



# Hip Tendinopathies: An Update of Concepts and Approaches

## *Tendinopatias do quadril: Uma atualização de conceitos e abordagens*

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### Abstract

The present update was based on new scientific evidence of major hip-related tendinopathies. Themes were addressed that involve the principles of the onset of tendinopathies through, mainly, the principle of capacity versus demand and the biomechanical aspects involved in its onset, its main characteristics, and clinical presentations. Associated with this, treatment-related updates were presented, with exercise therapy being the focus of conservative treatment and surgical approaches necessary for the control or resolution of these cases.

### Keywords

- ▶ tendinopathy
- ▶ lower extremity
- ▶ hip
- ▶ hip injuries

### Resumo

A presente atualização foi embasada nas novas evidências científicas das principais tendinopatias relacionadas ao quadril. Foram abordadas temáticas que envolvem os princípios do aparecimento das tendinopatias através, principalmente, do princípio da capacidade *versus* demanda e os aspectos biomecânicos envolvidos no seu aparecimento, suas principais características e apresentações clínicas. Associadas a isso, foram expostas as atualizações voltadas ao tratamento, com a terapia por exercício sendo o foco do tratamento conservador e as abordagens cirúrgicas necessárias para o controle ou resolução desses casos.

### Palavras-chave

- ▶ tendinopatia
- ▶ extremidade inferior
- ▶ quadril
- ▶ lesões do quadril

## Introduction

Tendinopathy is the most correct and current term to speak of in the context of tendon disease. This term is known as an umbrella term, because it applies to several other conditions such as reactive tendinitis or tendinopathy and tendinosis, from the microscopic to macroscopic scope.<sup>1</sup>

The pathophysiology of this clinical condition is still uncertain, as several conditions may be involved, from intrinsic and systemic conditions such as diabetes and

obesity to related extrinsic conditions, mainly due to overloads. At this point, the theory of capacity and demand is applied, where the demand often exceeds the ability of the system to withstand the load imposed either in training or even in the daily life of the patient.<sup>2</sup>

Because tendons are a tissue with very explicit specificity, where it can transmit strength from the muscle to the bone, mainly, its anaerobic aspect gives it the ability to resist overloads for longer periods, but when this process is broken, that is, there is some injury to the tendon, the healing process becomes difficult.<sup>3</sup>

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In most treatments seen today in the literature, treatment options are based on starting with conservative exercise-based treatment for at least 12 months. If this approach fails, surgical treatment can be considered. In general, the use of corticosteroid infiltrations is an unindicated approach; although it brings positive effects in the short term, its long-term effect is not beneficial and may evolve even with ruptures of the tendon. This same recommendation applies to therapies such as rest and immobilization.<sup>4</sup>

## Biomechanical Implications of the Hip

The hip joint is a synovial joint of the ball-and-socket type. Therefore, it is an articulation that has in its anatomy a stable characteristic because it is a ball and socket architecture.

Regarding the biomechanics of this articulation, it is valid to think about its amplitudes and that its actions take place in the two kinetic chains, with the closed kinetic chain being the most functional. It is worth noting the dynamic range that has in its biomechanics an adduction and internal rotation in closed kinetic chain. A situation in which shear forces are very evident, which requires a greater need for stabilization from the musculature and the muscles are overloaded. In this example, it is worth noting that the force of the abductors need to be equated with that of the adductors to have a more effective control in the frontal plane. The same is true for lateral rotators, which do not have primary antagonists, which need to have a force equal to or greater than three times the body weight as the Pauwells scale says.<sup>5</sup>

An interesting point to be talked about the hip joint is that by having the acetabulum in its composition and with this structure being composed of the three bones of the pelvis, any disarrangement that may interfere in the acetabulum causes an overload in the pubic symphysis and the sacroiliac joint, which leads to compensations in the whole functional structure of the pelvis complex.<sup>6</sup>

These concepts are very reductionist in the current contexts of biomechanics because it is known that the changes resulting from the hip are not the only source of compensation for the dynamic valve. Currently, we have alterations of more distal origin, such as the limitation of dorsiflexion that due to the entire lesional chain can interfere at the level of the hip generating the aforementioned compensations and, thus, the possible tendinopathies in the region. It is worth noting that this limitation of dorsiflexion has several origins, but ankle sprains generate an important reference that can be evaluated by lunge test.<sup>7</sup>

