MYOFASCIAL PAIN AND TRIGGER POINT INJECTIONS

THE LOWER BODY

BY MINESH NARAN, MD

Student resources access at
www.doctornaran.com

Illustrated by Gabi Westphal

Index

Chapter 1: Erector Spinae Muscles

The superficial layer of this muscle group consists of long-fiber longitudinal muscles and the deeper group of muscles are short diagonal muscles. This muscle group's main function is to provide extension movement of the spine and assist in stabilization and rotation of the upper torso. The outer layer of fibers provides the extension, while the deeper shorter muscles provide the stabilization and rotation.

Muscle Groups and Attachments

The superficial group of muscles attach above to the transverse processes of all the thoracic vertebrae and from the ribs from the first to the nineth rib. Below, it attaches to the lumbar transverse processes and to the anterior layer of the lumbocostal aponeurosis. The deep paraspinal muscles attach medially and above to the base of a vertebral spinous process. Laterally and below, they attach to the transverse process crossing five vertebrae down to the tenth vertebrae.

Referred Pain Pattern

When TrPs are activated in the superficial paraspinal muscles (longissimus thoracis) will have pain to the mid-thoracic area, upward over the shoulder and laterally to the chest wall. Activated TrPs in the iliocostalis muscle cause mid back pain across the scapula and around the abdomen. Pain to the lumbar region radiating to the buttock or around the side are related to activate TrPs to the iliocostalis lumborum and the longissimus thoracis.

The deep paraspinal muscles, the multifidi, refers pain to the region around the spinous process of the vertebra adjacent to the TrP. Multifidus' TrPs to the upper back can even refer pain anteriorly to the abdomen. In the lower back, multifidus TrPs at S1 radiate pain toward the coccyx often making the coccyx feel pressure sensitive.

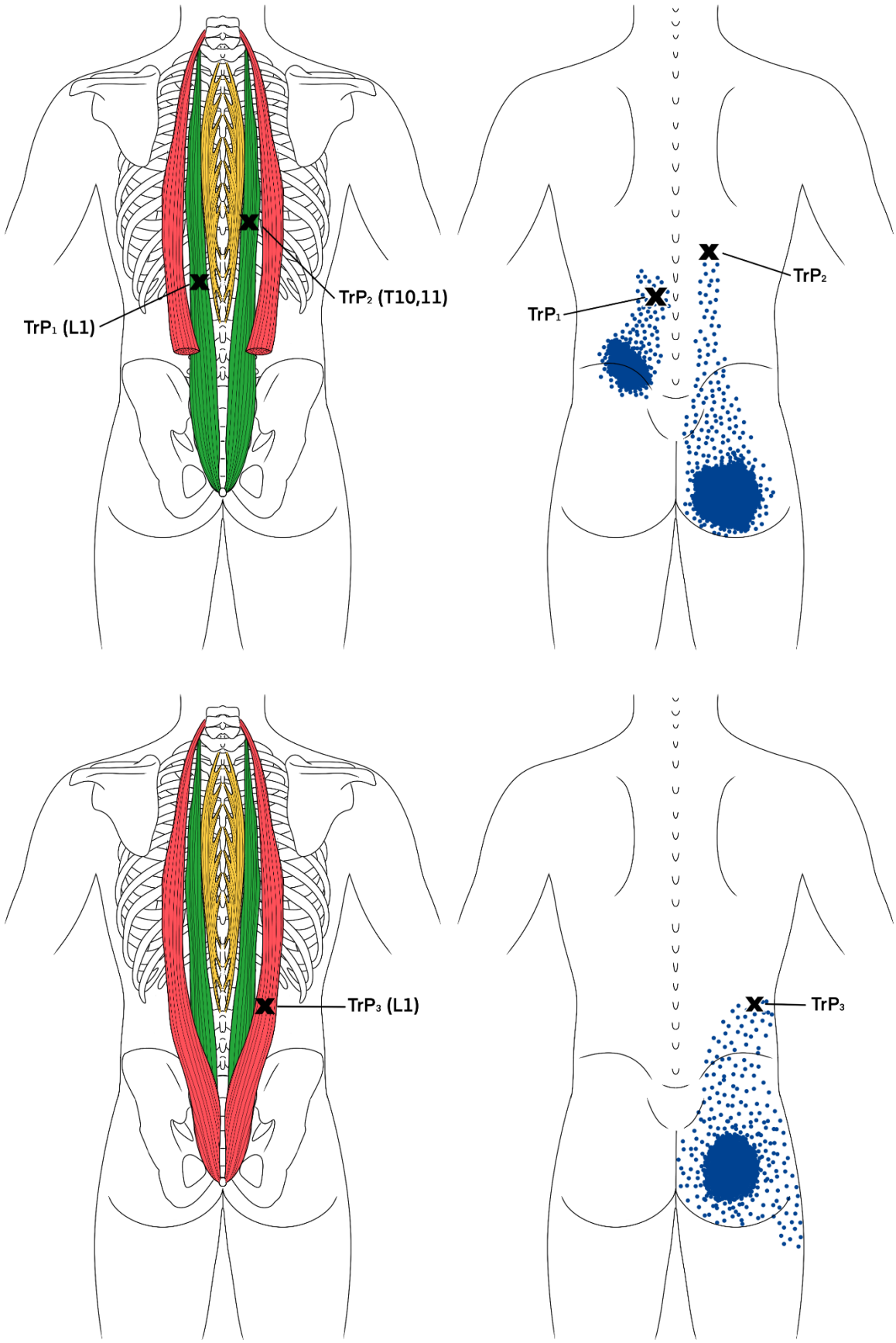

Figure 1: : Trigger Points and Pain Patterns in the Superficial Erector Spinae.

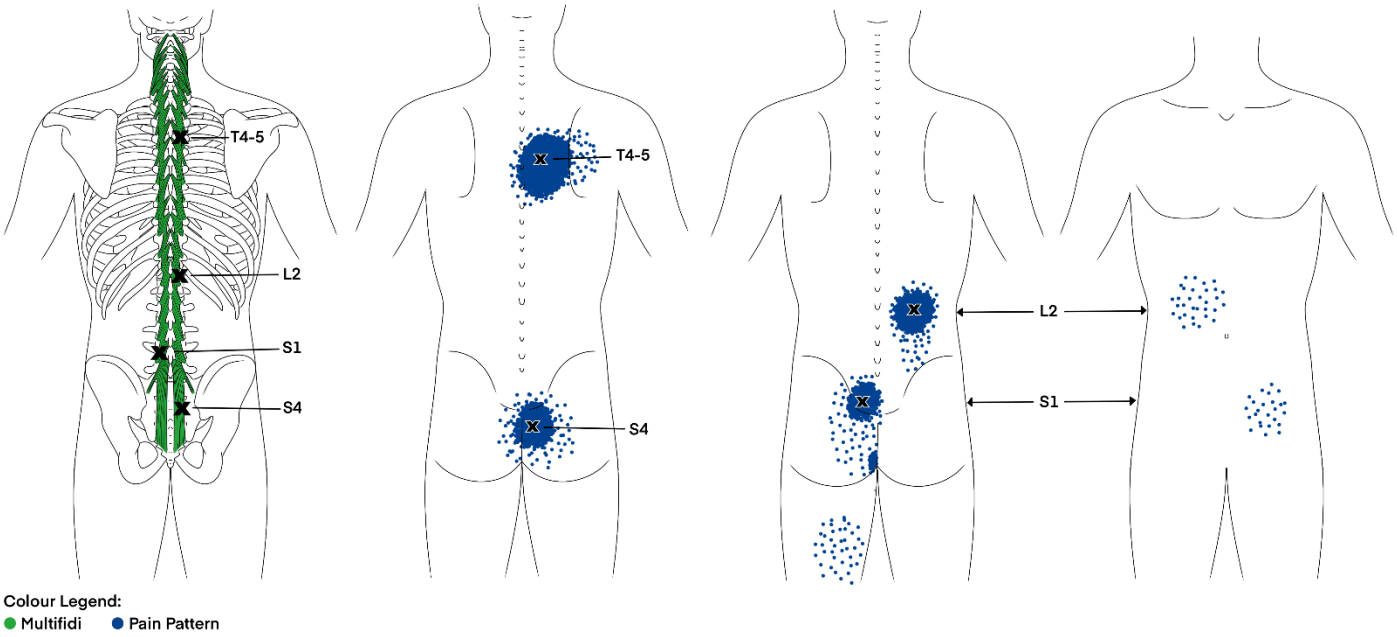

Figure 2: Trigger Points and Pain Patterns in the Multifidi.

Chapter 2: Quadratus Lumborum Muscles

The quadratus lumborum is made out of three distinct groups of muscle fibers: the iliocostal, iliolumbar and the lumbocostal fibers. The main purpose of these muscle fibers is to work together to provide stability to lumbar spine and with hip flexion. Bilaterally, it is partially responsible for forced exhalation and coughing.

Muscle Groups and Attachments

The iliocostal fibers attach in a vertical formation above from the 12th rib and below to the posterior ilium and iliolumbar ligament. The iliolumbar fibers attach diagonal from L1-L4 and below to the crest of the ilium and the iliolumbar ligament. The lumbocostal fibers attach diagonally in an interdigitated pattern lying anteriorly to the iliocostal fibers and attach to the iliac and costal attachments.

Referred Pain Pattern

TrPs activated in the quadratus lumborum muscle radiates posteriorly to the sacroiliac joint, over the gluteus maximus, along the iliac crest and referring into the lower abdomen. Often, pain is felt to the groin and greater trochanter to the point that sleep is disrupted.

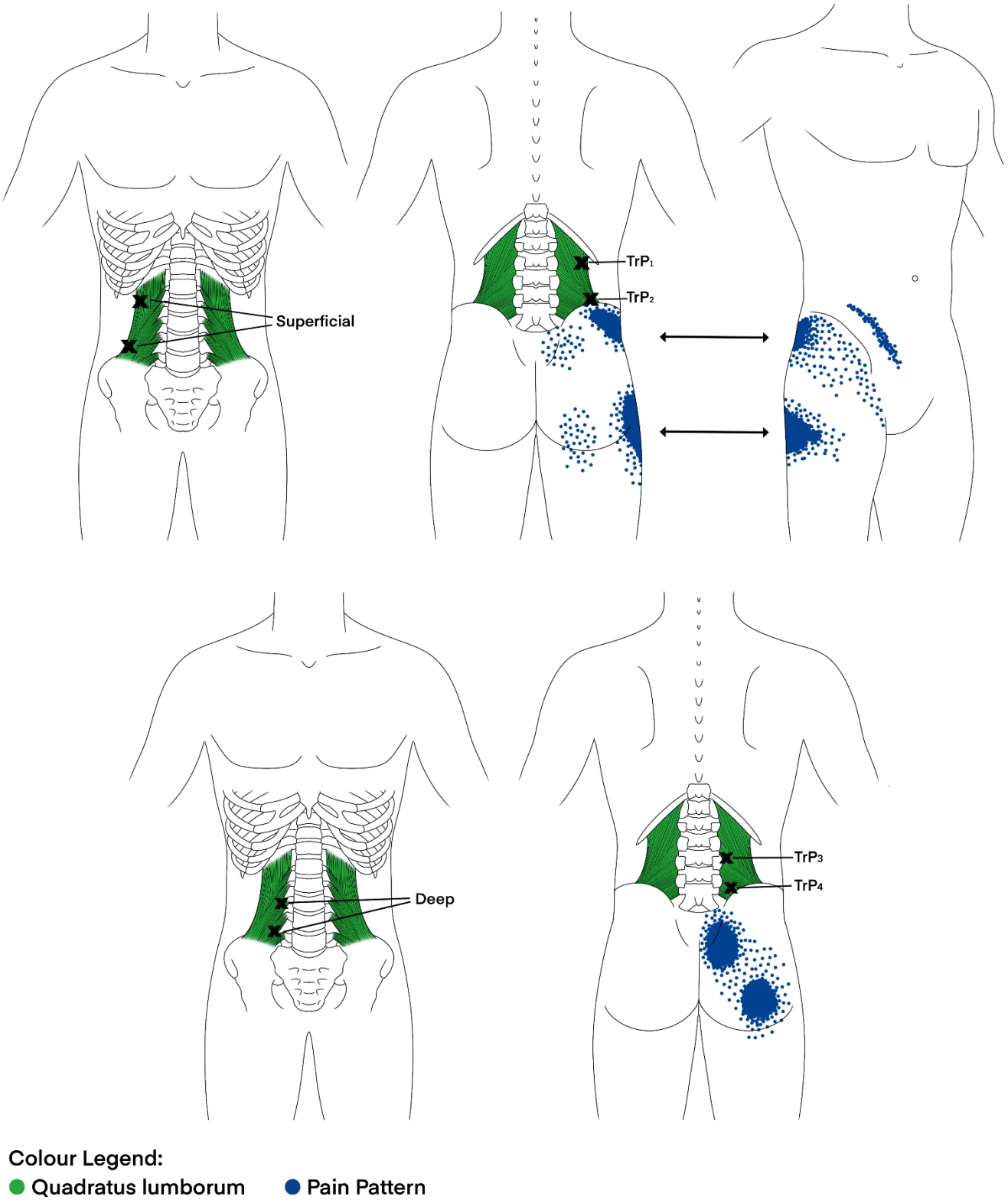

Figure 3: Trigger Point and Pain Patterns in the Quadratus Lumborum.

Chapter 3: Gluteus Maximus Muscles

This large muscle provides powerful extension of the thigh from the hip in exercises like running, jumping or stair climbing. It also provides stability with walking and is needed to regain body position over the forward stepping foot. To a lesser degree, it also provides stability with rotation of the hips.

Muscle Groups and Attachments

This dense muscle is composed of multiple slow-twitch fibers capable of continuous usage. It attaches to the posterior iliac crest, across the lateral sacrum and the coccyx. Distally, the muscle fibers are connected to the iliotibial band and the femur.

Referred Pain Pattern

Pain is usually localized to the buttock and rarely travels any considerable distance.

