross section of the human leg (from Gray's Anatomy).

5. It makes sense to me that rolling would not "stretch" the ITB (even if it was stretchable), or differentiate it from its surrounding tissues (which is one of the things we think we're doing in our Advanced Myofascial Techniques approach). Greg Lehman (who's iconoclastic perspectives I do enjoy, even though he probably throws a lot of babies out with his bathwater) says about this issue "I can't fillet a chicken breast with a rolling pin." In other words, mashing the ITB may or may not have some

Figure 2. Cross-section of the human leg, mid thigh, arrows indicate the location of the ITB which extends deep within the leg via an intermuscular septum that attaches it to the femur along its entire length. Image from the Visible Human Project.

benefits, but stretching or separating it from its surroundings probably aren't the explanations for why ITB rolling helps (or hurts).

6. This issue aside, in my reading over the abstract and the debates, I don't find any logic that supports NOT rolling the ITB, unless you're 1) overdoing it, or 2) doing it right before a performance event involving jumping. In fact, many authors sceptical of the stretching theory allow that there may be addition benefits not explained by stretching. So instead of one of the studies author's blog post title, "Ilio-tibial Band: Please do not use a foam roller! , a more logical conclusion might be "Rolling (probably) does NOT stretch the ITB, but don't over-do it!"

7. In my hands-on practice, I don't feel much if any stretch when I work with the ITB, though I often think I feel a change in ITB tissue resilience, density, and differentiation. And of course, clients report a change in movement, lateral leg proprioception, and pain as a result of hands- on work, and often, from rolling their ITB's themselves. There are several possible explanations for what I feel, and for the improvements my clients report, with influences on the nervous system being the primary suspects, and any actual change in the tissues' physical properties being secondary.

8. After reading the different views on ITB work, I went and wrote more about my own views as an article for the May-June 2016 issue of the Massage & Bodywork magazine here. (See also the video here https://youtu.be/wYQTcRRugBE)

So in conclusion, here's more evidence to suggest that our tissue-based models of manual therapy's effects might be less accurate than we thought. But, that doesn't mean that the old ways don't get results; it just means we need to stay open-minded about our explanations about how they do their good. And once we get clearer about the new models, they'll doubtless inspire new ways of working that we might not have imagined under the old models.

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ITB: Extrapolating results from research to hands-on manual therapy should be done with caution—Joe Muscolino

I always enjoy research and the conclusions that are reached from the studies, but extrapolating to hands-on manual therapy should be done with caution. As I read the Falvey *et al.*'s study, it purports to show that:

1. The ITB has little or no ability to stretch, and

2. there is no bursa located between the lateral femoral condyle and the ITB.

Therefore, it is unlikely that an ITB friction syndrome exists; and that trying to stretch the ITB, specifically by foam rolling, is not only not a valuable clinical manual/movement therapy technique, but a deleterious one.

My specialty is more macro-kinesiology than micro-kinesiology as discussed here. But here are my general thoughts and concerns regarding the study's findings and conclusions:

1. The tissue used had an age of 76 +/- 10 years. This means that all subjects were elderly, the tissue was not representative of younger or even middle-aged individuals. Soft tissues in elderly people tend to be less plastic and elastic.

2. Perhaps the presence or lack thereof of a bursa may be influenced by the age of the cadaver subjects.

3. Beyond all this, I never like to make conclusions based on research alone. I love research, but it should not allow us to ignore well-known principles of anatomy/physiology/kinesiology/histology. To wit, all soft tissue is to some degree elastic and plastic. Fascia is more so plastic than elastic, meaning it can be deformed, meaning it can adapt to forces placed upon it. Indeed, the principle of "creep" states that soft tissue is deformable when a sustained force is placed upon it. To state that the ITB cannot be stretched at all is to throw this well-accepted principle away. Certainly, much of the purpose of dense fibrous fascial tissue such as tendons and ligaments (and the ITB is effectively a tendon for the TFL and gluteus maximus) is to have great tensile strength, meaning that it does resist stretch. Otherwise, tendons would stretch every time that a muscle contracted, meaning that the muscle's contraction force would never be exerted on its attachments. But, having said this, even dense fascial tissue must be somewhat plastic and therefore deformable/stretchable.

