**Iliotibial Band: Overview and Details Regarding Iliotibial Band Syndrome**

The iliotibial band (ITB) is a unique tissue often involved in overuse syndromes and lower kinetic chain issues. 1 Iliotibial band syndrome (ITBS) is a particularly troublesome overuse injury for individuals, especially distance runners and cyclists. The purpose of this paper is to provide an overview of the ITB, discuss details concerning ITBS, and attempt to bridge the gap in knowledge of evidence-based interventions and treatment for ITBS. The anatomy, function, and other characteristics of the ITB will also be discussed in detail, as they are important to better appreciate subsequent issues related to this tissue.

**Anatomy**

The ITB is a band of fascia composed of dense connective tissue that acts as the tendinous insertion for gluteus maximus and tensor fascia lata (TFL). 2,3 The ITB originates above the hip joint from these muscles, overlies the vastus lateralis, and separates into two components at the knee: the iliopatellar band and the iliotibial tract. 1 The iliopatellar band connects the anterior aspect of the iliotibial tract and femur to the patella. 1 The iliotibial tract has superficial, middle, deep, and capsular-osseous layers. 1,4 This tract inserts onto the lateral femoral epicondyle, lateral intermuscular septum, lateral capsular ligament, biceps femoris tendon, fibula, and Gerdy’s tubercle. 1,4 An innervated and vascularized fat pad is located between the ITB and its insertion on the lateral femoral epicondyle. 3 Other researchers identified a potential fluid-filled space between the ITB and the lateral femoral epicondyle as well, referred to as the ITB bursa. 5

The ITB insertions form a “horseshoe-like” complex that aid in the anterolateral stability of the knee. 2 Overall, the ITB functions as an important lateral stabilizer and helps to maintain posture during gait. 1,2 It also acts as a synergist with knee flexion and knee extension depending on its position relative to the lateral femoral epicondyle.4

**Movement Studies**

It’s difficult to assess ITB response with changing loads in various ranges of motion that occur during athletic activities. Movement studies have assessed the ITB response with knee flexion and extension in controlled environments, enabling clinicians to better understand the potential implications of the ITB with real-life activities.

Due to the ITB attachment onto the biceps femoris tendon, the band is “pulled” posteriorly during knee flexion. 1 Because of the insertion angle of the iliotibial tract, it is considered a knee extensor when the knee is fully extended or has less than 30 degrees of knee flexion, as the band is anterior to the lateral femoral epicondyle. 1,6 The ITB is a knee flexor when the knee is flexed more than 30 degrees because of its position posterior to the lateral femoral epicondyle. 1,6

Researchers have found compressive forces at the lateral femoral epicondyle with approximately 30 degrees of knee flexion. 2,3,7 Orchard et al7 termed this as the “impingement zone”. Many authors believe ITBS is a friction syndrome due to the ITB rubbing over the lateral femoral epicondyle with activities that require repetitive knee flexion and extension. This irritation results in lateral knee pain, the characteristic symptom of ITBS. 6-11 Some researchers, however, believe it is the approximation of the ITB into the lateral femoral epicondyle that causes inflammation, as opposed to a friction syndrome. 3 Fairclough et al3 found that there is not necessarily anterior-posterior movement over the lateral femoral epicondyle, but rather a change in the tension between anterior and posterior fibers with knee flexion and extension. They concluded the ITB undergoes medial-lateral translation relative to the lateral femoral epicondyle with knee flexion and extension. 3 They also suggested that inflammation of the fat pad beneath the ITB might actually be the reason for the lateral knee pain. 3

Regardless of the cause, there is an agreement of an inflammatory response with this overuse type of injury that leads to lateral knee pain. One review on ITBS noted there might be inflammation and irritation of the lateral synovial recess, posterior fibers of the ITB, and/or inflammation of the periosteum of the lateral femoral epicondyle. 9 With the repetitive irritation and lack of time to heal, the irritated area increases, and so continues the cycle of discomfort. 9 A more recent review acknowledged the potential for subtypes of ITBS, such as irritation of a cyst, bursa, or lateral synovial recess, or compression of the ITB on tissues between the lateral femoral epicondyle and the knee joint line. 10