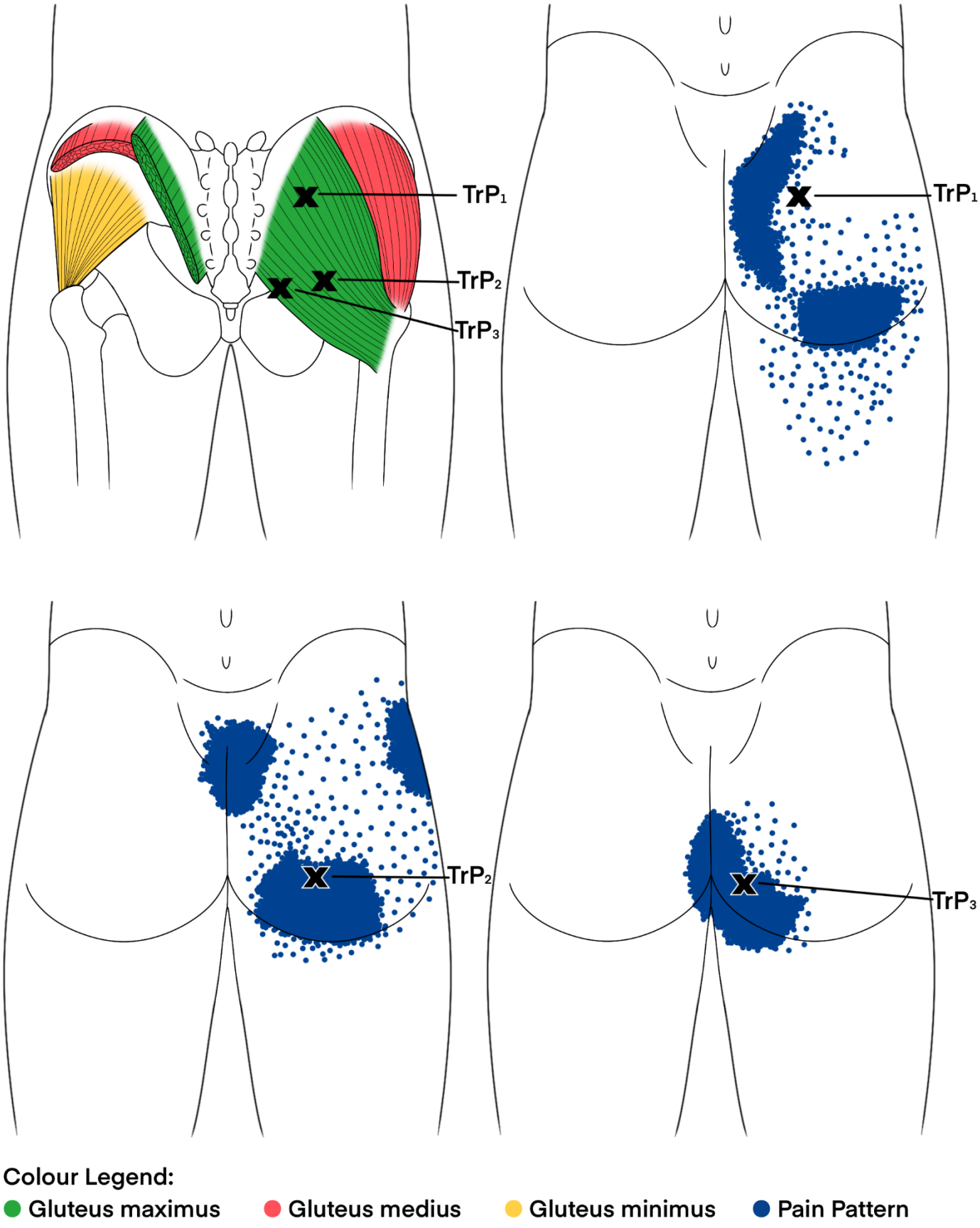

Figure 4: Trigger Point and Pain Patterns in the Gluteus Maximus.

Chapter 4: Gluteus Medius Muscles

The gluteus medius provides abduction of the thigh and stability to the pelvis while shifting weight from one foot to another. Interestingly, the gluteus medius is approximately double the size of the minimus and half the size of the maximus.

Muscle Groups and Attachments

The gluteus medius attaches proximally to anterior three fourths of the iliac crest and distally to the greater trochanter.

Referred Pain Pattern

This muscle is the prime culprit in complaints of low back pain. Tenderness is referred primarily along the posterior crest of the ilium, along the sacrum and posteriorly and laterally along the buttocks. It is often involved of complaints of pain down the side of the thighs.

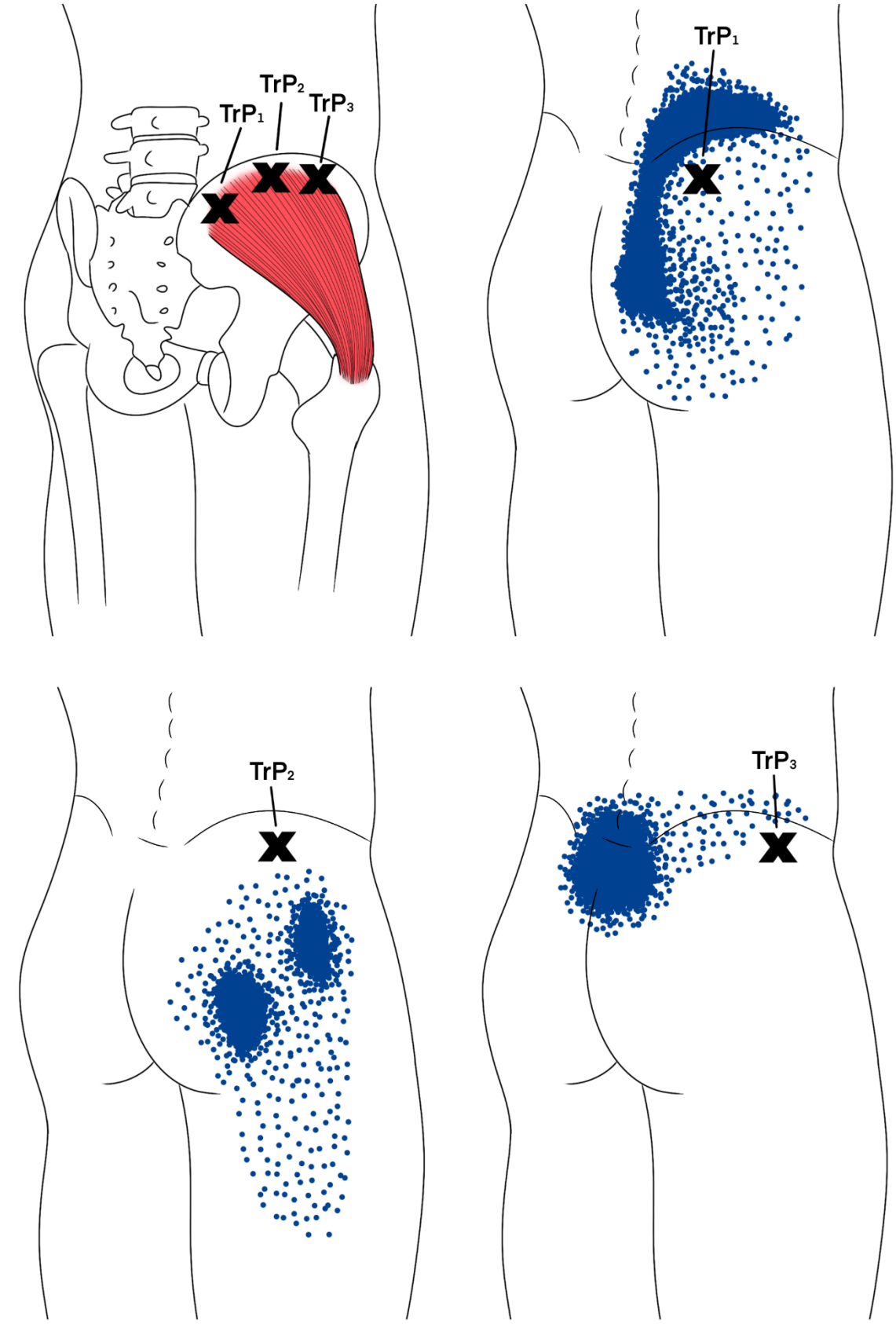

Figure 5: Trigger Point and Pain Patterns in the Gluteus Medius.

Chapter 5: Gluteus Minimus Muscles

The primary function of this smaller muscle is abduction of the thigh and pelvic stability with weight transfer from one foot to the other. It often referred to as the 'pseudo-sciatica' as its TrPs are largely responsible for pain down to the foot.

Muscle Groups and Attachments

The gluteus minimus has similar attachments to the medius but is less extensive to the overlying medius muscle.

Referred Pain Pattern

Activated TrPs cause two different referred pain patterns in the minimus. It is very common for activated lateral TrPs to cause pain from the minimus muscle itself, over the buttock, down the lateral leg, past the knee to the ankle and even to the dorsum of the foot. Patients complain of both pain and tenderness to the areas. The other pain referral pattern is associated with activated TrPs over the posterior gluteus minimus to the bulk of the buttock, along the back of the thigh into the calf. Patients describe this pain as intense and a dull-aching tenderness.

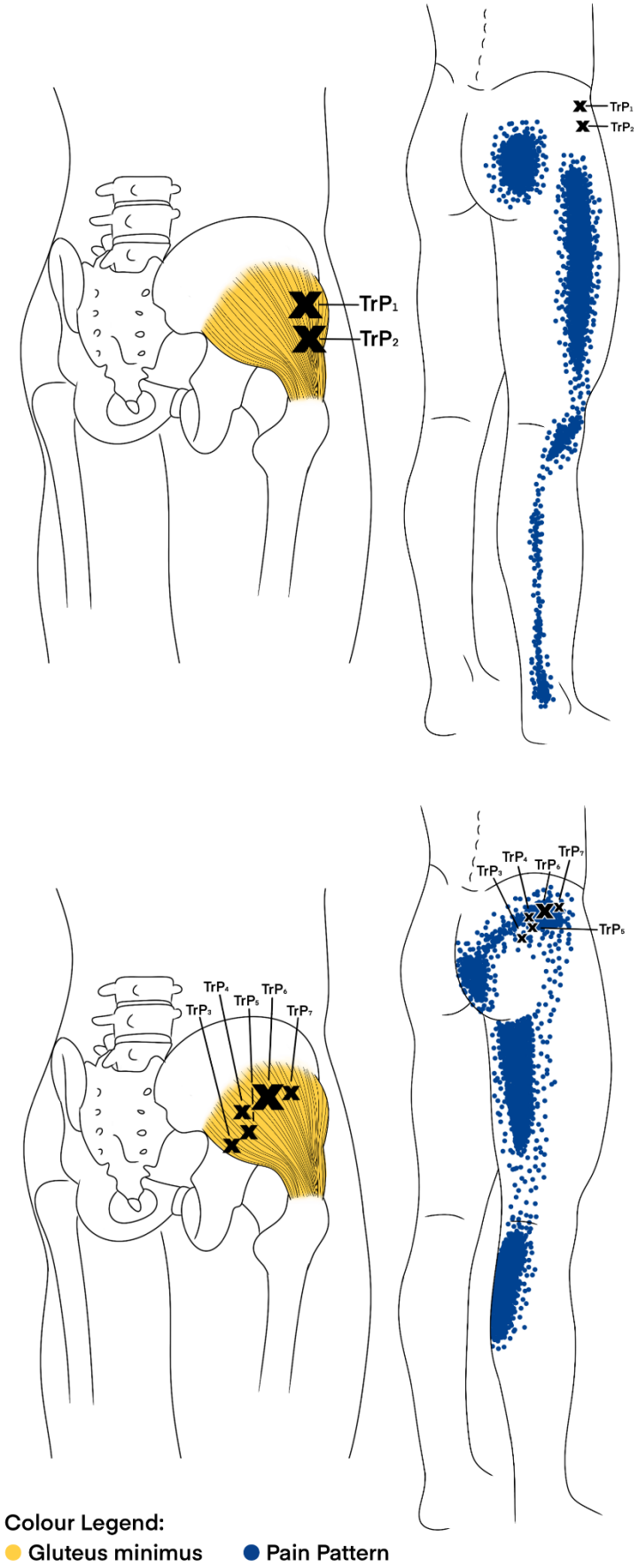

Figure 6: Trigger Point and Pain Patterns in the Gluteus Minimus.

Chapter 6: Piriformis Muscle

The primary focus for the piriformis is lateral rotation of the thigh and acts in abduction when the hip is in flexion. During rigorous exercise it provides restraint from over-rotation of the thigh. Piriformis syndrome can be especially painful not only due to activated TrPs but also from sacral nerve entrapment.

Muscle Groups and Attachments

Medially, the piriformis is attached to the inner surface of the sacrum. It exits the pelvis through the greater sciatic foramen. Laterally, its tendon attaches to the greater trochanter of the femur.

Referred Pain Pattern

Typically, activated TrPs refer piriformis pain to the sacroiliac area, over the buttock to across the hip posteriorly radiating down the back of the thigh.

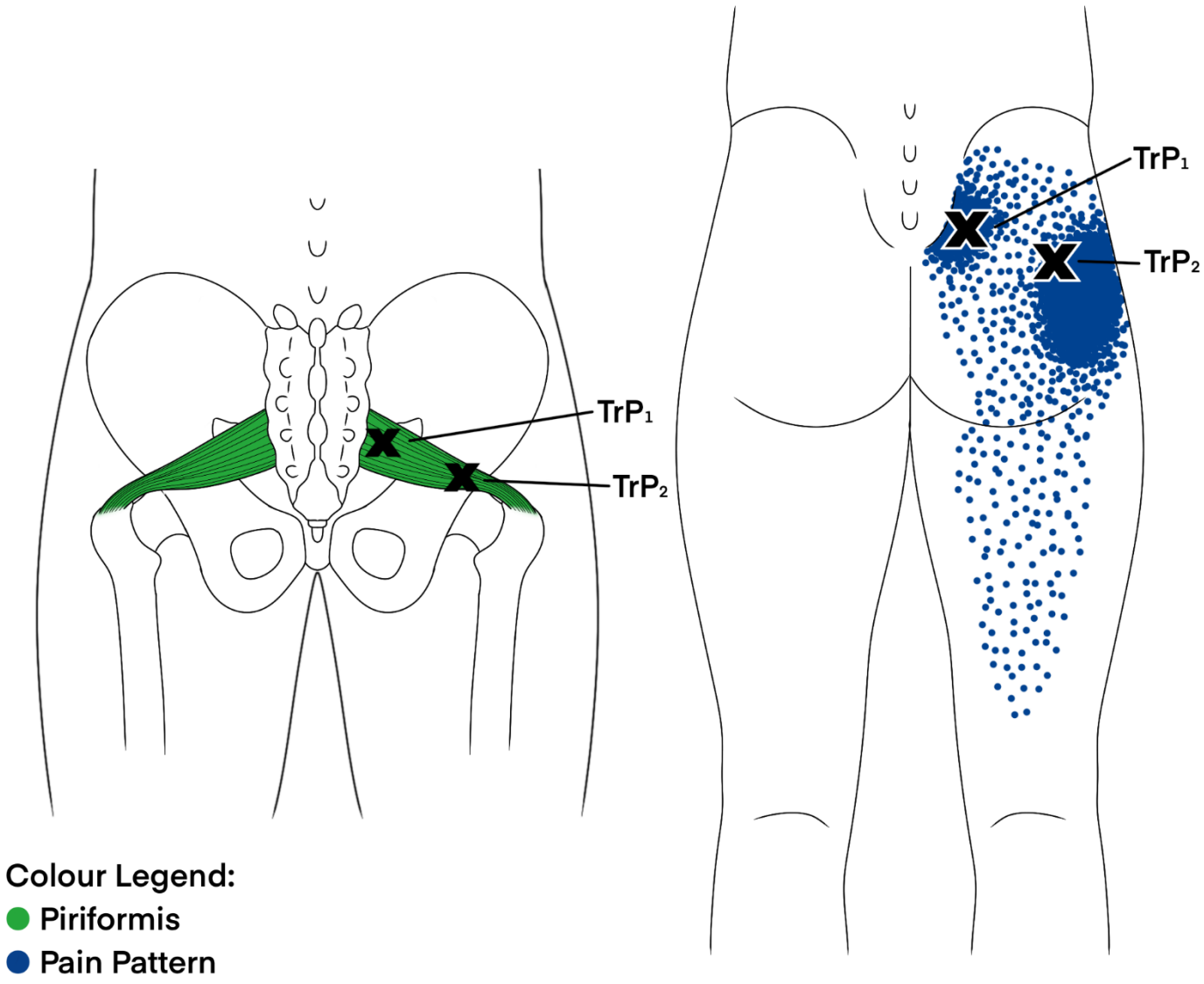

Figure 7: Trigger Point and Pain Patterns in the Piriformis.

Chapter 7: Tensor Fasciae Latae Muscle

The tensor fasciae latae muscle assists in normal gait assisting in hip flexion as the leg swings and stabilization to the core while standing.

Muscle Groups and Attachments

The tensor fasciae latae attaches to the anterior iliac crest and iliac spine. Distally, the tendinous fibers end combined with the deep fascia of the leg and the patellar ligament.

Referred Pain Pattern

Pain from activated TrPs in the tensor fasciae latae concentrates in the front of the thigh, over the greater trochanter extending down the lateral thigh to the knee.