## Great Trochanteric Pain Syndrome

Currently, the nomenclature for symptoms appearing on the lateral hip is great trochanteric pain syndrome (GTPS) and it includes patients with symptoms of peritrochanteric pain, middle/minimal gluteus tendinopathy, trochanteric bursitis, and external shoulder syndrome.<sup>8</sup>

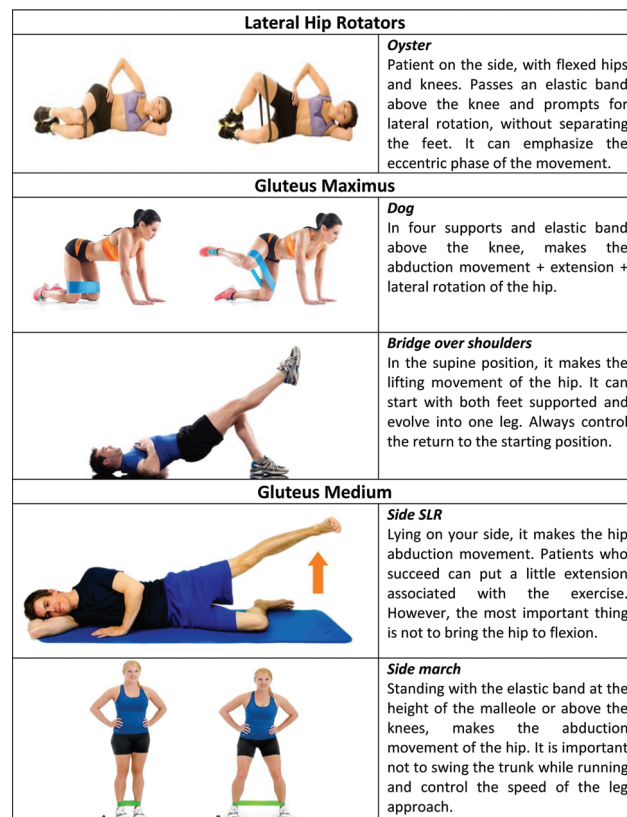
Therefore, there may be conditions in which tendinopathy is not present, but what we have observed is that the treatment is very similar for the different local pathologies.<sup>9</sup>

## Gluteal tendinopathy

If the main characteristic is focused on the failure of the balance between capacity and demand, the increase in demand will occur due to an excess of training or even to the detraining for daily activities. Older female patients show this action of detraining; also in younger populations, the prevalence is in women who practice some physical activity of impact that involves running. This fact can be explained by a more biomechanical view on the slope of the Pauwells scale failure, where there is a natural disadvantage of women in anatomy (wider pelvis) and a decrease in contraction strength and speed, factors that can negatively interfere with there is a disleveling of the pelvis (closed kinetic chain hip adduction) and thereby an increase in the demand for action of hip abductors and lateral hip rotators.<sup>5</sup>

With this, well-marked by the literature, the main approach is through exercise therapies, focusing on restructuring the strength of hip abductors and lateral hip rotators (► **Figure 1**). The association of local cryotherapy and a decrease, not total rest, in demand (training and/or routine activities) are allies for a good evolution of cases. Some authors advocate stretching of the iliotibial band (ITB) and cortisone injections in nonoperative treatment.<sup>8</sup>

Low-energy shockwave therapy may be a treatment option and the justification for its use in tendinopathy is that it can cause hyperstimulation analgesia by releasing cytokines into affected tissues. These, then, interrupt serotonergic activation that exert downward inhibitory control over pain.<sup>10</sup> When the diagnosis is established by means of



**Fig. 1** Initial basic exercises of orientation to patients for global hip strengthening.

meticulous physical examination and magnetic resonance imaging (MRI), it seems to be an effective treatment option for the relief of chronic refractory pain. However, its long-term effect seems to diminish over time.<sup>11</sup>

Open and arthroscopic repair techniques have been described in the recent literature, demonstrating excellent results reported by patients.<sup>12</sup> When surgery is indicated due to the failure of nonoperative strategies, open zeta-plasty at the level of the greater trochanter has been the traditional procedure. Endoscopic release of the ITB and bursectomy at the level of the greater trochanter have evolved in recent decades and have established themselves as an alternative method of surgery.<sup>8</sup>