**Implications on the Patellofemoral and Tibiofemoral Joints**

As discussed earlier, the ITB attaches to various structures, including the femur, tibia, and patella. Studies have confirmed altered patellofemoral and tibiofemoral kinematics due to ITB involvement. One study identified the influence of various ITB loads during an open chain scenario. With increasing loads, the patella translated more laterally, rotated more laterally, flexed, and the lateral aspect of the patella moved posteriorly. 12 These significant differences were noted in scenarios with more than 15 degrees of knee flexion. No patellar tracking changes were noted with full knee extension or within the first 15 degrees of knee flexion. 12 Tibial external rotation and slight adduction were also observed with the loaded ITB. 12 In addition to confirming decreased internal tibial rotation with loading of the ITB, another study also found significant increases in loads through the lateral tibiofemoral articulation and decreases in the medial tibiofemoral articulation. 13 It should be noted that these studies consisted of non-weight bearing loading scenarios. The influence of loading the ITB during closed-chain activities may have different outcomes. Maltracking of the patella may not be as noticeable in a closed chain situation with increased knee flexion considering the increased potential stability of the knee joint.

**Common Injuries**

While the ultimate purpose of this paper is to better understand the pathology and treatment for ITBS, there are other conditions relating to the ITB that should be acknowledged. Trochanteric bursitis is a common condition causing lateral hip pain. The ITB passes over the greater trochanter; repetitive flexing of the hip and pressure to the area may cause inflammation in the fluid-filled sac between the greater trochanter and the ITB. 14 External snapping hip is another condition involving the ITB. External snapping hip may be symptomatic or asymptomatic and is due to the thickened ITB fibers snapping over the greater trochanter with hip flexion and extension. 15 Symptomatic external snapping hip is associated with pain in the greater trochanter region. 15 Patellofemoral syndrome is another condition potentially related to ITB involvement. 10

**ITBS: Background Information**

As discussed before, ITBS is a common pain syndrome experienced by individuals who participate in repetitive knee flexion/extension activities, especially endurance runners and cyclists. Despite this common injury, there is debate over the exact pathoetiology of ITBS, including if it is a friction syndrome or a compressive syndrome, and what exact tissues are inflamed, causing lateral knee pain. Continued research efforts should help to clarify the exact pathoetiology. Meanwhile, it is important to understand the potential root causes for the dysfunction, the clinical presentation along with special tests that should be incorporated to identify this condition, and current treatment options.

**Root Causes for ITBS**

There are intrinsic and extrinsic factors that may contribute to the development of ITBS. Extrinsic factors are often the culprit for this condition. ITBS is commonly referred to as an overuse injury, often due to individual training errors. They may increase intensity, distance, and/or duration too quickly with activities like running, cycling, and jumping. 6 Other training errors by runners may include incorporating excessive hill running, excessive stride length, and running over uneven terrain that imposes excessive strain on the lateral aspect of the knee. 6 Poor equipment, such as footwear, and saddle position may also lead to ITBS. 6

There are a plethora of intrinsic factors that may contribute to ITBS, including: tight iliotibial band, tight TFL, tight gluteus maximus, weak hip abductor musculature, improper firing of the TFL, reduced hamstring strength compared to quadriceps strength, greater hip adduction angles, greater knee flexion angles during stance, greater peak knee internal rotation angles, abnormal foot and ankle biomechanics (e.g. greater rearfoot eversion), genu recurvatum, genu varus, decreased tibial internal rotation, and femoral external rotation. 2,6,10,16

**Clinical Presentation of ITBS**

The patient history and physical therapy examination help to distinguish ITBS. The patient history may identify training errors mentioned above. Additionally, individuals with ITBS will likely describe lateral knee pain as their main symptom. Some individuals may be able to describe exactly when the onset of pain occurs during their respective activity. 6 Runners, specifically, may be able to describe increased discomfort when running up or downhill, or when attempting to increase their stride. With worsening ITBS, the onset of pain may begin to occur earlier in their activity. 6

With the clinical examination, the patient is often tender to palpation on the ITB on the lateral femoral epicondyle, or between the insertion of the ITB between the lateral femoral epicondyle and Gerdy’s tubercle. When palpating the lateral femoral epicondyle with knee flexion and extension, some researchers have described a “creaking” sound, similar to when one rubs a balloon. 6 Other researchers have described a “wet leather” sound. 6 Additionally, the clinician may note signs of swelling.  6

There are three special tests commonly utilized by therapists to identify issues related to ITB and potentially indicate ITBS: Noble Compression, Ober, and Modified Ober tests. No studies have confirmed the diagnostic accuracy/psychometric properties of these exams at this time, but they continue to be recommended and used in the clinic.