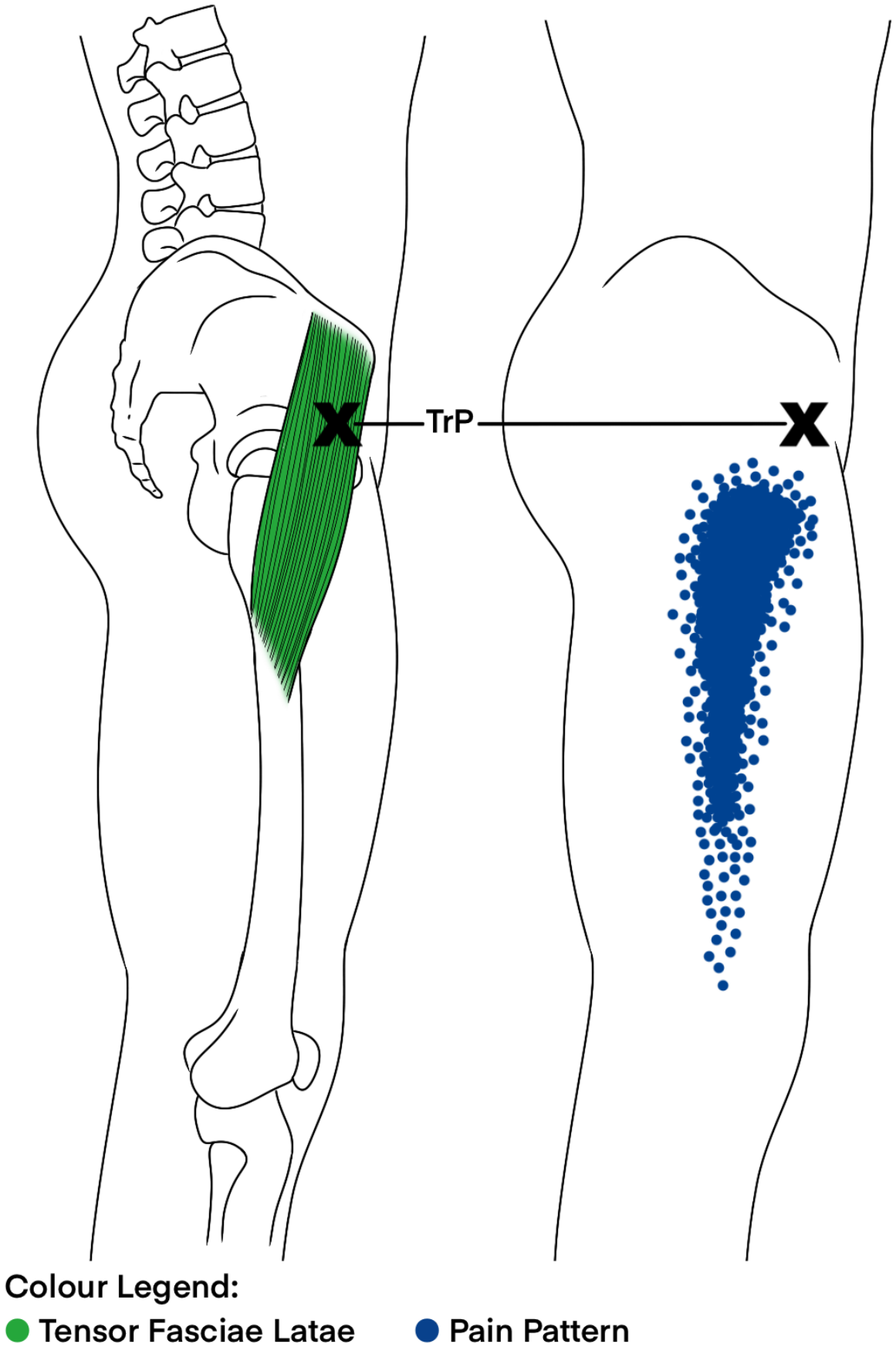

Figure 8: Trigger Point and Pain Patterns in the Tensor Fasciae Latae.

Chapter 8: Iliopsoas Muscles

Both the iliacus and psoas major muscles allow for flexion of the thigh at the hip and are actively involved in the stability of the torso with sitting. The psoas plays a significant role in allowing for upright posture with standing or walking and most especially with exercises like running or sprinting.

Muscle Groups and Attachments

The psoas major attaches, above, along the lumbar vertebrae and below, its tendon attaches to the lesser trochanter. The iliacus attaches, above, to the iliac fossa and below, it joins to the psoas major tendon.

Referred Pain Pattern

When TrPs in the psoas major muscle are activated, they cause pain along the spine anywhere from the thoracic region to the sacroiliac joint. Pain from the iliacus refers pain anteriorly to the thigh and groin region. Injections to this TrP are directed away from the pulsation of the lateral femoral artery and nerve that run closely parallel to each other.

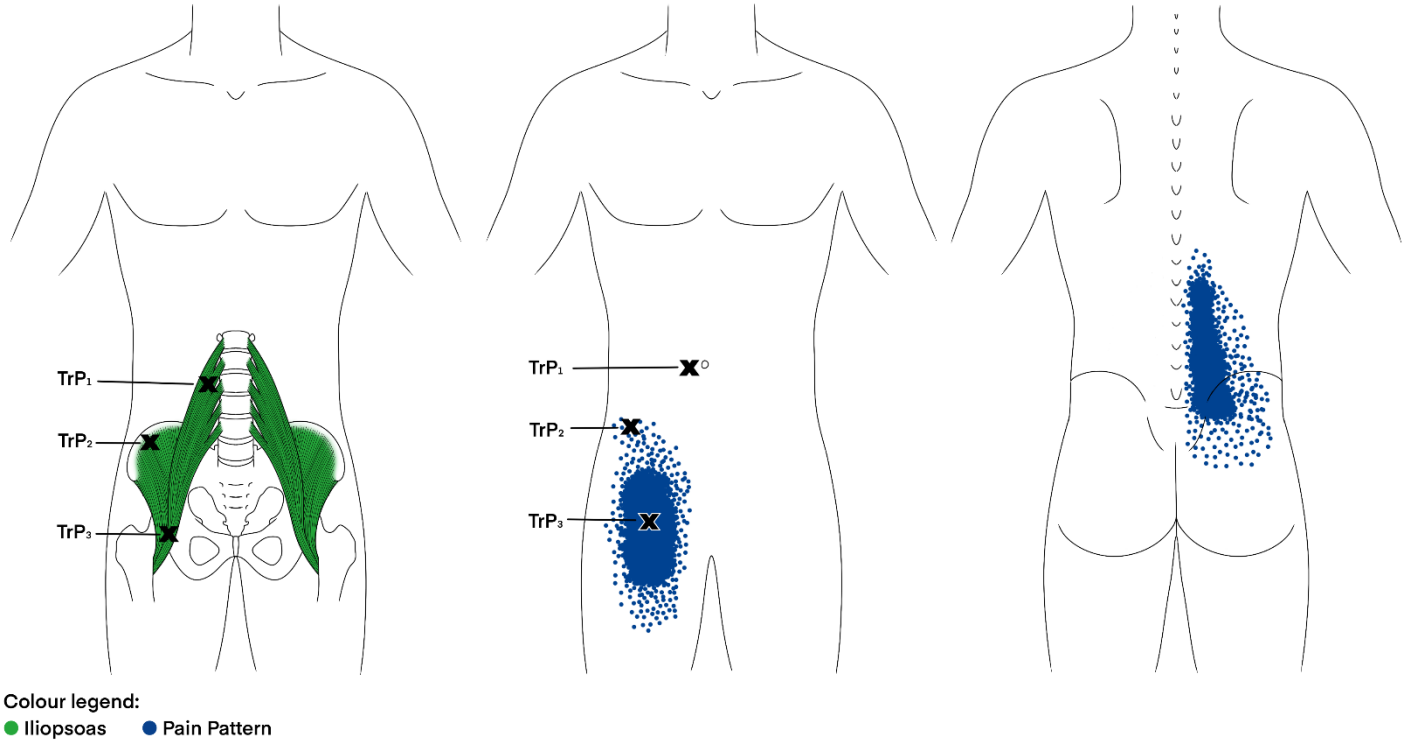

Figure 9: Trigger Point and Pain Patterns in the Iliopsoas.

Chapter 9: Pectineus Muscles

This short muscle allows for adduction and flexion of the thigh at the hip. Persistent pain is the classic symptom noted once active TrPs to the other adduction muscles have been treated.

Muscle Groups and Attachments

Proximally, this muscle is attached to the pubic bone and distally to the back of the femur below the attachment of the iliopsoas muscle.

Referred Pain Pattern

Pain from activated TrPs in the pectineus concentrates over the muscle and radiates from deep in the groin over the upper thigh. Take care to palpate the femoral pulse and inject medially from it to avoid the circulatory system.

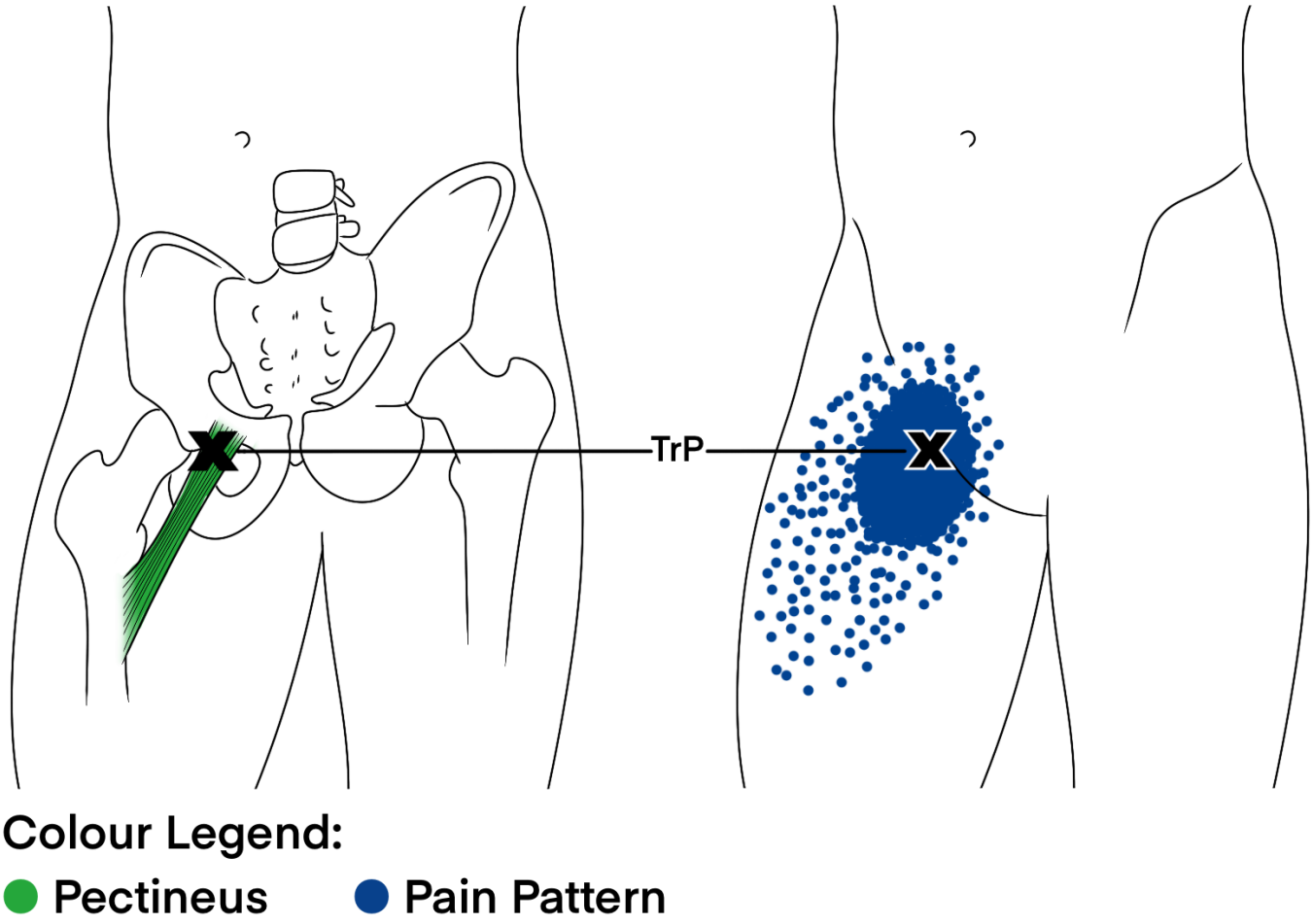

Figure 10: Trigger Point and Pain Patterns in the Pectineus.

Chapter 10: Adductor Muscles of Hip

The adductor muscles of the hip are made up of the adductor longus, adductor brevis, adductor magnus and gracilis that collectively are responsible for controlling adduction while standing and add stability by controlling lateral shift. While walking, the adductor magnus brings the leg toward the midline. Then later in the swing phase, the adductors and gracilis maintain flexion and forward reach. They are all involved in adduction of the thigh but the longus and brevis assist in medial rotation and flexion of the thigh.

Muscle Groups and Attachments

The adductor longus, adductor brevis, and two thirds of the adductor magnus attach to the lower borders of the pelvis along the pubic ramus and the ischial ramus to the ischial tuberosity. Distally, they attach vertically along the back of the femur from the lesser trochanter to a point above the knee. These three muscles overlap one another with the longus in front with the magnus behind. The remaining third of the adductor magnus attaches proximally from the ischial tuberosity and distally to the adductor tubercule on the medial condyle of the femur.

Referred Pain Pattern

Referred pain from activated TrPs in the adductor brevis and longus cause pain from the deep groin downwards towards the knee and shin. Pain referred along the inner thigh from the groin to above the knee is from activated TrPs in the adductor magnus. Activated point in the gracillis refer pain along the medial thigh.

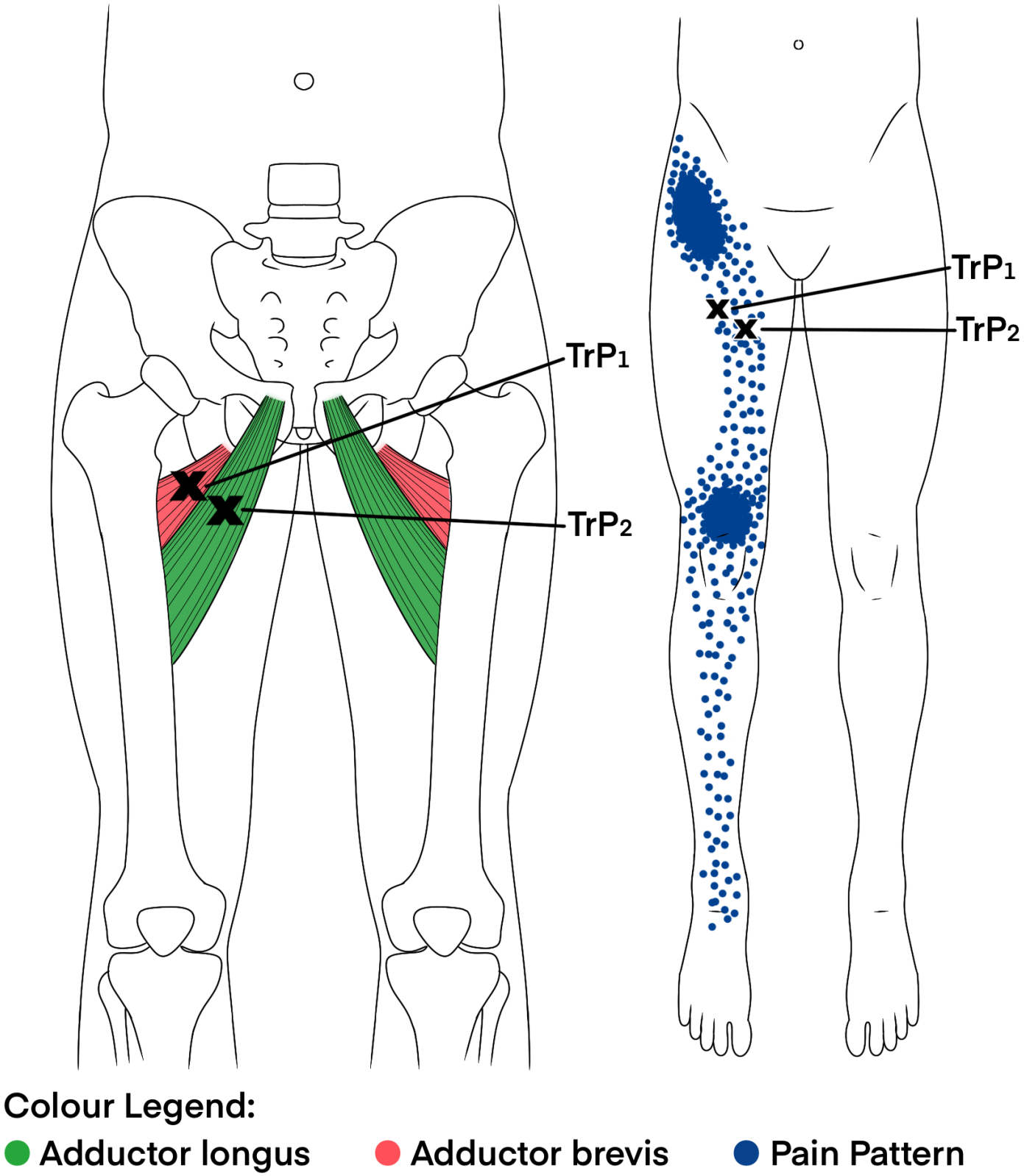

Figure 11: Trigger Point and Pain Patterns in the Adductor Longus and Brevis.