### Gluteus Syndrome

Defined as a myofascial pain syndrome (pain accompanied by confirmation of pain trigger points in specific muscles) resulting from the middle gluteus, it is one of the main causes of back or leg pain and it is similar to GTPS, which also manifests with back or leg pain, but is commonly related to degenerative lumbar disease, hip osteoarthritis, knee arthritis, and syndrome of failed back surgery. It is treated by physiotherapy, manual release therapy from the trigger point or trigger point block injection and, in difficult cases, by surgical decompression of the middle gluteus or of the sciatic nerve.<sup>13</sup>

### Snapping Hip Syndrome

Snapping hip syndrome, also known as thigh saltans (or dancer's hip), is a clinical condition characterized by an audible or palpable snap sensation that is heard during hip joint movement. Hip snap has multiple etiologies and is classified based on the anatomical structure that is the cause/source of the rebound sensation.

The external hip snap is most commonly attributed to the movement of the ITB over the great trochanter of the femoral head during hip movements in flexion, extension, and external or internal rotation. Other causes include the proximal hamstring thimble rolling over the sciatic tuberosity, be it the fascia lata or the anterior aspect of the gluteus maximus, rolling over the great trochanter and the psoas tendon rolling over the medial fibers of the iliac muscle. A combination of defects is also possible; for example, thickening of the posterior ITB and of the anterior gluteus, which fit into the greater trochanter at the same time.

When pain is not present, treatment is not justified. When pain is present in the snap, the treatment is conservative and consists of rest, stretching, steroid injections, oral anti-inflammatory drugs, physiotherapy, and activity modification. Most of the time, patients feel relief from these measures.<sup>14</sup>

The inner hip shoulder most commonly occurs when the iliopsoas tendon fits into the underlying bony prominences, such as the iliopectinal eminence or the anterior face of the femoral head. Other causes include paralysal cysts and partial or complete bifurcation of the iliopsoas tendon. The snapping sensation can closely mimic intra-articular pathology since both originate in the anterior area of the hip. Physical examination and close images can differentiate

the two. It should be noted, however, that in ~ 50% of cases of internal hip snap, an additional intra-articular pathology of the hip is identified.<sup>15</sup>

If pain persists despite these conservative measures, surgical intervention may be considered. For external snapping hip syndrome, loosening of the ITB is usually the goal and can be performed with open or arthroscopic procedures. The iliotibial tendon is elongated or completely released using various procedures, including formal Z-lengthening, cross-shaped release, Z-shaped release, or maximum gluteus release. Weakness in abduction can be a complication if the release is excessive or if there is damage to the surrounding area.<sup>14</sup>

For internal snapping hip syndrome, open or arthroscopic procedures are also available to lengthen or release the iliopsoas tendon. Arthroscopic methods are preferred to avoid complications of open surgery. The most common adverse effect of iliopsoas release is weakness of hip flexors, which can occur if there is excessive release or damage to the surrounding area. Corrective surgeries for the hip with internal or external snap may result in other complications, including infection, heterotopic ossification, muscle atrophy, ongoing symptoms, or nerve damage.<sup>2</sup>

### Piriform syndrome

Piriform syndrome (PS) is an uncommon and controversial disease that is presumed to be a compression neuropathy of the sciatic nerve at the level of the piriformis muscle (PM). It is an irritation of the piriform muscle, a small muscle below the gluteus maximus. Irritation can occur if we remain for long periods sitting or standing, or we repeat certain movements. When the piriformis muscle is hardened and spasmed, it can compress the sciatic nerve. Irritation, called PS, can cause pain and paraesthesia (numbness and tingling) in the gluteus minimum, the posterior area of the leg down to the foot. Symptoms are confused with disc diseases of the spine. One way to claim that it is PS is to bend your knees close to the body, with your feet in the air. Gently move your feet away one to each side. If there is pain in the buttocks when moving the foot, suspect PS. Treatment has focused on stretching, physiotherapy, local injections, including botulinic toxin and surgical management.<sup>16</sup>

### Proximal Femoral Rectus

The femoral rectus has its anatomical and biomechanical characteristic because it is a bijoined muscle, where it acts together with the quadriceps in the knee extension and in isolation in hip flexion. Its role, besides being functional, has an aspect of stability of the anterior part of this joint. Its stabilization action is similar to that of the iliopsoas, which assists in hip flexion.<sup>17</sup> The etiology of its overload is still imprecise, but it is known that the increase in its demand occurs in speed sports, especially in the phase of sudden deceleration and in long kicks in soccer.