4. Given that all soft tissue is somewhat amendable to manual therapy, foam rolling, or massage for that matter, should be somewhat effective. However, given the dense nature of the ITB, I would believe that the manual therapy would have to be performed in a very disciplined manner over a long period of time (months or years) to be effective.

5. In some ways, the conclusion of this study reminds me of the controversy over stretching in general. There are still many people out there who claim in some manner that stretching does not work. Yet, every study I have read shows that IF stretching is done in a disciplined manner over a long period of time, it is effective at increasing flexibility. If the act of placing a tensile (stretching) force can have absolutely no effect upon mechanically deforming fascial soft tissue, then it would seem that we are doomed to becoming ever increasingly tighter and rigid as we age. In a larger picture, this makes no sense to me. I cannot see how movement, whether it is formal stretching or non-formal stretching that occurs as a result of the normal movement of an active lifestyle can have no effect on fascial tissue. Fascial tissue is a mechanical structure that should be able to respond to mechanical forces. To ignore this is to ignore the entire realm of biomechanics.

6. I am actually the last person who should be countering this article's principle tenet because I believe that ITB syndrome does not occur anywhere near as often as it is purported to exist. When ITB friction syndrome does exist, it should be located directly at the lateral femoral condyle (or perhaps at the greater trochanter), but not anywhere along the middle of the ITB, as it is so often claimed to be present. In my opinion, the vast majority of pain anywhere along the ITB (other than the lateral femoral condyle or the greater trochanter) that is blamed on the ITB is actually due to tightness in the underlying vastus lateralis or vastus intermedius. And if this is true, then I would find that foam rolling (or massage) would compress the vastus musculature, which would be a good thing. After all, massage/manual therapy does work the vast majority of the time by compressing soft tissue. So to claim that foam rolling is deleterious is to effectively negate the entire field of manual therapy. (One can think of the wonderful Gil Hedley "Fuzz Speech" in which he describes the benefit of movement and manual therapy toward decreasing the build-up of fascial tissue.) I realize that the author of the study might not intend to make this claim, but it seems the inescapable conclusion of claiming that pressure from foam rolling should be avoided (unless he is simply ignoring the possible role of the underlying vastus lateralis and vastus intermedius tissue).

All in all, I find that using the results of this study as a basis for the conclusions that

1) ITB friction syndrome does not exist, and

2) manual compression therapy (read: foam rolling) is absolutely ineffective, or worse, deleterious,

would be an unsubstantiated reach.