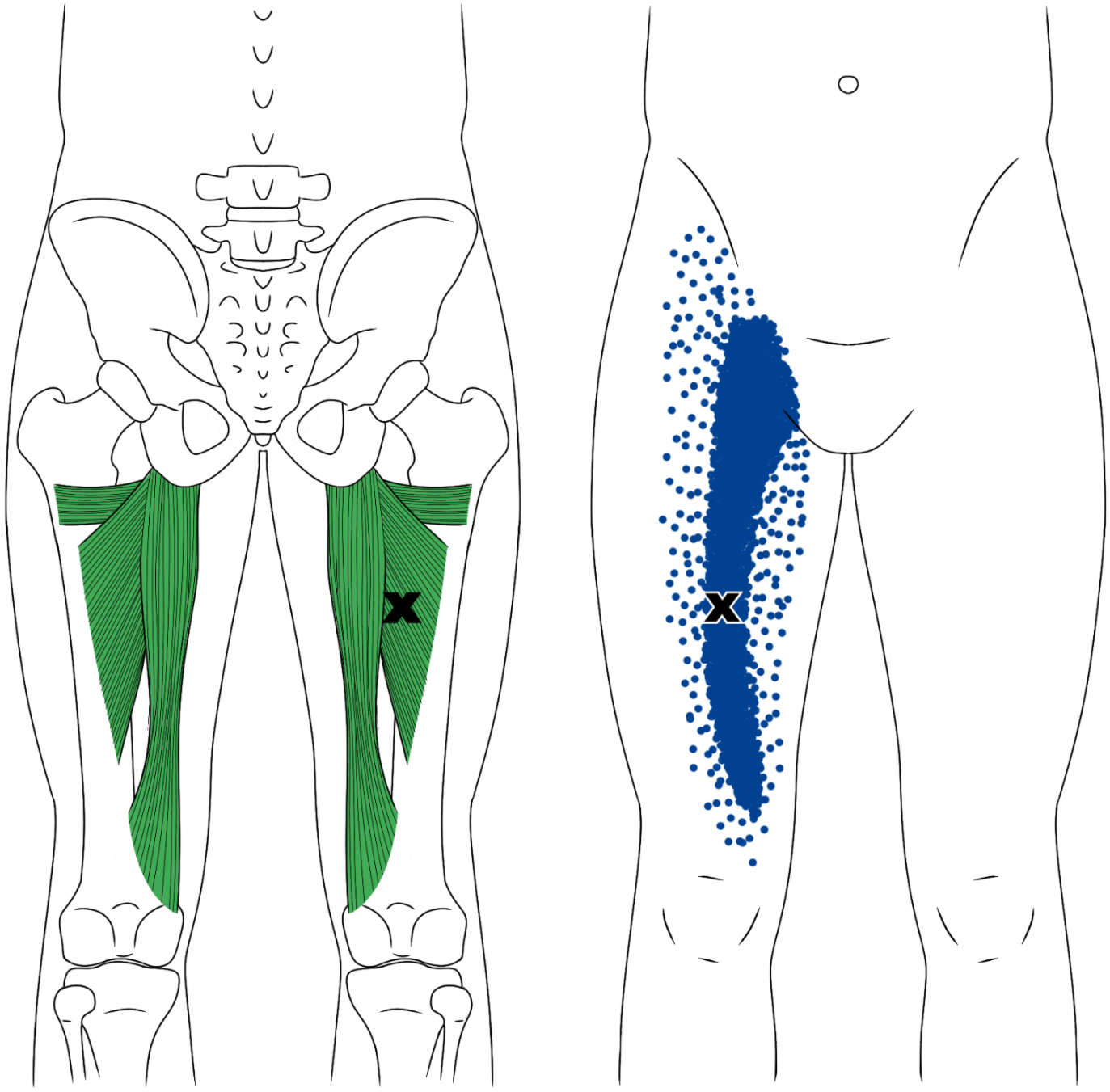

Figure 12: Trigger Point and Pain Patterns in the Adductor Magnus.

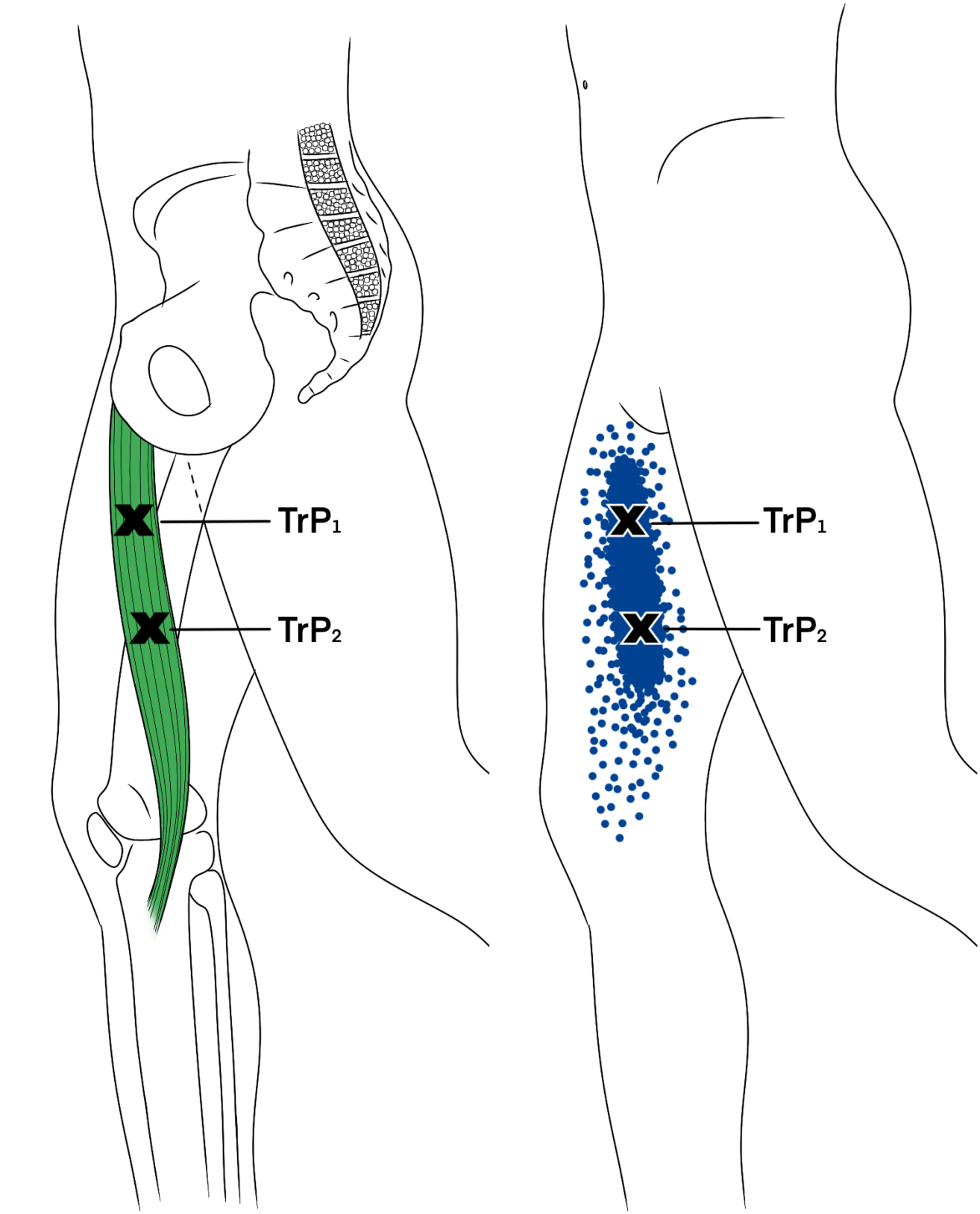

Figure 13: Trigger Point and Pain Patterns in the Adductor Gracilis.

Chapter 11: Sartorius Muscle

The sartorius muscle is the longest muscle in the body and is narrow and ribbon-like in appearance. It provides stability and hip flexion with the natural swing gait in walking. It also allows for hip flexion and assists in knee flexion.

Muscle Groups and Attachments

Attaching proximally to the anterior superior iliac spine, it crosses from the outer hip to the medial thigh over laying the femoral artery, vein, and nerve supply. Distally, it ends in a tendon attached to outer medial tibia.

Referred Pain Pattern

Pain is typically localized to the general area of the muscle and is normally described as sharp or tingling pain rather than deep ache.

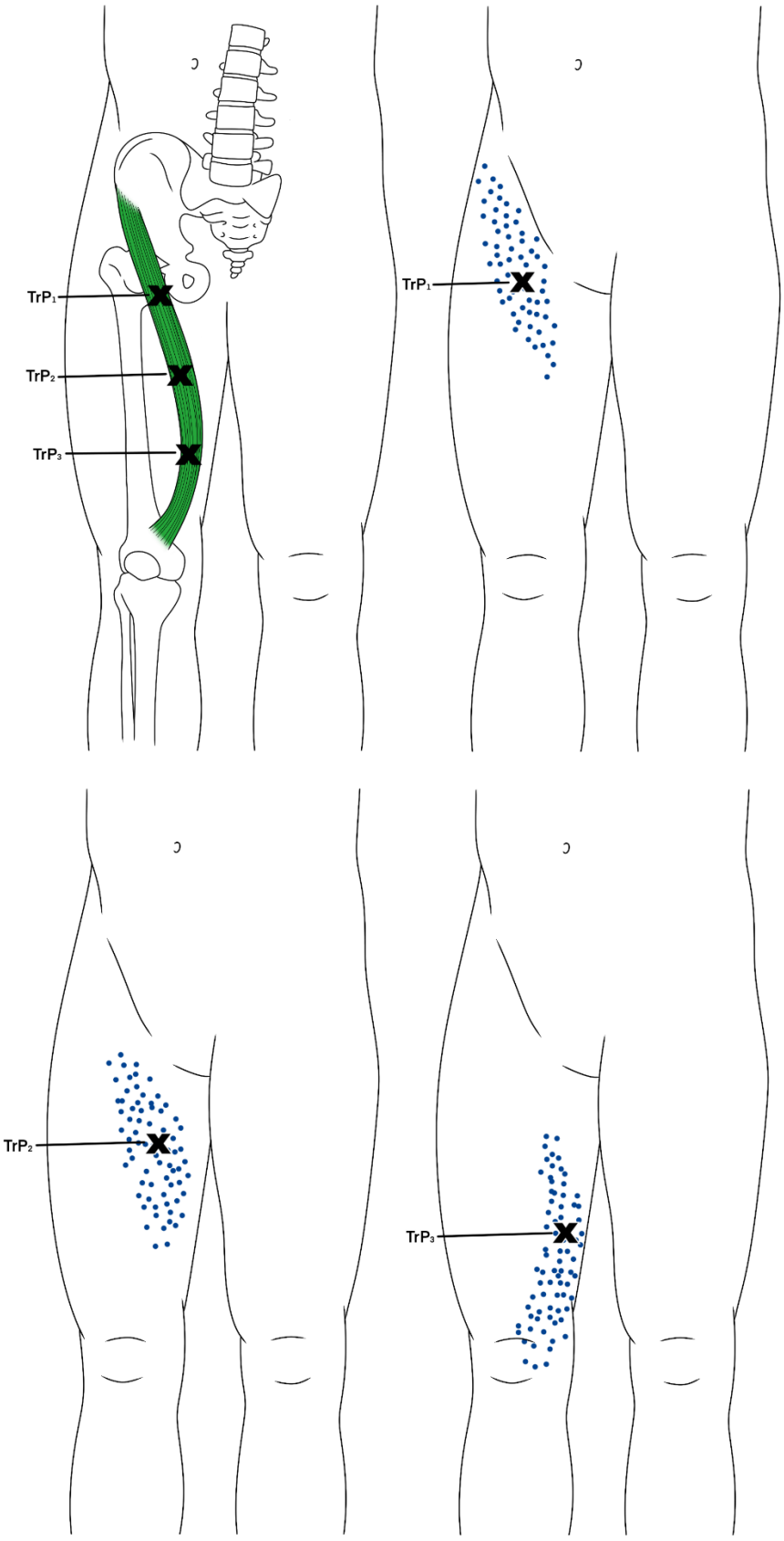

Figure 14: Trigger Point and Pain Patterns in the Sartorius.

Chapter 12: Quadriceps Femoris Muscles

The quadriceps femoris group is composed of the rectus femoris, vastus medialis, vastus intermedius and vastus lateralis. The quadriceps exert force on the thigh and control knee flexion. The critical job of the vastus medialis counters the lateral pull of the vastus lateralis on the patella. When the foot is free the quadriceps femoris acts to the extend the leg at the knee and assists in flexion of the thigh at the hip. The rectus femoris provides flexion at the hip with the help of the iliopsoas and pectineus maximus. Together, all the heads of the quadricep group allow for knee extension opposed by the hamstring muscles.

Muscle Groups and Attachments

All four muscles of the quadriceps femoris attach by a common tendon to the patella and then to the patellar ligament to the tibial tuberosity. The three 'vasti' muscles attach proximally to the femur and distally to through the patella and patellar ligament. The recuts femoris extends the length of the thigh and is firmly anchored to the pelvis by two tendons, one to the anterior inferior iliac spine and the other to the acetabulum. Distally, it attaches to the boarder of the patella, through the patellar ligament, to the tibial tuberosity.

Referred Pain Pattern

It can be imagined for such a large and diverse muscle group that the referred pain pattern is complex. Active trigger points in the rectus femoris can be found high on the upper thigh but classically cause lower anterior thigh and knee pain. Patients complain of not being able to find a comfortable sleeping position with the deep aching pain felt. Similarly, TrPs in the vastus medialis are found medially and above the knee but the referred pain is directly over the patellar region. The vastus intermedius develops many TrPs but it is difficult to palpate them as it lies underneath the rectus femoris. Pain is referred down the front of the thigh stopping short of the knee and is felt as intense thigh pain. The vastus lateralis has five possible active trigger points that cause pain along the lateral thigh and the outer side of the knee. Patients complain of deep pain and difficulty resting on the affected side.