The Noble Compression test helps to identify ITBS. With the patient lying supine and their involved knee flexed at 90 degrees, the therapist passively extends the patient’s lower extremity while applying pressure just proximal to the lateral femoral epicondyle. Reproduction of symptoms around 30 degrees of knee flexion indicates a positive test.

The Ober test helps to identify ITB tightness, which may contribute to ITBS. With the patient sidelying and the involved lower extremity side up, the therapist passively extends and abducts the patient’s hip, while the knee is maintained at 90 degrees of knee flexion. The therapist then allows the patient’s hip to adduct while stabilizing their pelvis and maintaining hip extension and knee flexion. If the patient’s involved lower extremity does not adduct, the test is positive and indicates ITB tightness. Clinicians may use an inclinometer to be more precise measuring ITB flexibility with the Ober test. 17 Reese and Bandy17 studied the use of inclinometers and found good intrarater reliability (ICC=0.9). Additionally, Ferber et al18 studied subjective reports with objective inclinometer findings in 300 athletes (250 injured; 50 controls) to establish “normative” values and identify “critical” values for ITB flexibility. They found “normal” ITB flexibility was -24.59 degrees +/- 7.27 degrees. The “critical” criterion for ITB flexibility was -23.16 degrees. 18

Modified Ober test is similar to the Ober test described above, with the modification of the knee being extended throughout the test. Again, clinicians may use an inclinometer to be more precise in measuring ITB flexibility. 17 Reese and Bandy17 identified good reliability with this test as well (ICC=0.91). Clinicians should note these are two separate tests with differing “normal” values and results with inclinometer readings. The Modified Ober test was noted to have significantly greater hip adduction range of motion compared to the Ober test. 17 These tests should not be used interchangeably when retesting for ITB flexibility throughout the rehabilitation course. 17

One physical therapist published literature recommending a “new” special test to be utilized in the clinic: a combination of Noble and Ober tests. 19 The author reported anecdotal evidence of success using a combination of the two tests to better identify ITB issues. 19 He recommends positioning the patient as one would for the Ober test with the knee flexed to 90 degrees. The therapist would then passively extend and flex the knee, while applying direct pressure over the lateral femoral epicondyle and noting the patient response for pain. If the first version does not reproduce the patient’s symptoms, he recommends progressing from passive knee flexion and extension to active knee flexion and extension to increase strain in the ITB. He also discusses including either a medial and/or lateral patellar glide during the passive or active knee flexion/extension movements as it could also reproduce the patient’s symptoms. He notes a medial patellar glide typically increases symptoms, while a lateral patellar glide reduces the patient’s symptoms. He discusses yet another modification, tibial internal rotation while moving from knee flexion/extension, as it could also reproduce the patient’s symptoms.

If these tests do not reproduce the symptoms in sidelying, the therapist may try straining the ITB with the patient in a full or partial weight-bearing position. The patient performs a curtsy-like lunge by having the uninvolved lower extremity lunge behind the involved side, while the therapist applies pressure to the lateral femoral epicondyle. 19

**Differential Diagnosis for ITBS**

The patient history and examination may lead clinicians to believe the patient’s discomfort is due to ITBS. As always, however, clinicians should be aware of other diagnoses that may present similarly. Differential diagnosis for ITBS may include a lateral meniscal tear, lateral compartment degenerative joint disease, biceps femoris tendinopathy, stress fracture, patellofemoral syndrome, lateral collateral ligament pathology, synovial knee cyst beneath the ITB arising from the knee capsule, synovial sarcoma, and potentially snapping popliteal tendon. 6,20-22

Physicians may order MRIs to rule out other conditions, and may also be used to help confirm the diagnosis of ITBS. 6 While imaging is not often utilized, it may be necessary for individuals with chronic conditions. Imaging has found thickening in the ITB over the lateral femoral epicondyle, and increased signals in the fluid-filled area between the lateral femoral epicondyle and the ITB.5,6

**Current Treatment Options for ITBS**

There are conservative and surgical measures to address ITBS. Treatment depends upon the stage of the condition: acute, subacute, or chronic. Conservative options most often lead to successful outcomes. While there are a multitude of conservative options, there is a lack of evidence confirming the benefits of these interventions and identifying which are optimal for addressing ITBS.