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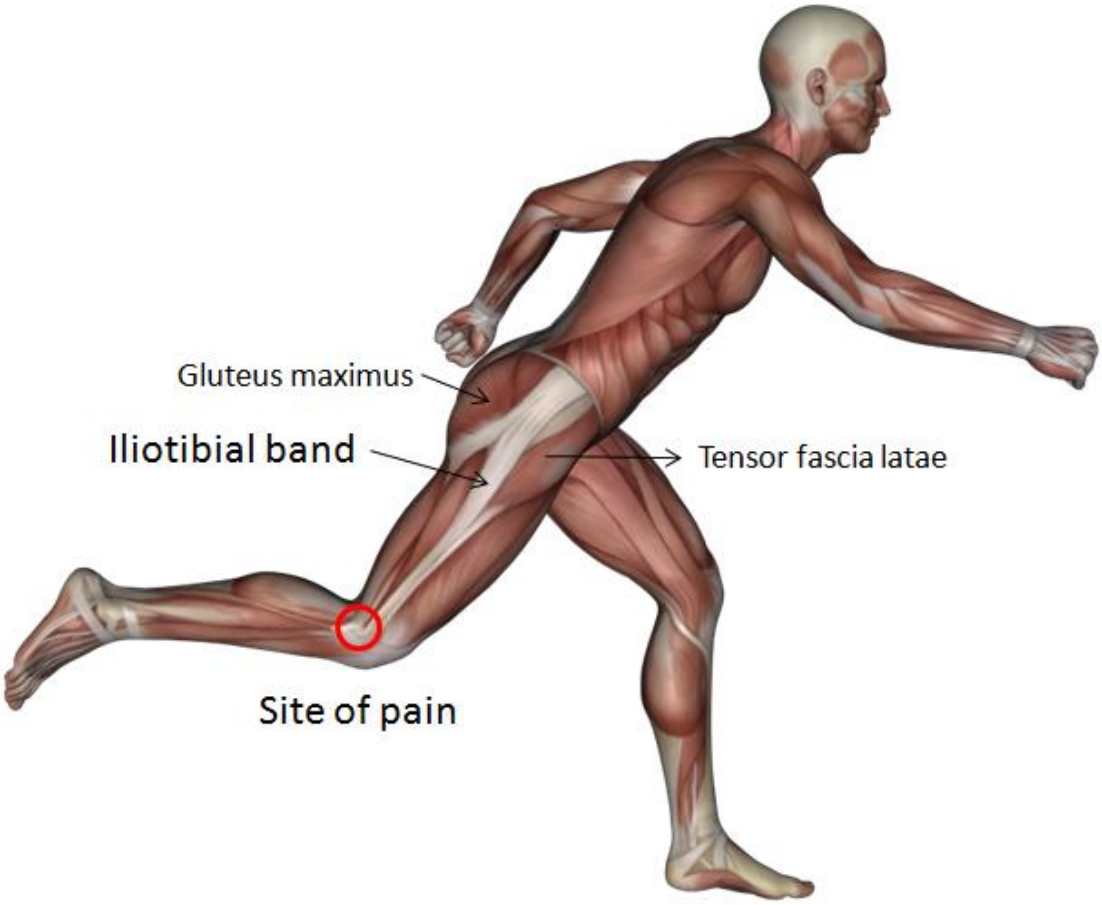

ITB: Empirical evidence is the reality—Robert Baker

First, I want to say – great questions and comments. It really is confusing when you have such well-done studies like Falvey *et al*. that present good information that the ITB stretches minimally in cadavers.

My response is that the clinician gets to choose what works and what does not work. The empirical evidence is the reality. If you use a foam roller and use soft tissue techniques, both the patient and you will know what works. Perhaps the first challenge is helping clients discriminate change in the short and medium term, with a long term strategy. Both the foam roller and hands on techniques will likely move Substance P and other neuro-modulators so a short term pain reduction may be present. Now if pain is a factor in increased tone in soft tissue, then perhaps the overall tone of the entire region may reduce. It may also be true that kinematics improve, and muscle activation changes as pain is reduced. So, the treatment session includes questions about pain reduction, and perhaps observations of gait, step down at 6 inches (15 cm) and maybe other functional tasks. So this clinical assessment of pain and function and duration of change are key areas to understand empirical outcome.

From the research perspective, there is evidence that ITB length does occur with stretching[1].

I have never seen a research project that tested foam roller. However the physiological concept is moving neuro-modulators, and traditional tack and stretch soft tissue methods that we use with our hands and instruments. In the literature, I think expert opinion favours hands-on techniques[2]. Conceptually, one soft tissue deficit is the bow string effect of the vastus lateral and biceps femoris that I referenced in my review paper. In this case you are trying to normalize the interface between the adjacent soft tissues to reduce that stress among those structures. Another conceptual approach is to look at the overall tone of the soft tissue including the gluteus maximus and TFL to ITB connects. This is based in part on the recent work of Carolyn Eng and colleagues[3] looking at the ITB as an energy absorbing structure in swing phase and delivers energy back in stance phase. So in effect, you are normalizing the tone of the ITB as a musculoskeletal structure interacting with the biceps femoris, vastus lateralis, and perhaps other muscles that affect running stride.