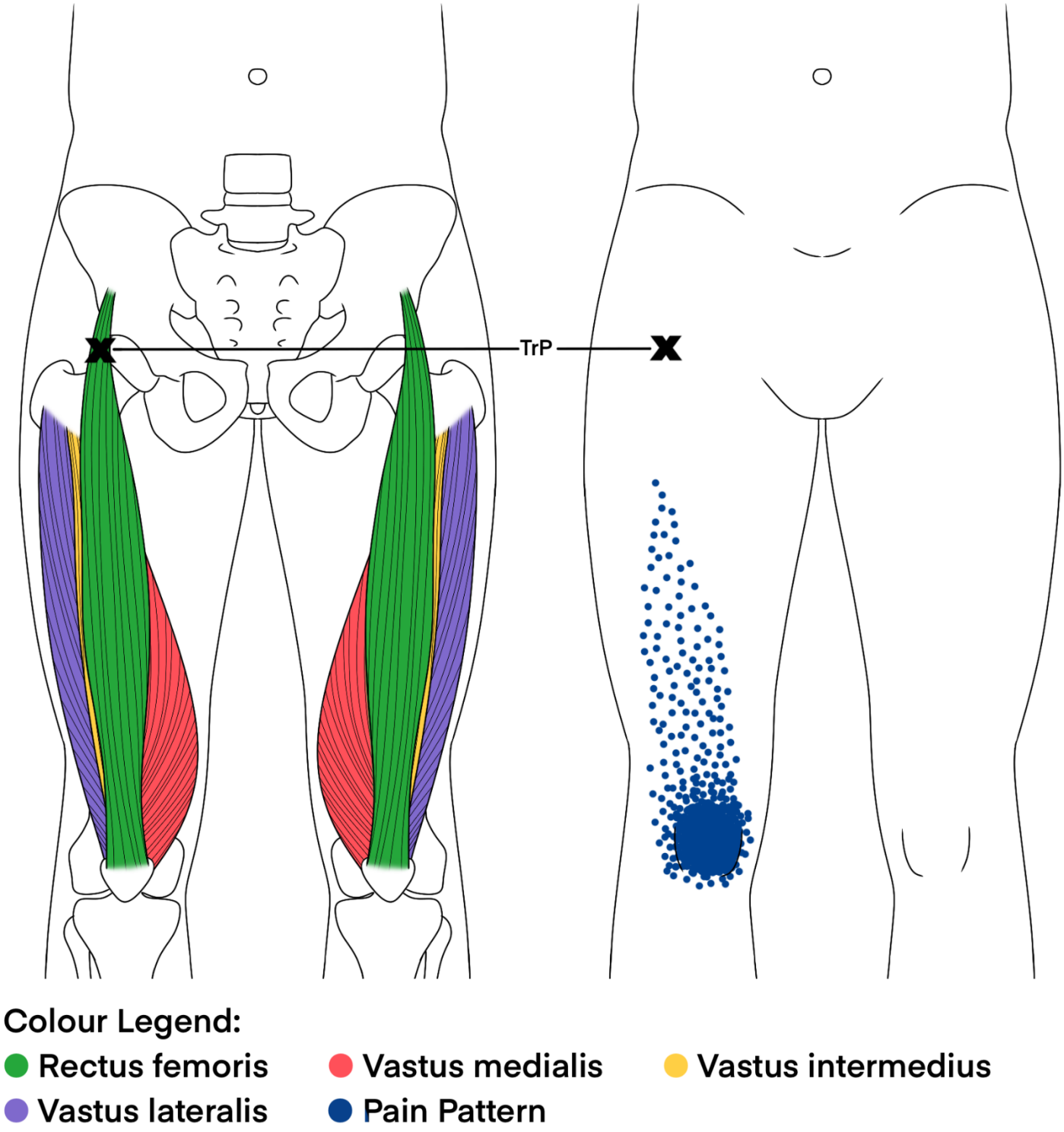

Figure 15: Trigger Point and Pain Patterns in the Rectus Femoris.

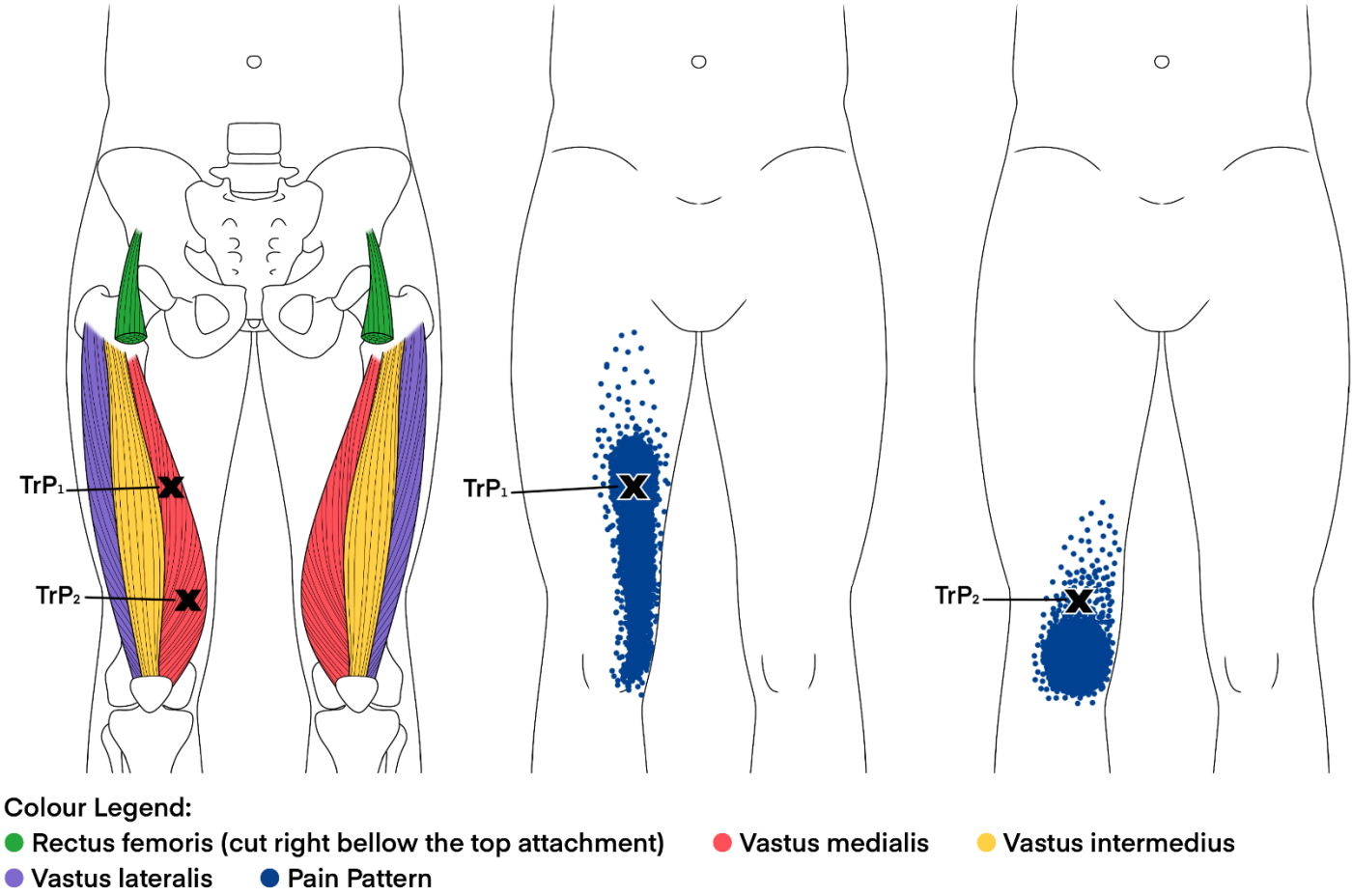

Figure 16: Trigger Point and Pain Patterns in the Vastus Medialis.

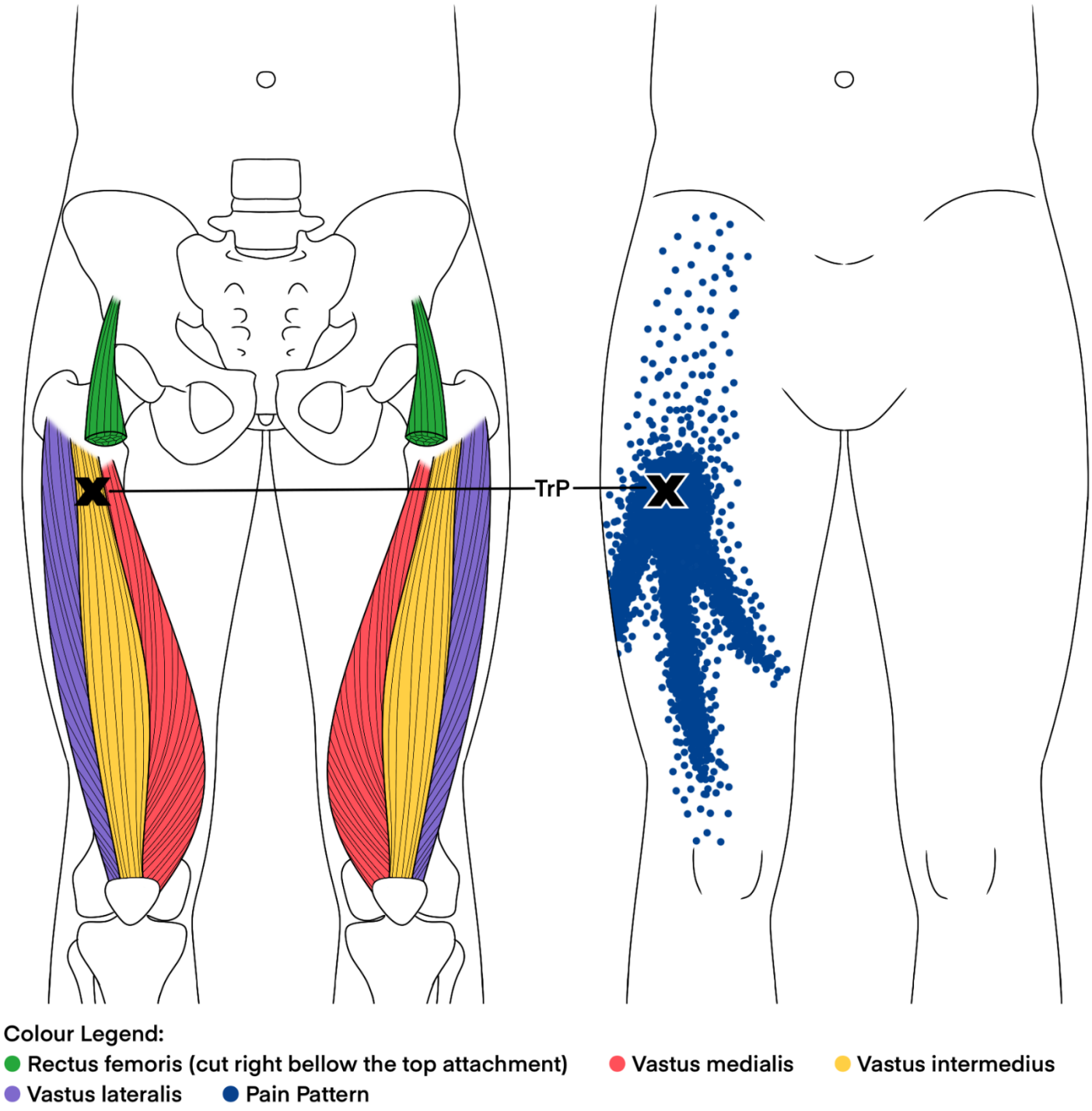

Figure 17: Trigger Point and Pain Patterns in the Vastus Intermedius.

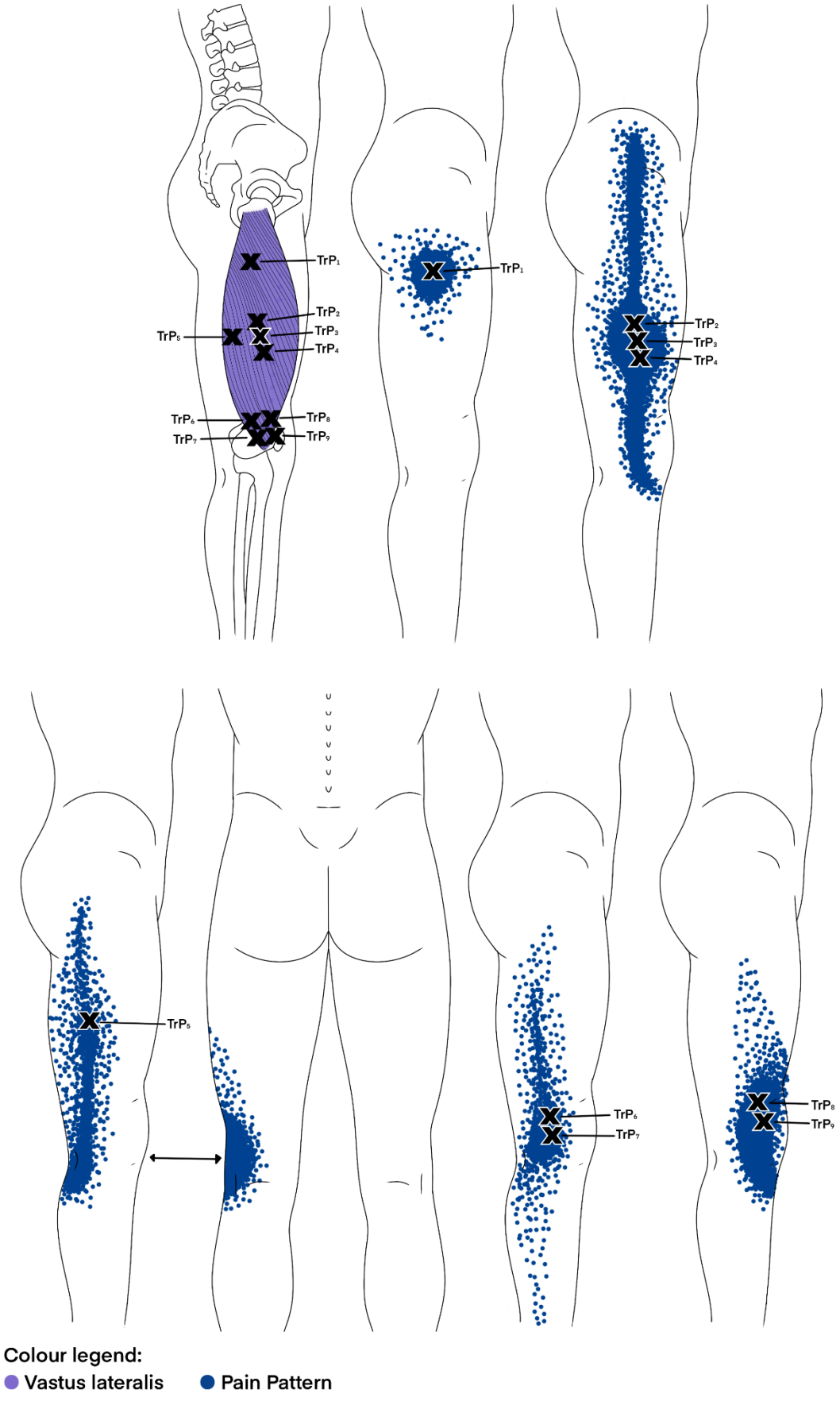

Figure 18: Trigger Point and Pain Patterns in the Vastus Lateralis.