Individuals may be able to return pain-free to activities within 6 to 8 weeks using conservative measures. 10 In general, activity modification/rest, NSAIDs and potentially cryotherapy are indicated during the acute period to control pain and inflammation. Once the inflammation is reduced, stretching of the ITB complex is often discussed in literature. Fredericson et al23 studied the effectiveness of three standing ITB stretches. All stretches incorporate the uninvolved lower extremity crossing over the involved, and leaning away from the involved side. The three variations are due to the changing position of the upper extremities. The first version is with hands on the hips, the second is with the arms overhead, and the final is with the arms overhead, but they are reaching away and down from their involved side. All three stretches caused a significant increase in ITB length. The second version was the most consistent/effective for changes in ITB length. 23

Progressive strengthening is often recommended, in addition to stretching. Gluteus maximus and medius, TFL, and core muscles help stabilize the pelvis and prevent hip adduction, knee varus, and knee valgus with activities, thereby preventing unnecessary strain on the ITB. 2,6

Neuromuscular re-education may be indicated to retrain the individual for proper neuromuscular control, such as proper timing of gluteus medius and TFL activation. 6 Education regarding running mechanics, such as altering their foot-strike, may be necessary. 6 Foot orthoses may also be needed based upon clinical examination findings. 6

Brosseau et al24 discussed the clinical implications of deep transverse friction massage to treat tendinitis in a Cochrane review. Only one randomized controlled trial (RCT) was included that involved ITBS. This RCT compared deep transverse friction massage combined with rest, stretching, cryotherapy, and therapeutic ultrasound, to a control group that had the same treatments, except for the massage component. No statistical significance was found within the four sessions for the participants. While there was no evidence of clinical significance, more high quality studies are needed to assess its effectiveness. At this time, deep transverse friction massage may not be indicated considering the potential for ITBS to be a friction-related syndrome. Adding an additional frictional component may not be advantageous.11

While deep transverse friction massage may not be indicated to the problematic area, breaking up adhesions and targeting trigger points along the rest of the ITB tissue may be beneficial. 11 Foam rolling is commonly recommended as a treatment option, but there is a lack in research demonstrating its beneficial influence on the ITB and/or ITBS. 6,11 Graston and active release techniques are growing in popularity, but again, there is a lack of evidence for the use of these treatment options. 6 The concept of Graston technique is to utilize different stainless steel instruments to identify tissue adhesions and use the technique to treat the tissues. 25 Chiropractic students conducted a RCT25 at their school to identify its influence on 14 classmates that had a positive Ober test. Their outcome measures were subjective reports of pain or tightness related to ITB, and the Ober test. The experimental group received two Graston Technique treatments on the ITB for two minutes over a period of one week. The control group received a sham treatment. The researchers found all participants who received the Graston Technique had improved subjective pain reports after the treatment. Five of the seven who received the treatment had a negative Ober test. Participants in the sham group did not have reduced pain reports, and all still had a positive on the Ober test. While this is not a high quality study, it indicates the potential for conducting future, high quality studies to examine if there are benefits of using the Graston Technique to treat ITBS.

Some companies have designed an ITB compression-like strap that is placed proximal to the knee joint to change the amount of stress on the actual lateral femoral epicondyle. Once again, there is a lack in research confirming and supporting the benefit of this device.

Physicians may utilize corticosteroid injections to reduce the inflammation and decrease pain for individuals presenting with ITBS. 6 ITBS that does not respond to any of these conservative measures may be treated surgically. One method is Z-lengthening. This procedure involves incisions that form a “z” figure, lengthening the ITB approximately 1.5cm, and then repairing the ITB in the lengthened position with sutures. 26 Another procedure involves extracting a triangular piece of the ITB from the area that overlies the lateral femoral epicondyle when the knee is flexed at 30 degrees (the “impingement zone”). 11 At times a lateral release procedure is used. Lateral releases, in general, should be performed on the pathological portions of the ITB to try and maintain its overall function. For example, if the knee is tight laterally with knee extension, the posterior portions should be slackened. If the knee is tight laterally with knee flexion, then the anterior portions should be selected for the procedure. 27 An ITB bursectomy, removal of the inflamed bursa below the ITB, is another surgical option. 28 Sangkaew29 published a case report of a newer, promising technique, the “mesh” technique. Multiple small (approximately 2mm long) incisions are made perpendicular to the ITB fibers overlying the lateral femoral epicondyle. The incisions are then enlarged through ITB tension and appear as tiny puncture wounds, the “mesh” appearance. This surgery resulted in relaxation of the tight ITB and ability to perform activities pain-free through the two-year follow-up. 29