The point that I am suggesting is that the ITB functions as more than a physical constraint to the lateral knee and femur. It likely has a proprioceptive role, and may even contribute energy to help running economy. The role of soft tissue mobilization may be to promote better tone among the related

muscles, and reduce pain caused by neuromodulators, trigger points and perhaps adhesions to nearby muscles. If you are looking at improved kinematics by better muscle performance, then the issue of a length change in the ITB is more an academic debate than a primary focus. The soft tissue work readies the muscles to work within their capacity in a pain reduced and overall healthier environment.

Muscle contractions and joint kinematics are the factors to treat. So your body work is trying to assist in muscle performance: well timed, appropriate duration and well balanced. The soft tissue work aims at normalizing muscle tone to improve muscle performance: eccentric and isometric muscle activation from lumbar core through the hip. Reducing pain, trigger points, tension, all normalize muscle tone and muscle readiness. Promoting the lumbar core length tension relationships may be a factor as well, but this is not fully researched.

Your empirical assessment should consider more than simply pain or ITB length, as an improvement is better lowering of the body with fewer trunk, pelvic and knee deviations. Unfortunately, the root factor may be non-visible – strain rate issues. So we have to use kinematic and muscle activation to gauge strain rate. Hamill *et al*. [4] found significant strain rate issues but not significant strain issues. So you can have a kinetic factor (strain rate) without necessarily a change in length factor. So the question of whether or not the ITB lengthens is not the only consideration, and may be a secondary consideration.

I will close by suggesting that a person cannot be at their best if stressed and irritated, and pulled and pushed while trying to perform. The same is likely true for the ITB. My suggestion is that the ITB works with muscles that cannot perform well in a painful, irritated, push and pull environments. Our techniques should aim to create relaxed muscle tone and hospitable environments where muscle performance is easier for the entire run and entire day.

The foam roller can be gentle or aggressive, so the actual method for the foam roller is based on your goal. If you simply want to move neuromodulators and ease tone, tweak that method so the ITB is nurtured at its own pace. If you want to separate adhesions between neighbouring muscles, perhaps you modify the technique to stretch and isolate those structures as appropriate to any other stretching technique. Creative use of therapeutic balls may be even better. Your clinical empirical evidence seems appropriate to use when assessing these approaches.

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ITB: Don't let one study deter you from work on this area — Art Riggs

What an interesting subject! I appreciate and agree with most all the comments of your experts, but after reinforcing some of their statements, I'd like to take a more informal approach to some of the broader issues that we therapists must deal with in interpreting and implementing research studies into our practices and offer a few strategies for work.

Of course I agree with the comments questioning the validity of conclusions about the stretching ability of the ITB from embalmed cadaver studies, and that even if it does not stretch appreciably, that benefits from manual therapy to the ITB can still be achieved and may be due to many other factors such as neuromodulators, trigger points, or release of adhesions. I particularly liked Joe Muscolino's caveat against extrapolating manual therapy strategies from isolated studies, along with his pointing out that fibrous tissue has different qualities besides just ability to stretch. I'll add my skepticism of jumping to conclusions from purported "evidence-based" research implying that manual therapy to the band is ineffective and that treating ITBS, "*…can **only** (my emphasis) be properly achieved when the biomechanics of hip muscle function are properly addressed*." Such exclusionary and simplistic implications that stretching and manual work on the ITB is not productive would short-change creative analysis and treatment of a complex situation that our clients desire. I would also suggest a more complex "chicken/egg" feedback loop, where the increased tension and especially pain of ITBS can **cause** dysfunction of muscles and joints rather than just being a result of their dysfunction.

The narrow conclusions and implications of treatment of the article remind me of other controlled cadaver studies stating that the SI joint is immovable, and quibbling over distinctions between "true" sciatica and apparent "false" sciatica that seems to discount overlap in symptoms and effective treatment.