Chapter 13: Hamstring Muscle Group

The hamstring muscle group is made up of the biceps femoris, semitendinosus and the semimembranosus. This group of muscles collectively functions to restrain hip flexion produced by the body with ambulating. This counter-restraint is needed in walking, running, jumping, dancing and bending forward. They act as both a hip extensor and a knee flexor. With knee flexion, the semitendinosus and semimembranosus muscles help with medial rotation of the knee, while the bicep femoris assists with lateral rotation.

Muscle Groups and Attachments

All three of the hamstring muscles attach proximally from the ischial tuberosity. Distally, the semitendinosus and semimembranosus attach to the medial side of the tibia below the knee. The bicep femoris long head attaches below to the lateral and posterior aspects of the fibula and the short head attaches to the posterior middle third of the femur.

Referred Pain Pattern

It is common to have patients complain of referred pain in the lower buttock and thigh from activated TrPs in the semitendinosus and semimembranosus muscles. Less commonly, pain can then also spread medially along to the thigh and knee. Activated TrPs from the biceps femoris focuses pain to the back of the knee and along the thigh even as high as the buttock crease.

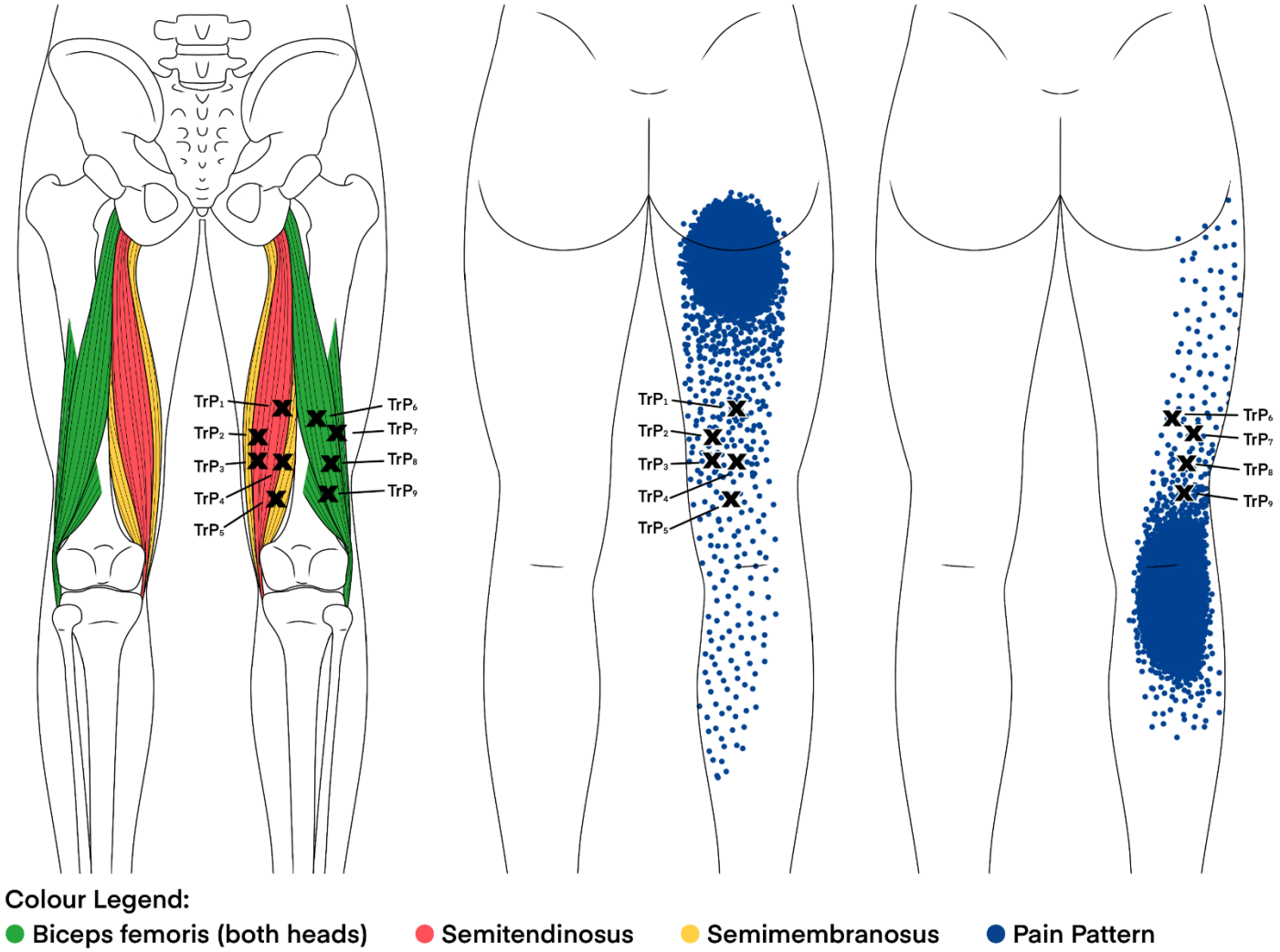

Figure 19: Trigger Point and Pain Patterns in the Hamstring Muscles.

Chapter 14: Gastrocnemius Muscle

The gastrocnemius muscle is known for typical calf cramp pain at night. Its primary function is to assist the plantar flexors in controlling forward rotation of the leg over the foot during ambulation as well as stabilizing the knee.

Muscle Groups and Attachments

This muscle spans two joints: the knee and ankle. Proximally, the medial and lateral heads attach to the femur posteriorly. Distally, the fiber ends join the soleus muscle and merge into the tendo calcaneus.

Referred Pain Pattern

Activated TrPs most often cause pain locally, usually along the medial head at the bell of the muscle. It is not unusual for pain to be referred along the instep or the foot, over the back of the calf past the knee to the back of the thigh.

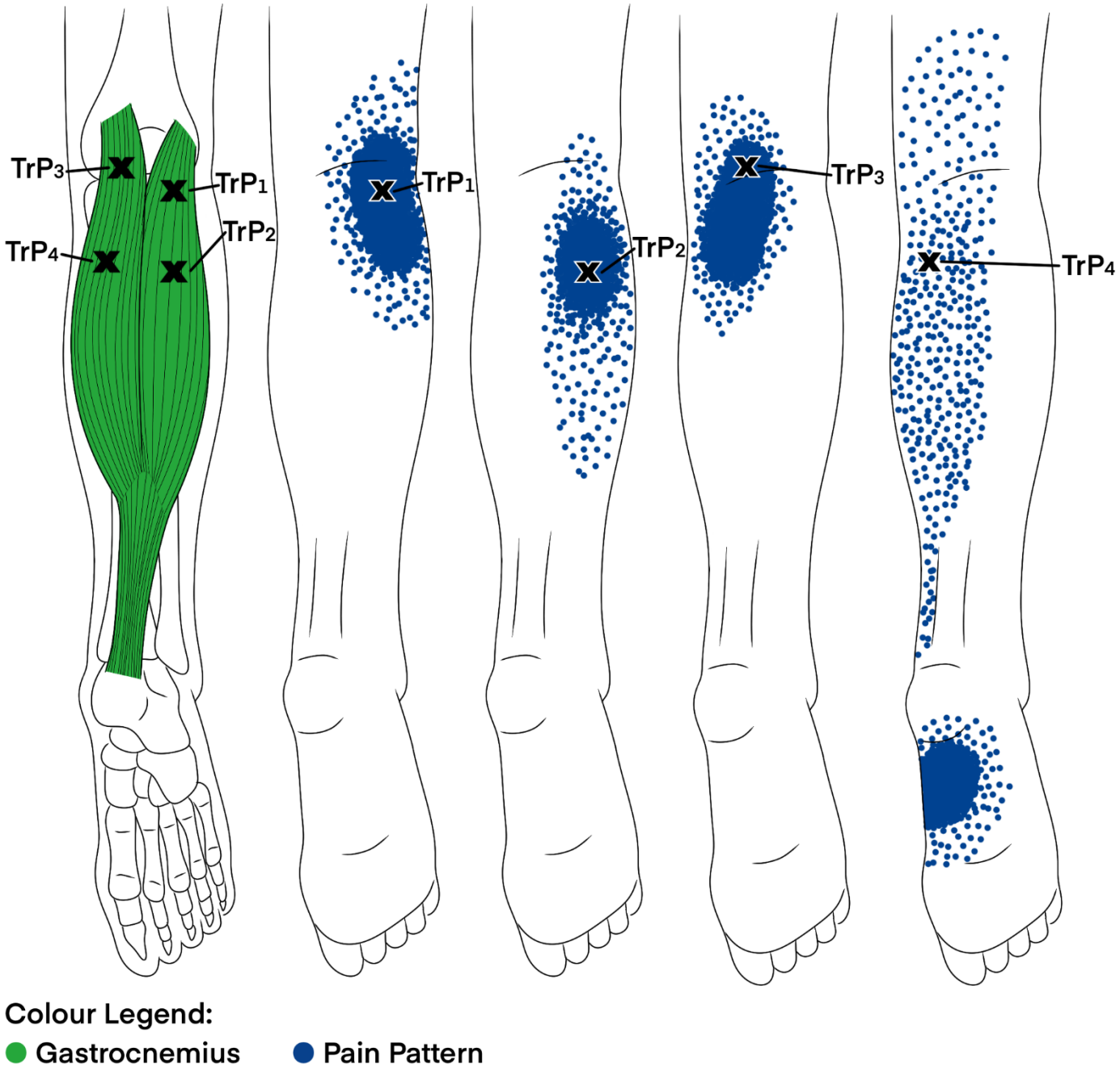

Figure 20 Trigger Point and Pain Patterns in the Gastrocnemius.

Chapter 15: Soleus and Plantaris Muscle

The function of the soleus muscle provides stability to the knee with walking and to the ankle with any forward rotation of the tibia over a fixed foot. Together, the soleus and gastrocnemius work to provide stability to the knee during walking. Both muscles are critical with running or jumping as they serve as a 'muscle' pump in conjunction with the venous system. The plantaris and the soleus combine to allow for plantar flexion and inversion of the foot.

Muscle Groups and Attachments

Proximally, the soleus attaches to the posterior surface of the head of the fibula and along the posterior boarder to the medial boarder of the tibia and along the tendinous arch spanning two bones. Distally, the soleus and the gastrocnemius joint to form the Achilles tendon. The plantaris attaches proximally to the femur and has a long tendon that goes between the gastrocnemius and the soleus that attaches to the posterior calcaneus.

Referred Pain Pattern

Complaints of pain referred from the distal soleus occur primarily along the back of the heel and/or the distal portion of the Achilles tendon. Interestingly, pain can also be referred to the sacroiliac joint on the affected side. The TrPs in the proximal soleus refer pain over the back of the calf. The TrPs in the plantaris refers tenderness to behind the knee to the middle of the calf.

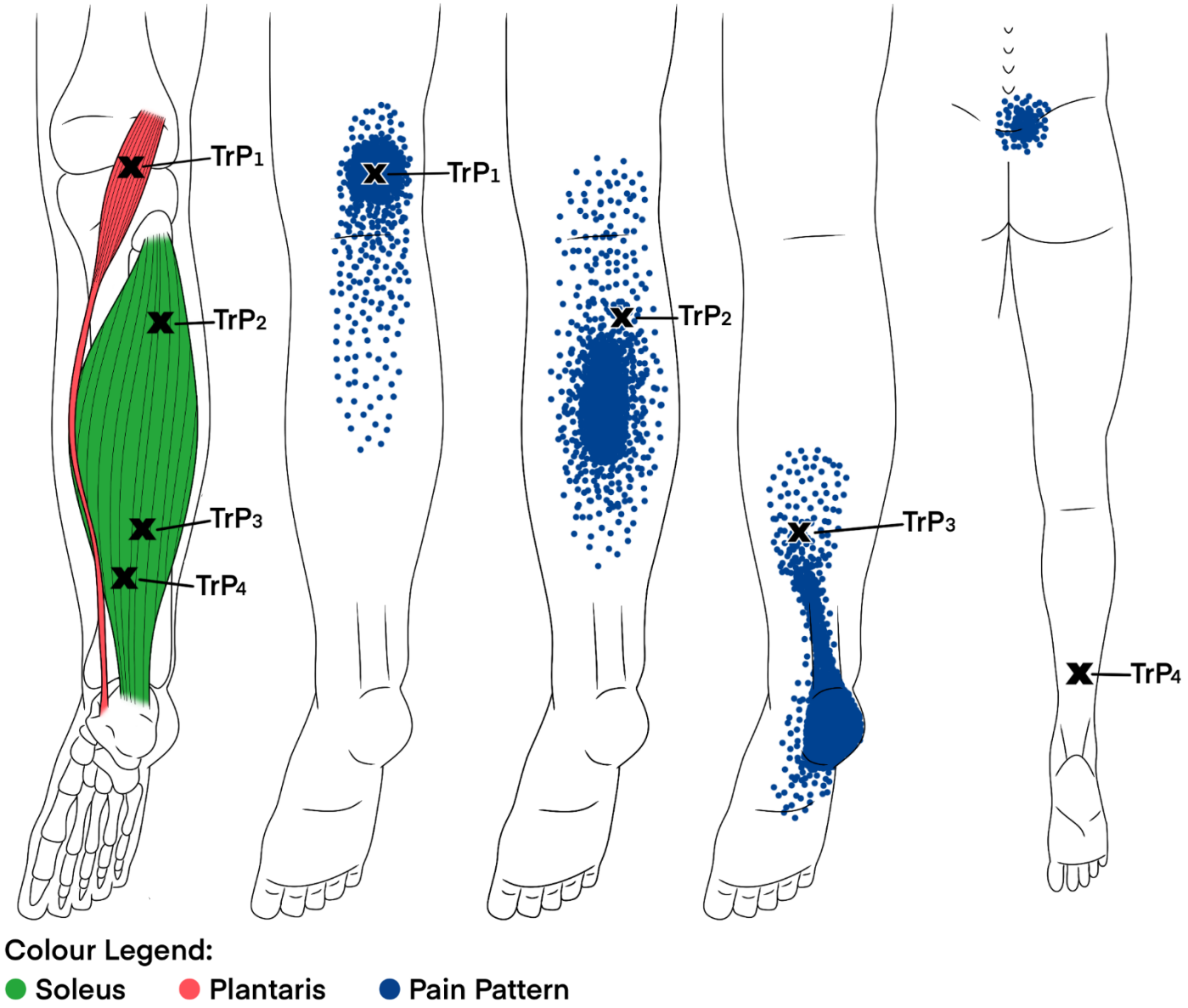

Figure 21 Trigger Point and Pain Patterns in the Soleus and Plantaris.

Chapter 16: Popliteus Muscle

This muscle is responsible for unlocking the knee at the start of weight bearing during ambulation and actively prevents forward displacement of the femur on the tibia during flexion poses.

Muscle Groups and Attachments

The popliteus muscle attaches proximally to the lateral condyle of the femur and distally to the posterior tibia medially.

Referred Pain Pattern

Pain is felt in the back of the knee from the activated TrP located in the main bulk of the muscle. Classically, patients will complain of pain to back of the knee when walking or weight bearing while walking down hill, down the stairs mimicking other conditions such as Baker's cyst or avulsion of the popliteus tendon.