The main affected population are children and the elderly; children in their process of beginning in the sport or older people who need a higher demand. Avulsion of this structure

can often occur along the anteroinferior iliac spine. In younger patients, the relationship is directly related to increased demands, specifically in sports such as soccer, associated with previous quadriceps injuries and with the biotype of younger and overweight people.<sup>18</sup>

Regarding treatment for cases of tendinopathy, the focus should be on balancing the demand conditions with increased strength of these structures, remembering that the specific strengthening of the region is interesting, that is, movements aimed at hip flexion. Another interesting consideration is the use of exercises focused on the most eccentric characteristics, aiming at the specificity of the gesture of the patient, as well as the metabolic demand of this muscle.<sup>19</sup>

## Hip Adductors

This set of muscles plays an important role for the hip joint, as its main action is to adduce the femur, but its secondary actions are linked to hip flexion and extension, that is, even without doing its main action, its activation is almost continuous. This condition increases its demand and the presence of its tendinopathy may be linked to this.<sup>20</sup>

This condition is one of the mainly related to pain in the groin, and the long adductor tendon is the most affected. Chronic pain in the groin in the athlete can be a difficult problem to control. The most reproducible finding for long adductor tendinopathy is tendon sensitivity with passive abduction and resisted hip adduction in extension.<sup>20</sup>

There are some conditions that may be linked to the appearance of adductor tendinopathy, including femoroacetabular impact syndrome and pubalgia. The latter, still without a consensus of cause and consequence, because much was previously thought only the disarrangement in the frontal plane of the pubic symphysis, theorizing that there was involvement only of the abdominal rectum and adductors that are directly connected in the pubic region.<sup>21</sup>

Currently, movement is believed to occur in the sagittal plane, also evidencing the importance of the relationship between flexors and hip extensors. It is believed that there is an imbalance between these two groups and, as the adductors are synergistic of these movements, their activation is increased, thus generating greater tension and overload.<sup>20</sup> With this more global view of pubalgia, treatment should be focused not only on the balance of the adductors, but rather on the gluteal and ischiotibial region, because they have their action in extension, and on the iliopsoas and the femoral rectus, and because it is the flexor group of the hip, and thus the adductors would enter only as a stoning, because often they are not weak and rather overloaded.<sup>21</sup>

Magnetic resonance imaging and anesthetic injection at the proximal muscle-tendon junction may be useful to confirm the diagnosis.<sup>20</sup>

The intervention for this tendinopathy is focused on symptom control, mainly through specific exercises for the region so that the demand and capacity for daily or sports activities can be balanced.<sup>22</sup> Nonoperative treatment may

consist of protected weight support, ice application, ultrasound, electrical stimulation, and gentle stretching with progressive strengthening.<sup>5</sup>

However, nonoperative treatment is not always successful for chronic tendinopathy. In such cases, surgical treatment can be quite effective through adductor tenotomy. This can be a useful tool for treating recalcitrant pain in the groin attributable to the long adductor.<sup>14</sup>

**ISCHIOTIBIAL (ICT) PROXIMAL TENDINOPATHY** (High ICT tendinopathy, Sciatic intersection syndrome, ICT entheopathy, or ICT tendinopathy)

Ischiotibial (ICT) injuries are one of the most common injuries suffered by athletes. These injuries usually occur in sprinters or in medium to long distance runners and range from sprains and acute ruptures to chronic-degenerative lesions that occur because of small repetitive loads and trauma to the origin of the sciatic tuberosity of the ICT tendons.<sup>23</sup>

The ICT complex consists of three muscles: semimembranous, semitendinous, and femoral biceps. The long head of the femoral biceps and the semitendinous muscles form the joint tendon that is part of the posteromedial aspect of the sciatic tuberosity.<sup>23</sup>

It is a chronic-degenerative disease associated with progressive morbidity and functional decline. There is an increasing incidence of the disease process, but the diagnosis is commonly delayed, as patients present vague and indolent symptoms, often without a specific precipitating lesion.<sup>23</sup>