Of necessity, careful evidence-based research must isolate factors, both of anatomy, symptoms, and treatments. But inference from the study that defines and limits ITBS symptoms as lateral knee pain and implies that since the ITB can't be stretched, attempts to lengthen are useless, is an example of the pitfalls of improper inference from isolated facts, especially in brief summaries or abstracts.

Abstracts and capsulized summaries often neglect many important descriptions of the methods and conclusions of the studies. A famous comic quipped, "I used speed-reading for Tolstoy's *War and Peace* and it only took 45 minutes!!!.....It was about Russia." More studied reading of the studies and comments from other researchers exemplify the importance of more careful reading and consideration of experiments and data. As a brief example, the measure of stretch was performed only with tension devices placed 8 cm proximal to the lateral condyle of the knee—questionably an accurate measure of the complex activity of movement of the ITB during activity.

What is the ITB? It is valuable that the authors point out that it is not a discrete anatomical entity but a thickening of the iliotibial tract or fascia latae. So extrapolating causes and treatment from isolated measurement of the ITB seems "a stretch" of throwing the baby out with the bathwater. ITBS would seem to be much broader in scope and this exemplifies the importance of semantics when anatomy makes its way into everyday speech by laymen. We see this in many other popularizations and simplifications of anatomy. For many people the "glutes" seem only to refer to gluteus maximus rather than the complicated weave of all the posterior pelvic muscles. To the public, the term "abs" refer only to

Figure 1. The Lateral line.

rectus abdominus rather than the complex relationship between the internal and external obliques, and transversus abdominus, as well as deeper abdominal muscles.

Attempting to isolate the ITB from the more accurate complex of the iliotibial tract and muscular and fascial connections that go both distal to the knee and ascend past the pelvis seems misleading. I think the more functional term "lateral line" (Figure 1) used Ida Rolf, Tom Myers, James Earls and many other structural integrators is much more useful and helpful for planning strategy, and henceforth I will speak to the issues of the term "ITB" with this broader definition.

Pain along the lateral line also seems much more extensive than just lateral knee pain caused from running and other athletic endeavours mentioned in the article; albeit the information that a bursa often does not even exist was very interesting. Many people, including non-athletes report considerable pain on the entire length of the lateral line. I would suggest that a tight and misaligned lateral line may be associated as both a cause and effect of strain patterns descending to foot balance and plantar fasciitis, and ascending upwards to hip and low back pain and stress patterns.

Also, although the lateral line does indeed *act like* a tendon in contraction of the TFL and gluteus maximus, it is not a tendon and has different cellular composition with properties of collagen and fascia with a capacity to alter its texture in response to manual therapy. Its role is not simply to exert force on the knee joint like a Newtonian physics pulley. In many ways it acts like a postural muscle to enable standing without muscular contraction, providing lateral stability, and has the important role of dissipating and distributing shock from foot plant. When stress is applied to the lateral line it actually recoils like a spring to augment muscular contraction from above and increase spring in walking and jumping.

Moving Beyond the Study to Applications

Since ITBS is so common, I'd like to move beyond the "science" of an isolated study to discuss some issues for treatment. Let's face it… it is very common for clients to come to us seeking manual work with complaints about pain in the lateral line and reporting benefit from manual therapy that go well beyond what would be expected from a placebo effect. We need to be able to work with this issue with understanding and skill.

Alignment of stress through joints and tissue by minimizing torsional strain is at least as important as simple stretching. Effective therapy should consider global issues of joints, fascia, transmission of shock, and the differences in the structure of individuals. A good structural integration approach should consider among others: varus/valgus knee patterns, internal/external femur rotation, anterior/posterior pelvic tilt and stress from factors in feet in pronation/supination and inversion/eversion.

Addressing ITBS causes and treatments

Manual therapy along the entire lateral line in combination with frequent and consistent home programs is an excellent plan, but it is crucial to recognize that alignment of torsional forces is equally important. A tight and painful lateral line can be reacting to very different body structures and activities since tissue and structure thicken according to strain patterns. Assessment of these patterns is crucial for treatment instead of one-size-fits-all unimaginative strokes.