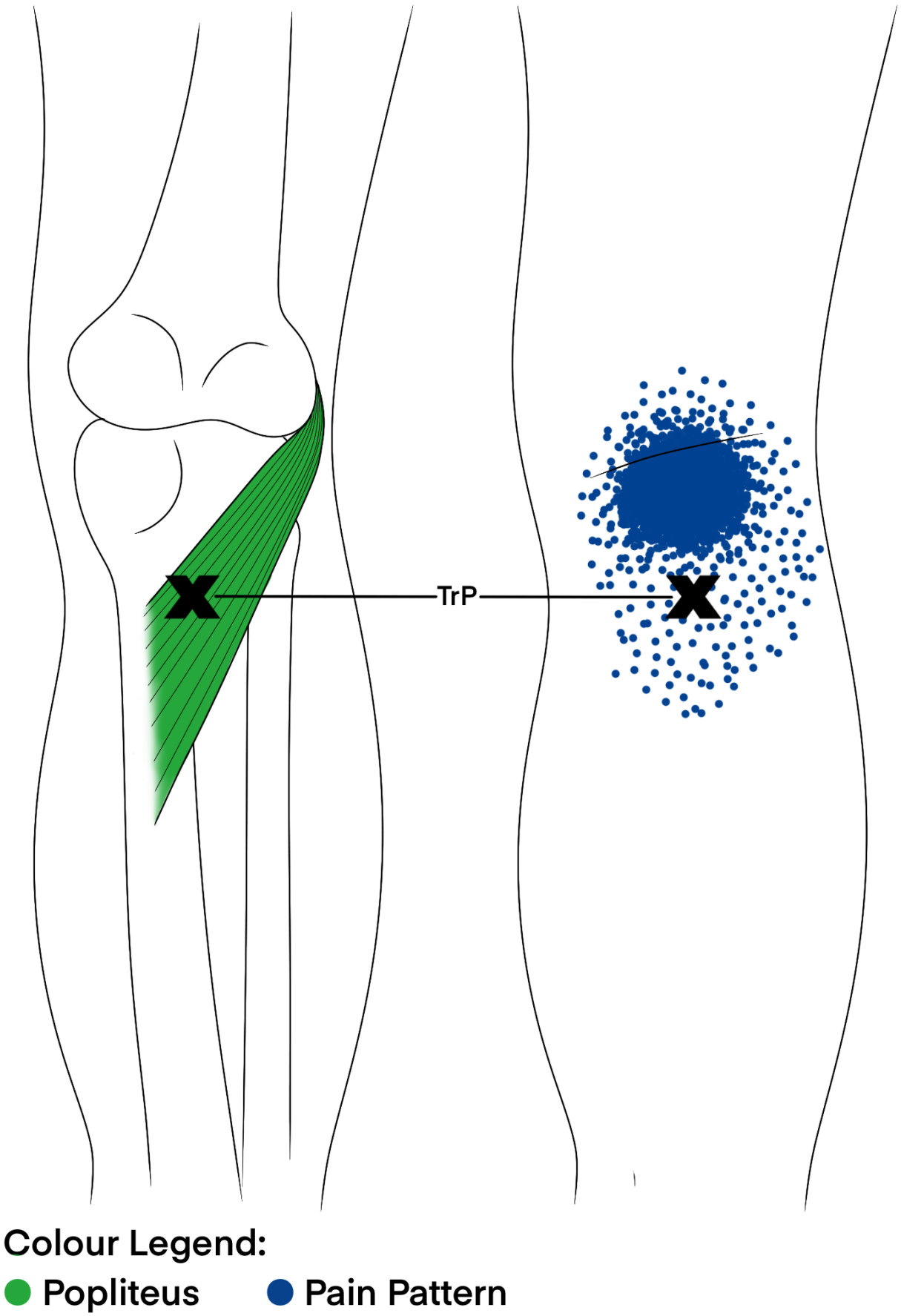

Figure 22: Trigger Point and Pain Patterns in the Popliteus.

Chapter 17: Tibialis Posterior Muscle

The tibialis posterior muscle prevents overpronation of the foot with walking and helps to distribute body weight through out all the metatarsals. Another function is as main supinator of the foot, and to a lesser degree, assists in plantar flexion of the foot.

Muscle Groups and Attachments

Proximally, the tibialis posterior attaches to the fibula and to the tibia. Distally, the tendon attaches to the navicular, calcaneus, each cuneiform and to the second, third and fourth metatarsals.

Referred Pain Pattern

Mainly, activated TrPs in the tibialis posterior cause pain over the Achilles tendon. Tenderness can also be felt in the calf, concentrated over Achilles, to under the arch of the foot.

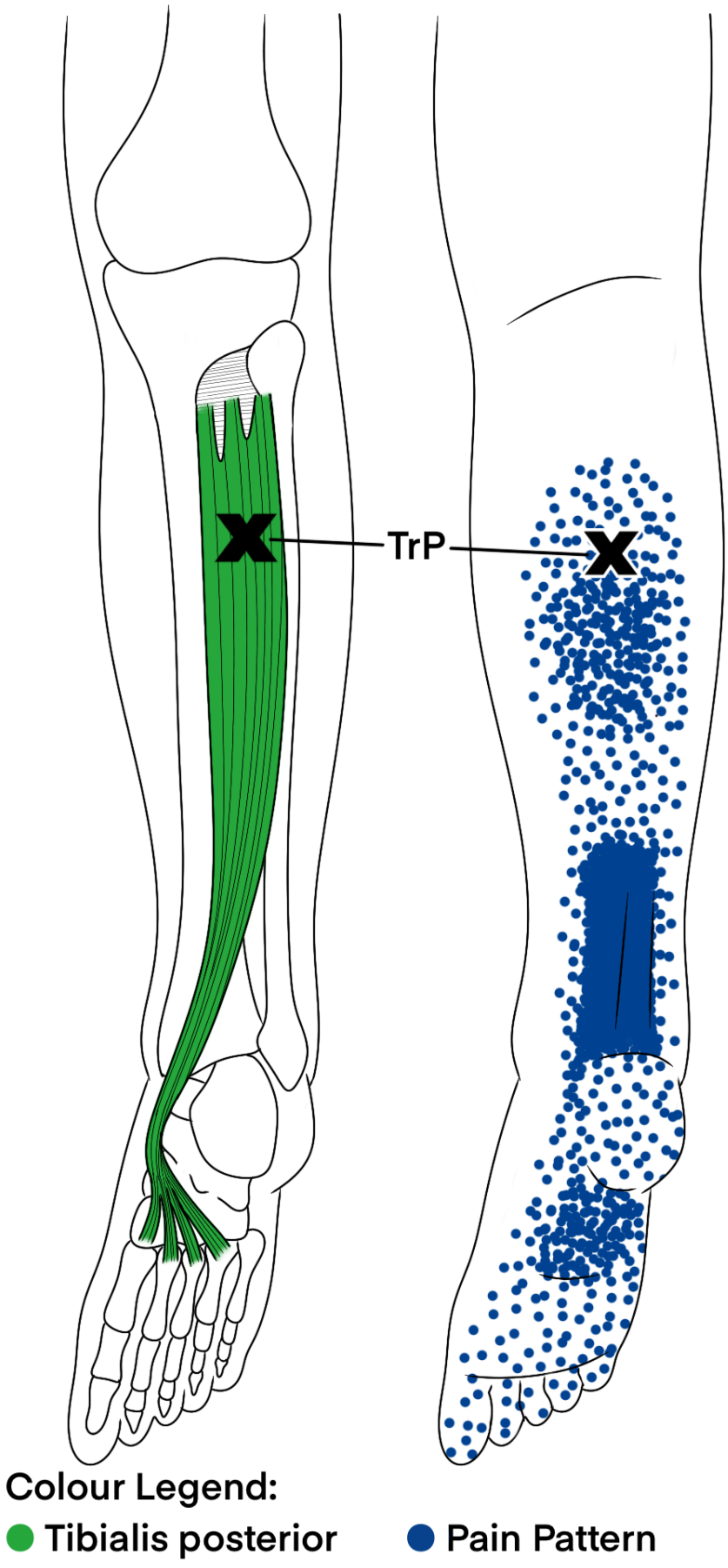

Figure 23 Trigger Point and Pain Patterns in the Tibialis Posterior.

Chapter 18: Long Flexor Muscles of the Toes

These muscles provide stability when the body weight is shifted forward on the forefoot and provides stability to the foot and ankle to the later stance phase in walking. They also provide strong flexion of the foot when it is free and stability when the foot is fixed.

Muscle Groups and Attachments

The flexor digitorum longus attach proximally to the posterior surface of the tibia and distally, to the base of the phalanx for each of the lesser toes. The flexor hallucis longus attaches proximally to the posterior surface of the fibula and distally, to the phalanx of the great toe.

Referred Pain Pattern

Pain can be referred from activated TrPs in the flexor digitorum longus to the middle of the plantar forefoot near the four lesser toes. Pain from active TrPs in the flexor hallucis longus concentrates to the great toe and first metatarsal.

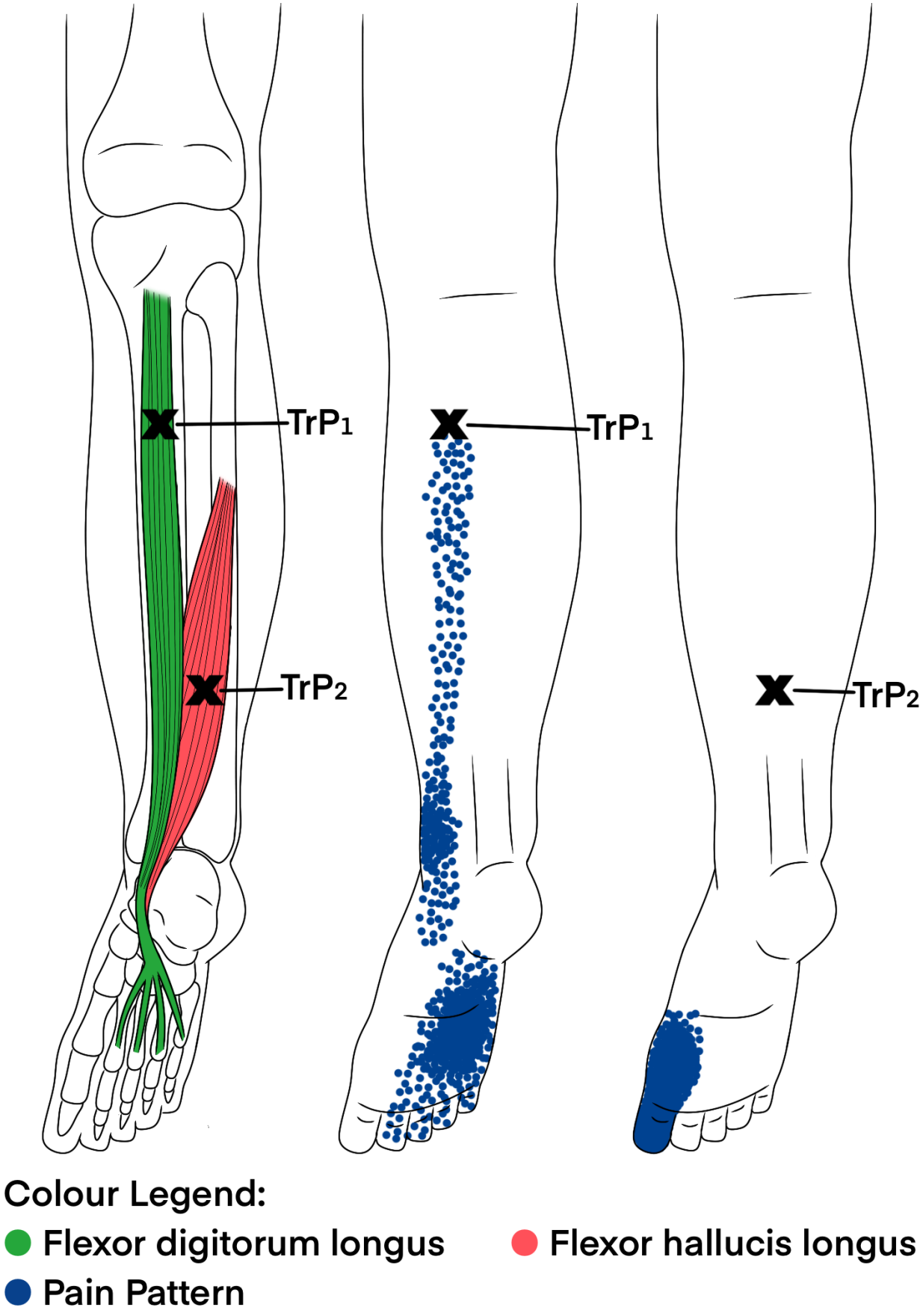

Figure 24 Trigger Point and Pain Patterns in the Long Flexors of the Toes.

Chapter 19: Peroneal Muscles

The peroneal muscles, commonly blamed for weak ankles, collectively is made up of fibularis longus, fibularis brevis and fibularis tertius. The longus and brevis muscles are responsible for prevention of medial inclination of the leg over the fixed foot with ambulation. These muscles also allow the foot to evert and abduct. The fibularis tertius allows for dorsiflexion of the foot and minimal assistance to eversion.

Muscle Groups and Attachments

All three of the peroneal muscles attach above to the fibula but the longus and brevis form the lateral compartment while the tertius is part of the anterior compartment of the leg. Distally, the fibularis longus tendon passes behind the lateral malleolus and then, medially ending on the first metatarsal bone. The tendon of the brevis also passes behind the lateral malleolus ending on the fifth metatarsal tuberosity. The tendon of the tertius runs in front of the lateral malleolus and ends on the fifth metatarsal.

Referred Pain Pattern

Pain from activated TrPs in the longus and brevis muscles typically concentrates around the lateral malleolus with mild pain noted to the lateral foot. Pain from the fibularis tertius causes pain to be referred over the anterior-lateral aspect of the ankle

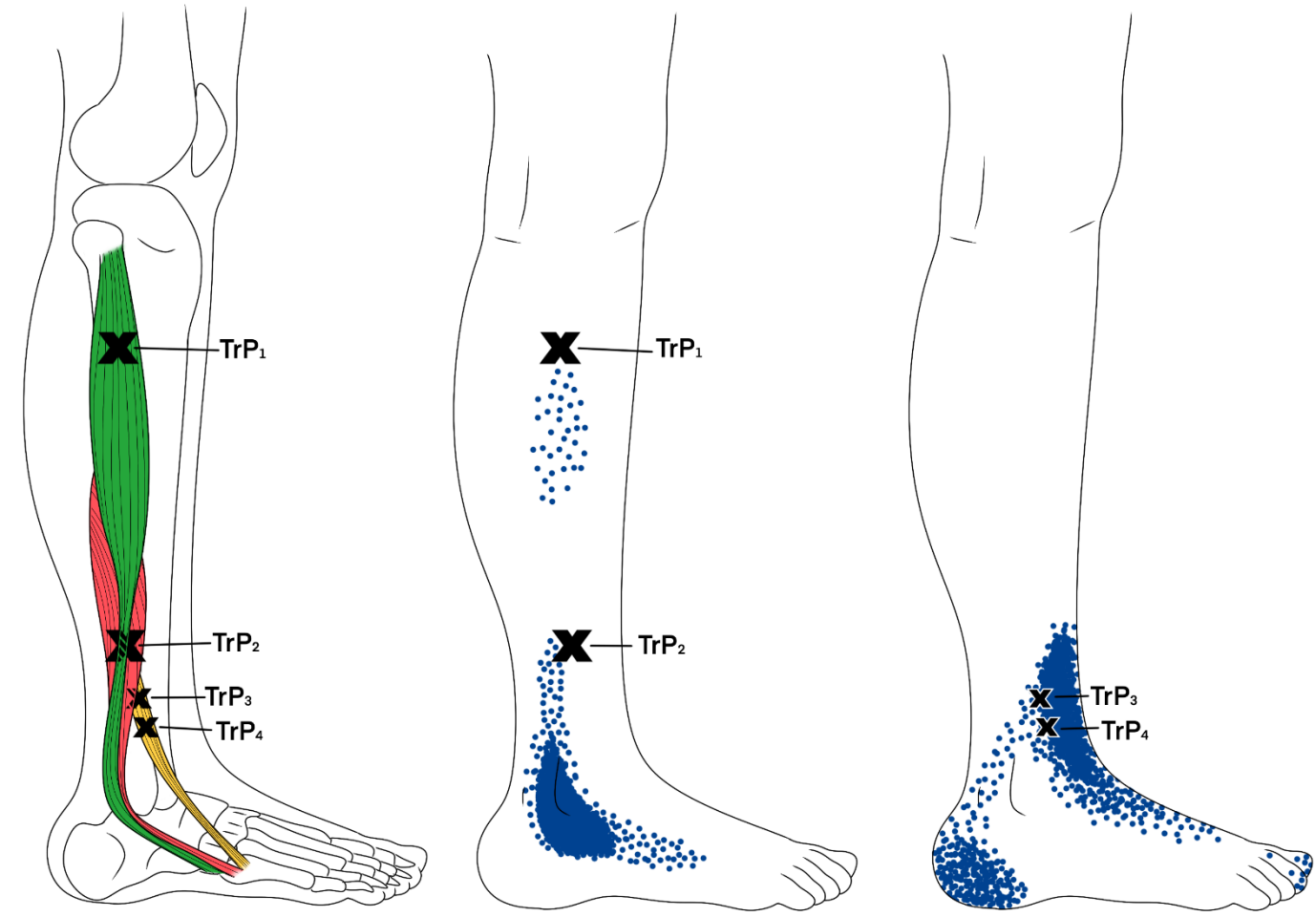

Figure 25 Trigger Point and Pain Patterns in the Peroneal Muscles.