**Conclusions**

The ITB is an important tissue for lateral knee stability and is often involved in overuse injuries. The exact pathoetiology of ITBS is not confirmed. Currently, there is debate whether it is due to friction from anterior-posterior movement of the ITB on the lateral femoral epicondyle or approximation of the ITB on the lateral femoral epicondyle, and whether the pain is from inflamed ITB tissue, an inflamed bursa beneath the ITB, and/or pain from irritated adipose tissue beneath the ITB. Patient history and examination during the physical therapy evaluation are critical in identifying ITBS, along with the root causes for developing this condition. There is a lack in research identifying optimal conservative measures to treat ITBS. In general, rest, ice, and NSAIDs are recommended during the acute inflammatory period. Progress to stretching, strengthening, foam rolling and/or manual therapy to reduce soft tissue adhesions in the ITB, as needed. Identifying and addressing the root cause(s) of the ITBS is always indicated. Clinicians should make sure to recognize any extrinsic and/or intrinsic factors that may contribute to the development and persistence of ITBS. Further research is needed to identify optimal conservative treatments for ITBS and preventive measures for developing this syndrome.

References:

1. Hertling D, Kessler R. *Management of common musculoskeletal disorders: Physical therapy principles and methods.* Fourth ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2006.

2. Baker RL, Souza RB, Fredericson M. Iliotibial band syndrome: Soft tissue and biomechanical factors in evaluation and treatment. *PM R*. 2011;3(6):550-561. doi: 10.1016/j.pmrj.2011.01.002; 10.1016/j.pmrj.2011.01.002.

3. Fairclough J, Hayashi K, Toumi H, et al. The functional anatomy of the iliotibial band during flexion and extension of the knee: Implications for understanding iliotibial band syndrome. *J Anat*. 2006;208(3):309-316. doi: 10.1111/j.1469-7580.2006.00531.x.

4. Vieira EL, Vieira EA, da Silva RT, Berlfein PA, Abdalla RJ, Cohen M. An anatomic study of the iliotibial tract. *Arthroscopy*. 2007;23(3):269-274. doi: 10.1016/j.arthro.2006.11.019.

5. Ekman EF, Pope T, Martin DF, Curl WW. Magnetic resonance imaging of iliotibial band syndrome. *Am J Sports Med*. 1994;22(6):851-854.

6. Strauss EJ, Kim S, Calcei JG, Park D. Iliotibial band syndrome: Evaluation and management. *J Am Acad Orthop Surg*. 2011;19(12):728-736.

7. Orchard JW, Fricker PA, Abud AT, Mason BR. Biomechanics of iliotibial band friction syndrome in runners. *Am J Sports Med*. 1996;24(3):375-379.

8. Jelsing EJ, Finnoff JT, Cheville AL, Levy BA, Smith J. Sonographic evaluation of the iliotibial band at the lateral femoral epicondyle: Does the iliotibial band move? *J Ultrasound Med*. 2013;32(7):1199-1206. doi: 10.7863/ultra.32.7.1199; 10.7863/ultra.32.7.1199.

9. Ellis R, Hing W, Reid D. Iliotibial band friction syndrome--a systematic review. *Man Ther*. 2007;12(3):200-208. doi: 10.1016/j.math.2006.08.004.

10. Lavine R. Iliotibial band friction syndrome. *Curr Rev Musculoskelet Med*. 2010;3(1-4):18-22. doi: 10.1007/s12178-010-9061-8; 10.1007/s12178-010-9061-8.

11. Fredericson M, Weir A. Practical management of iliotibial band friction syndrome in runners. *Clin J Sport Med*. 2006;16(3):261-268.

12. Merican AM, Amis AA. Iliotibial band tension affects patellofemoral and tibiofemoral kinematics. *J Biomech*. 2009;42(10):1539-1546. doi: 10.1016/j.jbiomech.2009.03.041; 10.1016/j.jbiomech.2009.03.041.