Shock transmission: A varus (bowlegged) knee and a high arched foot in impact related activities will send shock up the lateral aspect of the leg causing thickening of the entire area including vastus lateralus. Working with the feet for more balanced foot plant by mobilizing the lateral and medial arches to dissipate shock is often helpful along with attention to the adductors and medial leg for lateral/medial leg balance.

Strain and overwork of the lateral leg due to valgus knees (knock knees) or over-pronation presents a different problem. This is often a hyper-mobility issue, and soft tissue work would be considerably different from the previous example. The lateral compartments may be compensating in a productive attempt to provide stability, so stretching the ITB may be counter-productive. This is not to imply that thoughtful work on the area should be skipped, but the goals would be to increase circulation, free adhesions, work with trigger points and to work with alignment of the knee and hip. Rather than working to lengthen the ITB, cross-fibre work to break down adhesions and promote tissue health and decrease inflammation would be more effective.

Proximal strain patterns: As the authors note, strain on the ITB is often created from above the knee. Working with gluteus and TFL as described later can be very beneficial. In addition to lengthening and softening these tight muscles, enabling them to glide over deeper tissues by freeing their anterior and posterior borders with precise compartment separation strokes so they may exert force in a direct line depending upon hip flexion or extension. Visualize rolling the muscles from side to side in different positions of hip flexion, paying attention to any possible bias for restrictions on each side.

More global issues: Don't be too muscle specific in treatment; consider broader factors that may influence strain and torsion upon the hip, knee, and feet, including looking at broad fascial strain patterns that may transmit over several body segments. Shoulder carriage, tight lumbar fascia, quadratus lumborum, or hamstrings that are associated with pelvic tilt can significantly improve distribution of strain.

Clarity in intention with touch

The key to softening, lengthening, and aligning fibrous tissues is to grab and stretch the tissue rather than just sliding over it and compressing it. Use lubrication sparingly to enable a good grip and stretch on whatever layer you are working on. The biggest complaint I hear is from too aggressive and painful work. Almost always it is a result of two factors: *First*, working too fast so tissue does not have enough time to melt and cooperate; this actually can

Figure 2. Stretching the lateral line by adducting leg past mid-line.

result in a rebound that counters your attempt to promote lasting release.

Second, working too vertically and painfully compresses the ITB and other fibrosed tissue against the femur. This is the same drawback with foam rollers that several others mention. We are trying to elongate and align tissue, not squeeze and compress. The only force necessary is to slowly sink into whatever level you wish to free, then to grab without sliding and then apply force distally (rather than proximally since compression from activities "jams" the tissue upwards) at a very oblique angle while also working for alignment.

It is crucial to have clarity on your intention and techniques rather than just performing rote strokes without consideration of the depths of restriction. Different layers should be able to slide over each other. I teach the following examples in detail in classes, but limitations on space prevent that now. They are not intended as specific directions but as a conceptual way of working.

Free, align, and lengthen superficial fascia before addressing deeper layers , so it can slide over the fascia lata and consider fascial restrictions above and below the area of lateral pain. Work with broad and soft touch using fingers or palms of the hand to feel the superficial fascia glide over the facia latae. This can be done in neutral positioning, but adding stretch to the entire complex can be accomplished by adducting the leg across the midline. Examples here demonstrate the supine position (Figure 2) and a more aggressive stretch having the client in

Figure 3. Working on the ITB in side-lying position, putting the ITB on a stretch .

side-lying assisted by gravity with the leg extended and hanging off the table (Figure 3).

After working superficial fascia, ***sink to the next layer and very slowly "iron" the entire fascia latae*** by grabbing and sliding with it for length and direction, feeling for wrinkles and thickening and waiting for the tissue to melt. Pin and stretch strokes are an effective strategy using a soft forearm or fists. Rather than just working in a neutral position, lengthening the lateral line by body positioning when working is also very helpful add stretch (Figures 2 & 3).