Chapter 20: Long Extensors of the Toes

This group of muscles is made up of extensor digitorum longus and extensor hallucis longus. The main job of both of these muscles is to prevent foot slap post heel-strike and with toe clearance during the swing phase of walking. Patients classically complain of pain to the top of the foot or to the toes at night or even present with 'hammer toes' when activated.

Muscle Groups and Attachments

The extensor digitorum longus proximally attaches to the lateral condyle of the tibia and the fibula and the intramuscular septa. Distally, it attaches to the middle and distal phalanges of the four lesser toes. The extensor longus attaches, proximally, to the fibula and distally to the distal phalanx of the great toe.

Referred Pain Pattern

Activated TrPs from both extensors causes pain to the dorsum of the foot. Specifically, pain referred from the extensor digitorum longus concentrates to the dorso-lateral aspect of the foot to the middle three toes while activated TrPs to the longus concentrate over the first metatarsal.

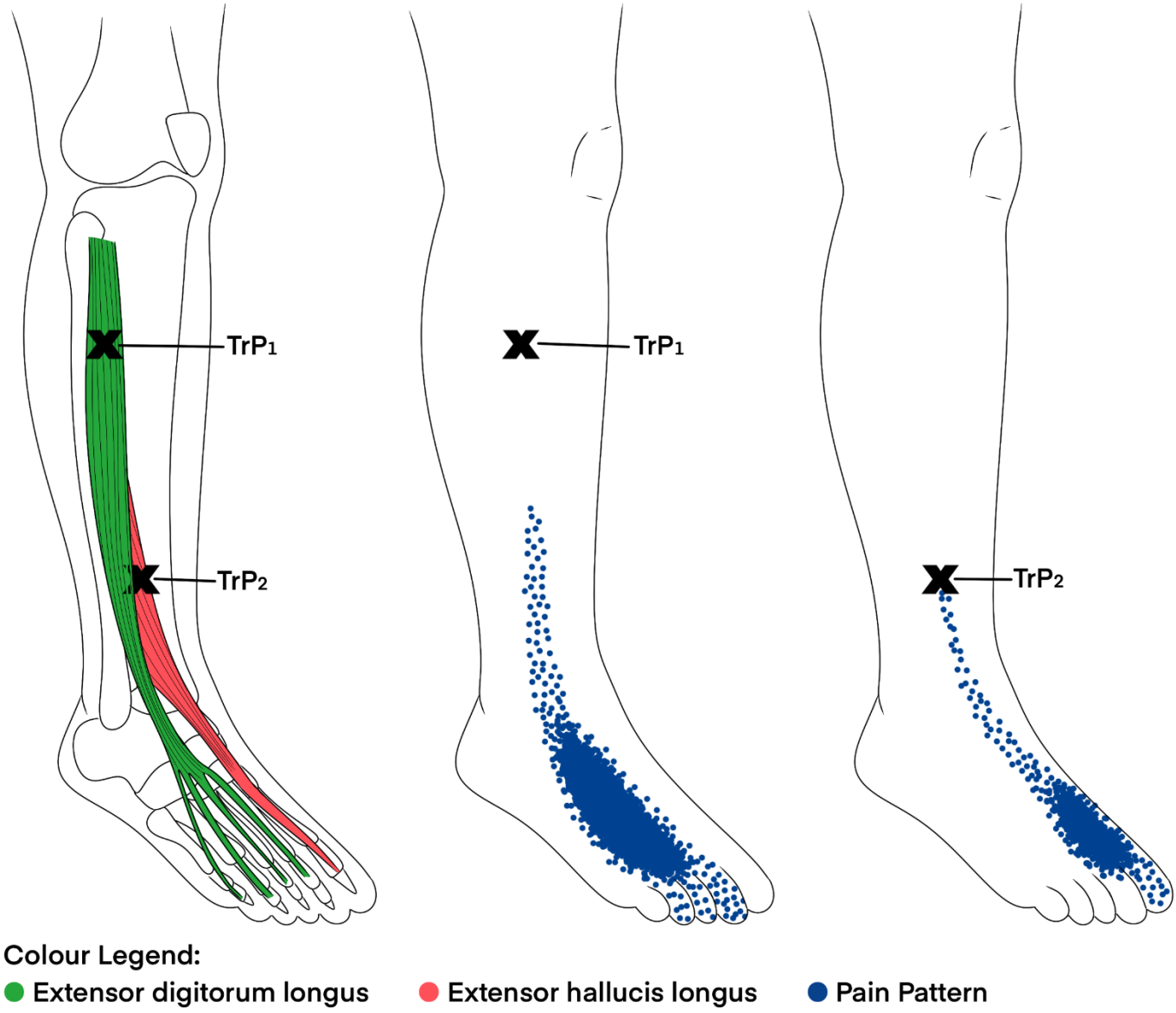

Figure 26 Trigger Point and Pain Patterns in the Long Extensors of the Toes.

Chapter 21: Tibialis Anterior Muscle

The main function of the anterior tibialis muscle prevents foot slap at heel-strike and to clear the toes of the floor during the swing phase of ambulating. During active sports like jogging or two-legged jumping it acts as a dorsiflexor of the foot.

Muscle Groups and Attachments

Proximally, the tibialis anterior muscle attaches to the lateral condyle of the tibia and distally to the medial and plantar surfaces of the medial cuneiform bone and base of the first metatarsal

Referred Pain Pattern

Pain from activated TrPs in the tibialis anterior cause pain to the front of the ankle, over the dorsal foot ending in the dorsal and medial sides of the great toe.

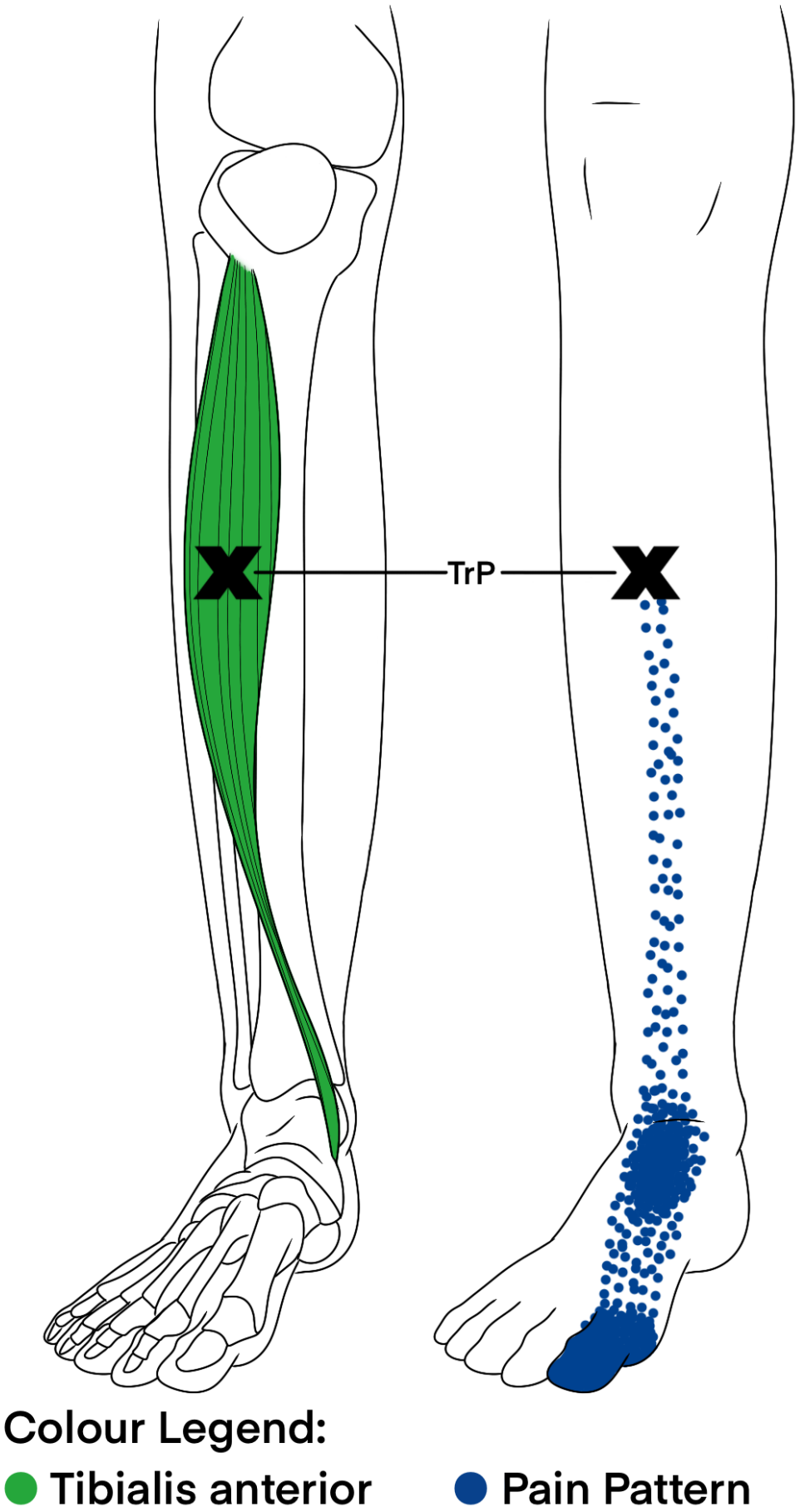

Figure 27: Trigger Point and Pain Patterns in the Tibialis Anterior.

Chapter 22: Quadratus Plantae

The Quadratus Plantae muscle plays a crucial role in stabilizing the foot during weight-bearing activities and aids in the proper function of the foot arches.

Muscle Group and Attachments

The Quadratus Plantae muscle originates from the medial and lateral aspects of the calcaneus and inserts onto the tendons of the flexor digitorum longus muscle. It assists in flexing the lateral four toes and helps to maintain the stability of the foot arches, particularly the lateral longitudinal arch.

Referred Pain Pattern

Pain from activated trigger points in the Quadratus Plantae muscle may be referred to the medial aspect of the foot, near the heel or arch region.

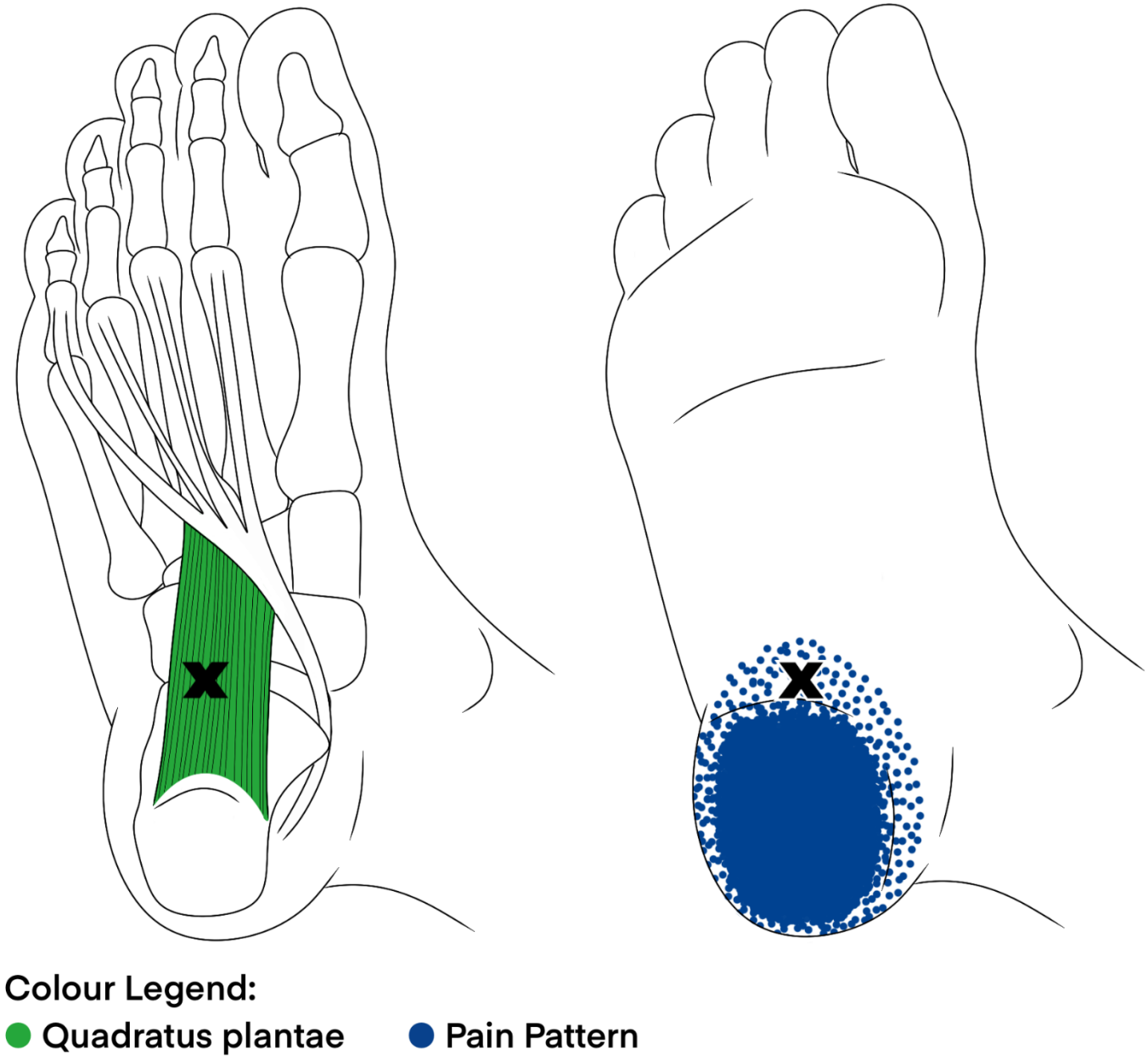

Figure 28 Trigger Point and Pain Patterns in the Quadratus Plantae.

Reference

Travell, J. G., & Simons, D. G. (1983). Myofascial Pain and Dysfunction: The Trigger Point Manual (Vol. 1). Williams & Wilkins.

Travell, J. G., & Simons, D. G. (1999). Myofascial Pain and Dysfunction: The Trigger Point Manual (Vol. 2). Williams & Wilkins.