The main functions of the ICT muscles are hip extension and knee flexion with primary innervation of the sciatic nerve (tibial). All three muscles receive their blood supply from branches of the femoral arteries and lower glute. Intraoperative biopsy samples from patients submitted to tendinopathy tenotomy showed that the ICT muscles can be affected alone or as a complex triad with varying degrees of inflammation within each proximal tendon.<sup>23</sup>

Intrinsic factors lead to structural abnormalities in its proximal origin that predispose the tendon to increased risk of injury and reduced healing potential. The ICT tendons in older patients show a lower capacity of tendon stem cells to stimulate clonogenicity, adipose indelicibility, and osteogenic inductiveness.<sup>24</sup> In perimenopausal women, reduced estrogen levels may have an adverse impact on hemostasis and tendon healing, leading to progressive and degenerative tendon collapse. Other intrinsic factors associated with proximal ICT tendinopathy include genetic predisposition (for example, mutations in *COL5A1* encoding for type V collagen), metabolic abnormalities (lipid level imbalance, glucose intolerance, insulin resistance), hormonal changes, and pharmacological agents (for example, fluoroquinolone antibiotics).<sup>23</sup>

Extrinsic factors may promote increased workload and eccentric load at the origin of the proximal ICT, and tendon compression at these origins during hip flexion and adduction may exacerbate symptoms. Increased hip flexion leads to greater shear forces between the sciatic tuberosity and ICT tendons, with greater displacement of proximal ICT. Training errors that increase the volume and duration of training very vigorously or introduce exercises such as speed or obstacle

running can trigger its proximal tendinopathy. These activities cause rapid contraction and stretching while the hip is in flexion, which generates greater tensile and compression loads in its insertion. Abnormal hip positioning in pilates and yoga postures can cause similar symptoms.<sup>18</sup>

Patients often report gradual increase in pain or discomfort in the subgluteal or posterior region of the thigh. This pain is described as 'cramping' or 'tightening' in the area of the deep buttocks and usually progresses over time without any specific trauma or incitement injury. Radiation into the popliteal fossa can cause inhibition of pain and weakness of the ICT muscles and difficulty in participating in sports activities. Symptoms may be exacerbated by repetitive eccentric load or prolonged frontal flexion of the trunk, such as during stretching, running, and sitting exercises for long periods. In more severe cases, fibrosis of proximal ICT muscles can trap and compress the sciatic nerve, causing acute pain radiating from the back of the thigh to the foot.<sup>13</sup>

Some authors believe that corticosteroids help limit chronic inflammation and therefore reduce the formation of scars and adhesions in the tendon. Administration of medications under ultrasound guidance facilitates the precise placement of injection into the tendon sheath and prevents direct infiltration into the tendon substance. Immediate resolution of symptoms with local anesthetic is a useful diagnostic tool for the origin of symptoms and indicates that the drug was administered accurately.<sup>25</sup>

Shockwave treatment can be used; the justification for its use in tendinopathy is that it can cause hyperstimulation analgesia through the release of cytokines in the affected tissues. These, then, interrupt serotonergic activation, exerting downward inhibitory control over pain.<sup>10</sup>

Platelet-rich plasma contains regulatory proteins, growth factors and platelets that instill and modulate the action of proinflammatory cells and facilitate faster tendon healing. Overall, studies using platelet-rich plasma showed promising results in the early stages with pain improvement and functional score in short- to medium-term follow-up.<sup>23</sup>

In surgical treatment, an option is to identify and release intraoperatively the probable ICT tendon causing tendinopathy by viewing the myotendinous unit that presented scars, hypertrophy, and fibrosis. Acute hamstring ruptures associated with proximal hamstring tendinopathy in high-level athletes may benefit from fixation with avulsion tendon suture anchor to the sciatic tuberosity or reconstruction with Achilles tendon allograft to restore function and help return to sports activities.<sup>18</sup>

## Final Considerations

Hip tendinopathies are common pathologies in the daily life of the orthopedist and, despite a multifactorial character, biomechanics plays a fundamental role in this pathology, especially the burden-demand relationship, and therefore the importance of an as early as possible approach in strengthening and balancing these patients. We still need studies to better understand their muscle relationships in

the various daily moments, but in most cases the conservative treatment is efficient, leaving the surgical treatment reserved for refractory cases.

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The authors have no conflict of interests to declare.

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