Figure 4. Softening the lateral line.

Free and clarify anterior and posterior borders of the ITB by "compartment separation" strokes. Notice if the band seems restricted on one side more than the other and clarify the boundaries with precise strokes (Figure 5).

Figure 5. Compartment separation strokes along the anterior or posterior border of the ITB.

Free large groups of muscles and fascia to slide over deep layers, including the femur. Free the lateral line to slide over the deeper vastus lateralus and then roll the whole quadriceps group and lateral compartment around the femur, paying attention to whether if presents a bias to move medially or laterally and working to help it pull in a straight line from the hip to the knee. Grab the entire complex to slide and rotate over deeper tissues and, in turn, visualize sliding all layers to roll around the femur where they seem "stuck" to the bone. (Figure 6).

Figure 6. Grabbing, rolling, and mobilizing the ITB from both deep restrictions and from adjacent, parallel muscles.

aggressive treatment that can increase symptoms. A home program is essential. As others mention, I'm not a big fan of the foam roller although it certainly seems to be popular. So it may be a worthwhile approach for some people, although I think other options are more effective and humane. One limitation with the foam roller is that it is difficult to work in tangential directions (the ball that Bob Baker mentions can solve this and also allows for different levels of inflation to not be painful.) Foam rollers present an all-or-none situation by having all

Soften and elongate the muscles that attach to the ITB, but pay particular attention to freeing them from adjacent or deeper restrictions. Perform muscle separation strokes along anterior and posterior border of the TFL which may be exerting torsion from adhesions along the anterior or posterior border. "Roll" the muscle using precise pressure with a fist or knuckles so it can work freely in different degrees of hip flexion and extension. Also work along the borders of the gluteus maximus, especially at fibrous build up at its lower attachment and to free it to slide easily from adhesion to the deeper rotators (Figure 7).

Figure 7. Soften and elongate the muscles that attach to the ITB.

Home Exercise

ITBS needs frequent incremental work; it seems unrealistic to create beneficial change by treating every week or two. Trying to make up for lost time between treatments can result in over-

Figure 8. Using a Theracane to "iron" dense tissue in different directions down the entire leg.

of one's weight on the roller which is often too intense for a painful ITB, and can also require a fair amount of strength in the shoulder girdle to move the body and maintain a side-plank yoga posture and create back strain. Too aggressive and perpendicular manual work using excess lubrication that prevents grabbing tissue has the same drawback.

The biggest drawback to the roller is that it only compresses tissue (picture a tire rolling over soft ground and leaving an imprint) rather than the all-important stretching and alignment that are beneficial. For this reason I recommend using a stick of some sort that allows for different directional vectors, variation in pressure, access to adjacent tissue such as lateral hamstrings or quadriceps, and especially, the ability to grab and stretch tissue approximating manual work rather than just compressing.

In the following example (Figure 8), the client is using a Theracane which allows for pinpoint pressure to trigger points from the hip down the entire leg and of course anywhere else on the body. It is also useful to create balance with the adductors while comfortably sitting in a chair. Almost all clients I show this technique to feel it is far more effective and easy to tolerate than foam rollers.

Good luck! And don't let one study deter you from work on this area. Clients want and appreciate work whether for ITBS or just to ease strain and tension. Properly performed manual work on the lateral line not only is helpful for treatment of ITBS, but feels worthwhile and actually pleasant to most everyone.

Art Riggs is a certified advanced Rolfer who has been practicing and teaching in the San Francisco Bay area and internationally for over more than 20 years. His graduate studies were in exercise physiology at the University of California in Berkeley. He is the author of Deep Tissue Massage: A Visual Guide to Techniques, now in a second edition and translated into five languages, and the seven volume companion DVD set. He just released a new "Deep Tissue Massage-A Full Body Integrated Approach" DVD set. His website is at www.deeptissuemassagemanual.com.