13. Gadikota HR, Kikuta S, Qi W, Nolan D, Gill TJ, Li G. Effect of increased iliotibial band load on tibiofemoral kinematics and force distributions: A direct measurement in cadaveric knees. *J Orthop Sports Phys Ther*. 2013;43(7):478-485. doi: 10.2519/jospt.2013.4506; 10.2519/jospt.2013.4506.

14. Trochanteric bursitis. [http://www.uptodate.com.libproxy.lib.unc.edu/contents/trochanteric-bursitis?source=search\_result&search=trochanteric+bursitis&selectedTitle=1~10](http://www.uptodate.com.libproxy.lib.unc.edu/contents/trochanteric-bursitis?source=search_result&search=trochanteric+bursitis&selectedTitle=1~10" \t "_blank). Accessed 12/1/2013, 2013.

15. Ilizaliturri VM,Jr, Camacho-Galindo J. Endoscopic treatment of snapping hips, iliotibial band, and iliopsoas tendon. *Sports Med Arthrosc*. 2010;18(2):120-127. doi: 10.1097/JSA.0b013e3181dc57a5; 10.1097/JSA.0b013e3181dc57a5.

16. Kisnery C, Colby LA. *Therapeutic exercise: Foundations and techniques.* Fifth ed. Philadelphia, PA: F.A. Davis Company; 2007.

17. Reese NB, Bandy WD. Use of an inclinometer to measure flexibility of the iliotibial band using the ober test and the modified ober test: Differences in magnitude and reliability of measurements. *J Orthop Sports Phys Ther*. 2003;33(6):326-330. doi: 10.2519/jospt.2003.33.6.326.

18. Ferber R, Kendall KD, McElroy L. Normative and critical criteria for iliotibial band and iliopsoas muscle flexibility. *J Athl Train*. 2010;45(4):344-348. doi: 10.4085/1062-6050-45.4.344; 10.4085/1062-6050-45.4.344.

19. Rosenthal MD. Clinical testing for extra-articular lateral knee pain. A modification and combination of traditional tests. *N Am J Sports Phys Ther*. 2008;3(2):107-109.

20. Mesiha M, Bauer T, Andrish J. Synovial sarcoma presenting as iliotibial band friction syndrome. *J Knee Surg*. 2009;22(4):376-378.

21. Costa ML, Marshall T, Donell ST, Phillips H. Knee synovial cyst presenting as iliotibial band friction syndrome. *Knee*. 2004;11(3):247-248. doi: 10.1016/j.knee.2003.07.003.

22. Crites BM, Lohnes J, Garrett WE,Jr. Snapping popliteal tendon as a source of lateral knee pain. *Scand J Med Sci Sports*. 1998;8(4):243-244.

23. Fredericson M, White JJ, Macmahon JM, Andriacchi TP. Quantitative analysis of the relative effectiveness of 3 iliotibial band stretches. *Arch Phys Med Rehabil*. 2002;83(5):589-592.

24. Brosseau L, Casimiro L, Milne S, et al. Deep transverse friction massage for treating tendinitis. *Cochrane Database Syst Rev*. 2002;(4)(4):CD003528. doi: 10.1002/14651858.CD003528.

25. Iliotibial band syndrome: A common source of knee pain - american family physician. [http://www.aafp.org/afp/2005/0415/p1545.html](http://www.aafp.org/afp/2005/0415/p1545.html" \t "_blank). Accessed 12/4/2013, 2013.

26. Richards DP, Alan Barber F, Troop RL. Iliotibial band Z-lengthening. *Arthroscopy*. 2003;19(3):326-329. doi: 10.1053/jars.2003.50081.

27. Whiteside LA, Roy ME. Anatomy, function, and surgical access of the iliotibial band in total knee arthroplasty. *J Bone Joint Surg Am*. 2009;91 Suppl 6:101-106. doi: 10.2106/JBJS.I.00532; 10.2106/JBJS.I.00532.

28. Hariri S, Savidge ET, Reinold MM, Zachazewski J, Gill TJ. Treatment of recalcitrant iliotibial band friction syndrome with open iliotibial band bursectomy: Indications, technique, and clinical outcomes. *Am J Sports Med*. 2009;37(7):1417-1424. doi: 10.1177/0363546509332039; 10.1177/0363546509332039.

29. Sangkaew C. Surgical treatment of iliotibial band friction syndrome with the mesh technique. *Arch Orthop Trauma Surg*. 2007;127(4):303-306. doi: 10.1007/s00402-006-0152-3.