More on ITB Research

Iliotibial band stores and releases elastic energy during running

ITB can only found in homo sapiens, and it has been hypothesised that ITB allows us to stand upright. A study from Harvard published in May 2015, examined how the ITB stores and releases elastic energy to make walking and running more efficient. The researchers developed a computer model to estimate how much it stretched — and by extension, how much energy it stored — during walking and running. They found that ITB's energy-storage capacity is substantially greater during running than walking, and that's partly because running is a much springier gait.

Lead author Carolyn Eng explained the role the ITB plays in locomotion: One part of the IT band stretches as the limb swings backward, Eng explained, storing elastic energy. That stored energy is then released as the leg swings forward during a stride, potentially resulting in energy savings. It's like recycling energy, replacing muscles with these passive rubber bands makes moving more economical. There are a lot of unique features in human limbs — like long legs and large joints — that are adaptations for bipedal locomotion, and the ITB just stood out as something that could potentially play a role in making running and possibly even walking more economical. Their calculation showed that largest strains in the anterior part of ITB occur in early swing with ITB stretching 0.9–1.7 cm beyond slack length. Meanwhile peak strains in posterior part of ITB occur in late swing, stretching 1.4–3.0 cm beyond slack length.

We asked Dr. Eng on how she measured the strains of ITB and the difference with the study by Falvey et al.

"In their study, Falvey et al. measured strains in the ITB when the subject's joint angles are static and not changing. I am not surprised that their results suggest small strains in the ITB because they do not account for the muscle/ITB strains occurring when the joints move (e.g., hip and knee flexes for the posterior ITB). These joint angle changes play an important role in determining ITB strains in my study."

"The ITB is undoubtedly integrated with other muscles and connective tissues in the limb and this determines the large forces being transmitted through the structure. While some of the forces generated by the muscles at the hip (i.e., gluteus maximus and tensor fascia lata) may be lost with their connections to other structures/tendons at the hip, a large portion will still be transmitted to the knee via the ITB. Using cadaveric dissections, I determined the percentage of the hip muscles' cross-sectional area (and hence, force) that inserts on and is transmitted to the ITB and my calculations did not include the portions of these muscles that insert on bone or other tendinous structures at the hip."

Eng, C. M., Arnold, A. S., Biewener, A. A., & Lieberman, D. E. (2015). The human iliotibial band is specialized for elastic energy storage compared with the chimp fascia lata. The Journal of Experimental Biology, 218(15), 2382-2393.

Questioning the Ober Test

The Ober test is the most commonly recommended physical examination tool for assessment of ITB tightness. Willet et al. (2016) questioned the validity of the Ober test. They conducted an experiment using embalmed cadavers. They refute the hypothesis that the ITB plays a role in limiting hip adduction during the Ober test and question the validity of these tests for determining ITB tightness. The study suggests that the Ober test assesses tightness of structures proximal to the hip joint, such as the gluteus medius and minimus muscles and the hip joint capsule, rather than the ITB.

Willett, G. M., Keim, S. A., Shostrom, V. K., & Lomneth, C. S. (2016). An Anatomic Investigation of the Ober Test. The American Journal of Sports Medicine, January 11, 2016.

Does the Iliotibial Band Move?

A study by Elsing et al. (2013) examined whether the ITB moves relative to the lateral femoral epicondyle (LFE) as a function of knee flexion in both non–weight-bearing and weight-bearing positions in asymptomatic recreational runners. Evaluation using ultrasound on the ITBs of 20 male and female asymptomatic recreational runners clearly showed an anteroposterior motion of the ITB relative to the LFE during knee flexion-extension. The ITB does, in fact, move relative to the femur during the functional ranges of knee motion.

Jelsing, E. J., Finnoff, J. T., Cheville, A. L., Levy, B. A., & Smith, J. (2013). Sonographic Evaluation of the Iliotibial Band at the Lateral Femoral Epicondyle Does the Iliotibial Band Move?. Journal of Ultrasound in Medicine,32(7), 1199-1206.